



# Prefabricated Housing in Australia. Skill Deficiencies and Workplace Practice



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National ISS Institute Overseas Fellowship

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# Executive Summary

Prefabricated housing for both internal and external structures has become a boom industry in Australia and across the world, based upon its relative affordability, the speed by which it can be erected and the ease by which it can be made to meet modern environmental considerations. In some countries (more notably the UK in recent times) the use of prefabricated technology has declined, in part because there is now a proliferation of new materials available and that applied research has not kept pace with building demands.

The technology has outstripped the current ability of the building and construction training industry to qualify and quantify the specific skill sets involved in the various processes. There are generic competencies relating to what might now be referred to as traditional prefabricated housing (eg tilt-up concrete slabs). In fact the emergence of more modern materials, coupled with environmental considerations, occupational health and safety issues, and affordability, require more specific options to link together the various roles. Although in part they are site-based, they have their genesis in a factory or workshop. The overarching argument is about where prefabrication as a concept begins and ends.

In the factories and workshops composite parts are assembled and packaged for transport to the erection site. Modern industry skills training has become much more site-based and increasingly reflects the economic trend towards a more commercial product.

The current housing affordability crisis, predicated on increasing mortgage interest rates, acute skill shortages in such trades as bricklaying and the finishing trades, shrinking availability of 'green-field' land development by State and Territory Governments, escalating costs of traditional building materials and the recent ten year long water drought have together brought about the need for innovative thinking to maximise the building product, so that it is more accessible to a demanding and at the same time educated public.

Prefabricated housing requires a unique blend of contributing skill sets along the entire Supply Chain, encompassing research (including design anthropology to create liveable habitats for human occupation), concept/idea development, designing and manufacturing component parts, through to fabrication and construction of the final dwelling.

Tradespeople involved on the factory or workshop floor must be able to create 'kitset' composite parts so that prefabricated housing componentry is easily transportable, safe to use, quickly erectable, and cost and environmentally efficient. They must also ensure that Federal Safety Commission standards are adhered to throughout the building procedure.

This report looks at skill deficiencies in the prefabricated housing sector of the Australian Building and Construction Industry, referred to in the United Kingdom as 'Modern Methods of Construction'<sup>1</sup> (MMC). There is a case to be made for delineation of prefabricated house building to become a discreet set of skills in its own right, or at least demarcated in a meaningful way as a manifest departure from traditional building and construction methodology. The reason being is that it adds another dimension to building. The substantive issue is in the need for awareness in three main areas of trade and para-professional development:

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<sup>1</sup> MMC – new generation building methods based on new material and building techniques.

# Executive Summary

1. Learners to understand and demonstrate an awareness of project planning and delivery as subordinate executors. Daly's observations and interviews reflected that the 'bigger picture' awareness impacted significantly in terms of project continuity and worker satisfaction. Workers also clearly understood site-based role demarcations and appreciated the reasons for these.
2. Learners to understand communication and engagement skills with specific attention paid to social and cultural considerations, so as to ensure that clients are appropriately engaged and responded to on-site.
3. Learners to understand the need for sustainable work practice and to apply this, especially in the context of prefabricated building materials and practices. Sustainable work practice is ultimately habit-forming, especially where diligence and proactive practice are positively reinforced.

It also identifies that certain deficiencies are super-ordinate to the core competency-based training approach of the Australian Qualifications Framework and are appropriately the domain of the employer rather than additional competencies to be added to already busy qualifications at trade and para-professional levels.

# Table of Contents

<b>i</b>	<b><i>Abbreviations and Acronyms</i></b>
<b>1</b>	<b>Acknowledgments</b>
1	Awarding Body - International Specialised Skills Institute (ISS Institute)
3	Fellowship Supporter
3	Supporters
4	Australian Organisations Impacted by the Prefabricated Housing Industry
<b>5</b>	<b>About the Fellow</b>
<b>6</b>	<b>Aims of the Fellowship</b>
<b>7</b>	<b>The Australian Context</b>
8	SWOT Analysis of Prefabricated Housing in Australia
<b>10</b>	<b>Identifying the Skills Deficiencies</b>
10	Definition – Skills Deficiencies
10	Identifying and Defining the Skills Deficiencies
11	Questions Related to the Skills Deficiencies
12	Why the Skills Deficiencies Need to be Addressed
<b>14</b>	<b>The International Experience</b>
15	Research Outcomes
17	Building and Construction – a Broad Stroke of the Brush Overview
18	Prefabricated Housing
20	Training in Context
25	Prefabricated Housing – the Fellowship Visits
26	Questions and Answers
<b>41</b>	<b>Knowledge Transfer – Applying the Outcomes</b>
41	Workshop
<b>42</b>	<b>Recommendations</b>
42	Government
42	Industry
42	Professional Associations
43	Education and Training
44	Community
44	ISS Institute Inc
<b>45</b>	<b>References</b>
<b>46</b>	<b>Attachments</b>
46	Attachment 1: Education and Training
49	Attachment 2: Boswell Houses
50	Attachment 3 – French Construction: Training system in the Building Sector. Grant Daly Visit in Paris
55	Attachment 4: Notes on People and Organisations Related to this Report

# *Abbreviations and Acronyms*

ABBTF	Australian Brick and Blocklaying Training Fund Authority
ABN	Australian Business Number
AQF	Australian Qualifications Framework
ARCOM	Association of Researchers in Construction Management
BCITO	Building and Construction Industry Training Organisation
BRANZ	Building and Research Australia and New Zealand
COAG	Council of Australian Governments – Builder Licensing Committee
CPSISC	Construction and Property Services Industry Skills Council
DEEWR	Department of Education, Employment Workplace Relations
EET	Employment, Education and Training Committee – facilitated by the Australian Chamber of Commerce
FMB (UK)	Federation of Master Builders (UK)
ISS Institute	International Specialised Skills Institute
MPBA	Modular and Portable Building Association
NCVER	National Centre for Vocational Education Research
NHBC	National House-Building Council (Great Britain)
NVQ	National Vocational Qualifications
NZQA	New Zealand Qualifications Authority
RPL	Recognition of prior learning
SVQ	Scottish Vocational Qualification
UKTFA	UK Timber Frame Association

# Acknowledgments

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## **Awarding Body - International Specialised Skills Institute (ISS Institute)**

**We know that Australia's economic future is reliant upon high level skills and knowledge, underpinned by design and innovation.**

The International Specialised Skills Institute Inc (ISS Institute) is an independent, national organisation, which has a record of nearly twenty years of working with Australian industry and commerce to gain best-in-the-world skills and experience in traditional and leading-edge technology, design, innovation and management. The Institute has worked extensively with Government and non-Government organisations, firms, industry bodies, professional associations and education and training institutions.

The Patron in Chief is Sir James Gobbo AC, CVO. The ISS Institute Board of Management is Chaired by Noel Waite AO. The Board comprises Franco Fiorentini, John Iacovangelo, Lady Primrose Potter AC and David Wittner.

Through its CEO, Carolynne Bourne AM, the ISS Institute identifies and researches skill deficiencies and then meets the deficiency needs through its *Overseas Skill Acquisition Plan (Fellowship Program)*, its education and training activities, professional development events and consultancy services.

Under the Overseas Skill Acquisition Plan (Fellowship Program) Australians travel overseas or international experts travel to Australia. Participants then pass on what they have learnt through reports, education and training activities such as workshops, conferences, lectures, forums, seminars and events, therein ensuring that for each Fellowship undertaken many benefit.

As an outcome of its work, ISS Institute has gained a deep understanding of the nature and scope of a number of issues. Four clearly defined economic forces have emerged out of our nearly twenty years of research. The drivers have arisen out of research that has been induced rather than deduced and innovative, practical solutions created - it is about thinking and working differently.

### **A Global Perspective. 'Skills Deficiencies' + 'Skills Shortages'**

Skill deficiencies address future needs. Skill shortages replicate the past and are focused on immediate needs.

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas. This is the focus of the work of ISS Institute.

There may be individuals or firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the IP to themselves; and over time they retire and pass way. Firms likewise come and go. If Australia is to create, build and sustain Industries, knowledge/skills/understandings must be accessible trans-generationally through nationally accredited courses and not be reliant on individuals.

Our international competitors have these capabilities as well as the education and training infrastructure to underpin them.

Addressing skill shortages, however, is merely delivering more of what we already know and can do to meet current market demands. Australia needs to address the **dual** challenge – skill deficiencies and skill shortages.

# Acknowledgments

Identifying and closing skills deficiencies is vital to long-term economic prospects in order to sustain sectors that are at risk of disappearing, not being developed or leaving our shores to be taken up by our competitors. The only prudent option is to achieve a high skill, high value-added economy in order to build a significant future in the local and international marketplace.

## The Trades

The ISS Institute views the trades as the backbone of our economy. Yet, they are often unseen and, in the main, have no direct voice as to issues which are in their domain of expertise. The trades are equal, but different to professions.

The ISS Institute has the way forward through its 'Master Artisan Framework for Excellence. A New Model for Skilling the Trades', December 2004. The Federal Government, DEEWR commissioned ISS Institute to write an Australian Master Artisan School, Feasibility Plan.

In 2006, ISS Institute Inc. set up a new ISS advisory body, the **Trades Advisory Council**. Members are Ivan Deveson AO; Martin Ferguson AM, MP, Federal Labor Member for Batman; Geoff Masters, CEO, Australian Council of Educational Research; Simon McKeon, Executive Chairman, Macquarie Bank, Melbourne Office; Richard Pratt, Chairman, Visy Industries and Julius Roe, National President Australian Manufacturing Workers' Union.

## Think and Work in an Holistic Approach along the Supply Chain - Collaboration and Communication

Our experience has shown that most perceive that lack of skills is the principal factor related to quality and productivity. We believe that attitudes are often the constraint to turning ideas into product and a successful business; the ability to think laterally, to work and communicate across disciplines and industry sectors, to be able to take risks and think outside the familiar, to share – to turn competitors into partners.

Australia needs to change to thinking and working holistically along the entire Supply Chain; to collaborate and communicate across industries and occupations - designers with master artisans, trades men and women, Government agencies, manufacturers, engineers, farmers, retailers, suppliers to name a few in the Chain.

## 'Design' has to be seen as more than 'Art' discipline – it is a fundamental economic and business tool for the 21st Century

Design is crucial to the economic future of our nation. Australia needs to understand and learn the value of design, the benefits of good design and for it to become part of everyday language, decision making and choice.

Design is as important to the child exploring the possibilities of the world, as it is to the architect developing new concepts, and as it is to the electrician placing power points or the furniture designer working with a cabinet-maker and manufacturer. As such, design is vested in every member of our community and touches every aspect of our lives.

Our holistic approach takes us to working across occupations and industry sectors and building bridges along the way. The result has been highly effective in the creation of new business, the development of existing business and the return of lost skills and knowledge to our workforce, thus creating jobs - whereby individuals gain; industry and business gain; the Australian community gains economically, educationally and culturally.

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This Fellowship has been supported by the Department of Education, Employment and Workplace Relations (DEEWR), Australian Government.

The Australian Government's Department of Education, Employment and Workplace Relations (DEEWR) implements Government policies and programs to provide education and training opportunities for all Australians, to increase employment participation and to ensure fair and productive workplaces. Education, training and workforce participation are central to our goal of building a productive and socially inclusive nation, one which values diversity and provides opportunities for all Australians to build rewarding social and economic lives. Grant Daly would like to thank them for providing funding support for this Fellowship.

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- Brian Welch, Executive Director, Master Builders Association, Victoria
- Mark Wombwell, Project Manager, Hindmarsh Constructions, ACT

## **Australian Organisations Impacted by the Prefabricated Housing Industry**

### **Government**

- Construction and Property Services Industry Skills Council (CPSISC)
- State and Territory Industry Skills Councils (formerly ITABs)
- State and Territory training organisations

### **Industry**

- Affordable housing networks within State and Territory Governments
- Building and construction businesses throughout Australia whose specific brief is to erect prefabricated housing

### **Professional Associations**

- Master Builders Association

### **Education and Training**

- TAFEs and other registered training organisations

# About the Fellow

For the past four years Grant Daly has been employed within the Master Builders Association (MBA) movement, commencing as Learning and Development Manager for MBA, ACT before being appointed to the position of National Director Training, Master Builders Australia. In that capacity he sat on several national committees including:

- Construction and Property Services Industry Skills Council (CPSISC) as Executive Director
- Employment, Education and Training Committee (EET) facilitated by the Australian Chamber of Commerce
- Australian Brick and Blocklaying Training Fund Authority (ABBTF) National Committee
- Builder Licensing Committee – Council of Australian Governments (COAG) national working party

In February 2007, Grant Daly returned to the Master Builders of the ACT as Director of Skills Development and Research, charged with the brief (among other things) of developing a para-professional learning pathway for 'cadets' to articulate into university undergraduate qualifications. His time is currently divided between developing training and assessment materials, facilitating training, and over viewing portfolio assessments for those in the industry who wish to access the various classes of builder licensing.

Daly's passions include implementing a rigorous, valid, consistent and fair process of assessment for all cadets, tradespeople and apprentices as they apply themselves to qualifications on the Australian Qualifications Framework (AQF), and developing employer capability as primary stakeholders in the training and assessment processes.

Daly is the holder of both New Zealand and Australian Diplomas in Training, Assessment, Moderation, Recognition of Prior Learning and Management. Alongside a Graduate Diploma in Social Work and an Advanced Diploma of Business in Human Resource Management, he is a strong advocate for bringing professional integrity into the training field, and nationally-consistent competency-based education, training and assessment practice in the Building and Construction Industry.

# Aims of the Fellowship

The aims of this Fellowship are to review the various processes within the prefabricated housing context, to identify both current deficiencies in terms of skill training and to identify new skill requirements alongside innovations in available materials, so that environmental, occupational health and safety, cost, and other considerations are adequately addressed in the associated training regimens. This industry niche is somewhat fragmented in terms of the composite skill requirements in the engagement of present technology; it is Daly's intention to look at where bridging of current training can occur to bring about a more cohesive training framework and at the same time to initiate development of new competencies to address the transitions between existing practice and new ideas.

Prefabricated housing is certainly not a new practice in Australia, and a wide variety of construction modalities are currently in existence. Those working in this building genre represent a wide spectrum of industrial backgrounds and there is a need to bring together the various skill sets so that new learners can specialise in what is becoming a boom application, and at the same time have an applied appreciation of its composite parts.

The Building and Construction Industry is characterised by current skill shortages at all levels and one of the corollaries of this has been the emergence of highly skilled, but formally unqualified operatives, who are able to carry out specific deployments, but lack the overall training of a qualified tradesperson. There are attendant dangers in this context; skills in localised applications do not necessarily align with over-arching and indispensable considerations such as occupational health and safety. Second generation unqualified operatives are now providing 'over the shoulder' training for new unskilled persons coming into the industry and, despite attempts to regulate this trend through registration and licensing, the industry must find ways to ensure that formal training, apprenticeships, and cadetships are not obviated in favour of a more expedient way of getting a job done.

It is not so much an overview of prefabricated housing technology and materials used that is required; (although in part this is a necessary pre-cursor) it is an understanding of the demands being placed on those working in this area, and a need to identify structures within which targeted training can be housed.

# The Australian Context

Even without the current skills shortages in pivotal areas such as bricklaying and the finishing trades, prefabricated housing would have found a strong market in that it is an efficient means by which to erect housing, because it is relatively inexpensive, quick to erect and sustainable.

In the commercial sector of the Building and Construction Industry, prefabricated buildings are becoming significantly more commonplace. It is easy to see why this trend is developing as prefabricated buildings require a lesser deployment of human resources, substantive quality can be assessed at point of origin and they are relatively easy to transport and erect in the form of 'tilt-up' concrete slabs.

Prefabricated housing however requires greater versatility in terms of materials used, as both consumer discernment and less-bulky components are significant factors. It is still possible to 'production line' the core templates, but there is much greater need to provide variation and cost-efficiency.

The revolution in frames and trusses for example, has meant that in recent times housing can be erected using steel instead of wooden frames. So-called 'kitset' interiors, assembled in factories and flat-packed for delivery, have been the pre-eminent form of prefabrication, although increasingly, Australian builders are looking to innovations in exterior prefabrication beyond the more traditional concrete slabs because it has been found that structurally, other materials present better medium and long-term economy.

The Federal Government initiated the 'Affordable Housing' mandate which has been taken up by State and Territory Governments. The policy has been sharpened by the booming Australian economy with the concomitant buoyancy against international currencies. This has resulted in an appreciable rise in costs for building materials. Add the potent mix of a shortage of tradespeople across the entire industry, pressure on rental home availability, escalating costs for building materials, drought conditions and rising mortgage costs, and it is easy to see why owning a house – the Australian foundation for the family – is quickly becoming a 'middle-class' option. The ability of new home buyers to raise the necessary deposit for a home, let alone deal with the other contingencies, is being rapidly marginalised.

The erection of prefabricated housing fuses together a range of different Australian industrial partnerships. For both interiors and exteriors as well as for their composite parts, much begins in the 'workshop' where materials are combined so that they can be transported to an on-site location, taking account of external factors such as portability, weather conditions, and load considerations. Modular construction for kitchens and bathrooms is now commonplace and it is often seen as providing an inexpensive alternative to crafts-personship.

The substantive issues from a training point of view will be to correctly sequence the building processes for both internal and external housing. Also, to identify the skills of the various contributors and to 'overcoat' a qualification base so that those who elect to work in this niche area can access directly relevant and comprehensive qualifications which embed all of the overarching skill requirements. This is particularly for those whose interest is in career progression and management, for they will be the harbingers of further development and the moderators of what is contemporaneously used.

## SWOT Analysis of Prefabricated Housing in Australia

### Strengths

- French, British and American precedential practices based on urgent need in various locales eg London to cope with de-urbanisation, Georgia USA to cope with flood damage. These programs have arisen out of acute necessity and have sustained over a period of years, thus providing a rich source of information about good practice based on urgent circumstances.
- Solid research foundations in Holland and Sweden (Lund University) as pioneers in working with both new technology and material innovations.
- In the UK particularly, notably in Greater London, Swedish and Dutch innovation has been translated into practice and, thus, we have the possibility of viewing first hand theory and practice, the latter which has driven specific training regimens.
- Qualifications base for practitioners in New Zealand and the United Kingdom – both within the competency-based qualification context. In New Zealand where the trend has been to break down the traditional full-trade qualification to skill sub-sets, prefabricated housing associated skills sit on their qualification framework as discreet competencies. It is a useful precedent to consider as the basis for adopting an Australian alternative.
- Australian ability to import materials and construct in Australia, thus generating an economically viable processing, building and construction sequenced option.
- Ability of existing workforce and those working in allied fields to 'credit transfer' and RPL into prefabricated housing qualifications to more quickly qualify as specialists in this area.

### Weaknesses

- Different geographies and climatic considerations – Australia has a much greater range of temperature fluctuations with extremes of heat and cold and thus the due diligence process used (as opposed to doing due diligence in itself) in determining material suitability is what is important.
- Traditionalist view of housing negates the potential value of prefabricated housing eg seen as 'kitset' and cheap. Unless the market can be persuaded to be more open-minded about prefabricated housing, there will always be limits on its application.
- Relative distances in Australia far greater than in above contexts for internal transportation. This has particular significance for associated skill sets such as packing, unpacking, and site-assembly.
- Stress factors in Australia for longevity considerations eg weathering and sustainability.
- Different building and construction training regimens – the symbiosis in some countries is not apparent in Australia eg role demarcations in European countries are less apparent.

# The Australian Context

## Opportunities

- Gaining of insights into international practices which have driven the training qualification bases, and to examine the roles of trainers and educators at all levels of the industry niche.
- Provide quality assurances for materials already being successfully used and debunk the view that prefabricated housing is applicable to only cheaper housing.
- Expand professional networks.
- Share training ideas and contribute to the internationalisation of prefabricated housing skill sets.
- Influence 'Affordable Housing' policy in Australia.

## Threats

- Resistance by building and construction advisory councils to the idea of specialisation for discreet prefabricated housing skill sets.
- Lack of support by the industry either in part or wholly.
- Costs for importing indicated materials prohibitive in Australia.
- Resistance by registered training organisations (including TAFE) to offer training.
- Lack of uptake by learners.
- Currently, expertise for this niche area in Australia resides with university research teams at post-graduate level insofar as materials used is concerned. Building Research Australia and New Zealand (BRANZ) have a research facility in Pauatahanui, New Zealand, where considerable material research has already taken place. However, this research largely relates to New Zealand conditions, and *ipso facto*, what materials they are able to use in building and construction which may be mitigated by Australian issues, such as for example, termites.
- There is a need to develop both education and training packages for those in both professional and para-professional levels to work with the associated prefabricated housing materials and technology as well as for subordinate levels to develop knowledge of attendant OH&S considerations across the whole construction process.
- Prefabricated housing erection is almost wholly carried out by tradespeople with either generic building and construction qualifications at best, or by 'rogue scholars' ie those who have learned their skills outside of the Australian Qualifications Framework.
- OH&S and environmental technology as specialised backdrops to prefabricated housing are areas where generic considerations must be drilled down to extract considerations often taken for granted.

# Identifying the Skills Deficiencies

## Definition – Skills Deficiencies

As already established, skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas.

## Identifying and Defining the Skills Deficiencies

The following outlines the skills deficiencies that were addressed during the Fellowship.

### 1. Identification of the key drivers for prefabricated housing.

- Through interviews and research collect factual data and record its origins, relating to the evolution, key driving forces and future trends of the prefabricated housing industry.
- Gain an understanding of how the industry has evolved in alternative contexts – what are the past and current key drivers? Gain an insight into what issues and vicissitudes will drive this industry going forward.

### 2. Differentiate between the known skills of the established industry in Australia to date and the skills deficiencies existing due to new processes and innovation in the industry overseas.

- Clearly identify the level of prefabrication that already exists in traditional housing in Australia today and benchmark this with countries that have similar climatic conditions and standards of housing. Through site visits, interviews and research clearly identify which elements of the prefabrication processes in these countries are new and the relative specialised skills that will be required.
- Gain an understanding of new processes and innovations evolving in the industry overseas to prepare for the new training and resources required to upskill tradespeople in Australia. An attendant consideration is that less than 60% (NCVER, 2006) of the Building and Construction Industry hold formal qualifications at trade level and thus, training in any context needs to be compelling in an overarching way.

### 3. Identify how newer building materials are impacting the industry relative to design, environmental and sustainability issues, energy usage and cost structures.

- Conduct interviews with legislative bodies, designers, manufacturers and tradespeople on the relative benefits and environmental impacts of newer building products in use in the industry.
- Gain an understanding of the relevant issues and benefits surrounding newer building products that will become available for use in the local industry and the new skills associated with these products.

### 4. Analyse quantitative comparisons between prefabricated and traditional housing regarding issues of affordability, speed and environmental considerations.

- Using a 150sqm home as a model, compare the overall issues relating to consumer affordability per sqm, speed of development to lock up stage including (for prefab) factory time and set up time, and the total carbon footprint of both.
- Gain an understanding of where the prefabricated industry currently sits in comparison to traditional home building methodology in relation to aforementioned important issues.



# Identifying the Skills Deficiencies

## 5. Examine training models, skill sets and outcomes in overseas trade institutions.

- Conduct visitations and interviews of institutional managers, teaching staff and trade students. Examine relevant curriculum content and effective styles of delivery. Study trade student retention rates and why these outcomes are achieved.
- Gain an understanding of the educational environment and its functionality relevant to producing successful training outcomes and positive industry retention rates.

## 6. Establish relevant OH&S requirements for new materials coming onto the market in Australia as they interface with economic, environmental, OH&S and other mitigations.

- Analyse materials currently used in overseas markets that will invariably become figurative in the prefabricated home industry in Australia. These materials, if not used before, may require new OH&S considerations and handler training.
- Gain an understanding of the OH&S considerations relevant to new materials coming online in the prefabricated home industry.

## Questions Related to the Skills Deficiencies

Identified skills deficiencies enquiries in prefabricated housing included, but were not limited to the following sample questions:

### *OH&S:*

- How are OH&S provisions demarcated in a put-together project context such as prefabricated housing?
- What overlaps and underlaps?
- How do materials used and physical resource (progressively) temper any OH&S provision?
- Does prefabricated housing, in itself, warrant a specific OH&S provision?

### *Materials:*

- What measurement systems do you use?
- What issues are there related to plans, cutting and finishing?

### *Packing and unpacking:*

- How do present inter-industry demarcations affect prefabricated housing as an industry in its own right?
- How do we define industry for the purposes of training provision?
- Are current training regimens too rigid and isolative?

### *Crane work and dogging:*

- Truck driving carrying heavy weights: what are the substantive issues relating to use of 'heavyweight' building componentry eg concrete slabs, and how do we solder together diverse functions into a siloed context for prefabricated building?

### *Erection of prefabricated frames; sequencing and joinery skills:*

- Does the training for project management in a prefabricated context require a lower level of application ie at trade levels as opposed to project management?
- Are carpenters/joiners training pathways necessarily the preclusive pathways for prefabricated framing work?

# Identifying the Skills Deficiencies

## *Internal fit-outs; technology:*

- How can our training system ensure that it has structures in place to account for changes in technology eg materials, etc?

## *Environmental issues; 'green' living:*

- How do we create conduits, lugs and mouldings to facilitate 'green' technology?
- How do we progressively rate sustainability and conservation issues over and above present ratings?
- How do we change the mindsets of builders et al to embrace overarching considerations, particularly environmental ones, in a prefabricated building context?

## *Finishing trades; plastering, painting, electrical and plumbing:*

- What can be done to prepare projects for finishing trades more readily?
- What (soft skills) training outside of the skills-based contexts is needed to promote inclusiveness, and an outcomes-orientation?

## *Overarching considerations:*

- How do present practices take account of various skills shortages and has the market for prefabricated housing been at all mitigated by skill shortages?
- Are prefabricated options, relatively speaking, more or less expensive than component-built options?
- What are the issues such as longevity, wear and tear or attritional usability?

## **Why the Skills Deficiencies Need to be Addressed**

Since the current apprenticeship system was augmented in the 1940s it has been supplemented by a component of off-site learning, for the main part carried out by the TAFE system in each of Australia's states and territories. This off-site learning has manifested variously as a day each week, or as periodic block courses with the idea of bringing together all of the theory-based learning necessary for an apprentice to complete their trade (and more recently para-professional) learning. The balance and, in fact, the majority of the trade and para-professional learning is undertaken on-site where the learned theory is enacted into practice under the direct supervision of an employer. On-site practices represent the actualisation of the learned knowledge and skills, and significantly, it is the employer who both integrates and marshals this.

The vocational training and education sectors have grown exponentially, particularly in the last twenty years, and arguably have become industries in their own rights.

A further factor related to the training and education industry, particularly competency-based training, is that their focus resides on a curricularised 'bricks in a wall' approach (where each competency is like a brick) rather than the whole wall itself. This is certainly not true for trades, where registration and licensing are a practising requirement (plumbing and electrical), because of the delineation between formative (component focus) and summative (overview) assessment, but it is a context which the other building and construction trades and para-professions must consider to retain relevance of the overall qualifications being delivered.

## Identifying the Skills Deficiencies

Daly asserts that potentially the greatest danger faced by the training and education industry is that it could easily cease to align with the required outcomes of the contributing industries it purports to represent. The result of this is truncation; off-site learning from the on-site learning which forms the axis of the trade qualification. The relevance of trade training qualifications is already an issue when industry questions its structure in that it illustrates the extent to which the primary stakeholders have become outsiders looking in.

The deficiencies identified in this report are areas of knowledge and practice largely outside the domain of formal teachings; they are moreover contexts best taught and inculcated *in situ* on the building sites. They are on balance more aligned with commercial than educative or training outcomes and indicate what the Fellow sees is the need for employers to train next generation 'builders' as opposed to merely qualifying tradespeople. Daly contends that apprentices with a 'big picture' analysis are much more likely to embrace the need for an industry commitment to ongoing training, because they will be able to see that the present skills shortages situation has been a direct result of the industry's unwillingness to take a future-based approach to working.

A big part of the work of builders, in each of their professional manifestations, is about engaging people, whether they be clients, colleagues, or authorities. The soft skills required to successfully engage and work with people are a commercial reality and a prime indicator of business success. Coupled with an appreciation of project management requirements, (from the point of view of a contributing practitioner) we provide apprentices with the opportunity to become professionally self-actualised and offer a pathway to becoming at the very least a capable project manager and at best a successful builder with a heightened appreciation of role responsibilities, an understanding of continuity issues, due diligence and troubleshooting methodologies, and the importance of forward planning. Project management is a template in many ways for the predicated success of the Building and Construction Industry.

The importance of sustainable work practices cannot be overstated, especially in an industry in which wastage equates to costs, and poor practices do not provide assurance of building robustness in the face of possible extreme global weather changes in the future. There is a direct linkage between environmentally poor construction practice and material shortages, climate change, and resource depletion. These are practices which must be inculcated into the very fabric of apprenticeship training and education as enterprise standards at the meso-level, and to maintain congruency with political mandates on a macro level.

Sustainable work practice, alongside sound health and safety practice, is ultimately an investment, not a cost, and without unnecessarily further complicating the formal learning requirements for trade and para-professional qualifications, employers have a role in providing leadership as role models in what is fundamentally a practice outcome. It is possible, within the microcosm of prefabricated house building, to pilot a more equitable franchising of theory and practice to the employer, and to provide validation for sound processes of apprenticeship engagement and assessment readiness.

# The International Experience

*“In times of change, learners will inherit the Earth while those who call themselves the learned will find themselves beautifully equipped to deal with a world that no longer exists.” - Erik Hoffer*

The Fellowship research focussed on identifying training needs and skill deficiencies within the prefabricated housing area<sup>2</sup> of the Australian Building and Construction Industry.

Daly carried out more than 30 interviews and discussions with apprentices, tradespeople, professionals and para-professionals from across the United Kingdom, Paris, France and Stuttgart in Germany. Daly visited a total of 15 worksites comprising both residential and commercial-scale housing developments in Leeds, London, Llanelli, Neath and Bridgend, as well as visiting two building and construction trade colleges in Sir Gar and Bridgend.<sup>3</sup>

In addition, Daly visited the Scottish Qualifications Authority in Glasgow; the prototype for the Australian and New Zealand qualifications authorities, to see how it currently organises its building and construction qualifications in light of significant changes to technology, the built form and the proliferation of prefabricated materials on the market.

Daly interviewed many more building and construction practitioners<sup>4</sup> than he had scoped for and this has resulted in a more qualitative<sup>5</sup> set of research outcomes. Daly attributes this to his attendance at the ‘Live in Australia’ expos<sup>6</sup> in London and Leeds, which provided access to a rich source of vitally interested informants.

Daly spent many hours communicating with information sources, and researching academic papers, policy documents and specifications in preparation for his Fellowship journey.

The reasons for choosing to travel to the United Kingdom, central Europe and New Zealand for this subject matter were as follows:

1. The United Kingdom comprises four separate countries who share a common vocational education and training system; the genesis of the current Australian Qualifications Framework. This was an opportunity to look at a cultural, educational, training and social context with strong similarities to the Australian Federation.
2. New Zealand has an established set of competencies for most areas of prefabricated work and a world-renowned testing facility in Pauatahanui, Wellington Region (BRANZ). This facility is a joint-venture with Australian concerns.

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<sup>2</sup> Prefabricated housing – for the purposes of this presentation, prefabricated may be taken to mean substantive internal and external building structures (as opposed to prefabricated componentry).

<sup>3</sup> In the UK and in France, the term ‘builders’ is used generically whereas in Australia, the term is taken to mean a tradesperson who has been registered (Victoria and Western Australia) or licensed (NSW, Queensland, ACT, South Australia and Tasmania) and who has undertaken further assessment and qualifications in conjunction with this status.

<sup>4</sup> Practitioners – includes tradespeople, para-professionals and professionals as well as apprentices from various trades.

<sup>5</sup> Daly had set out to represent a more quantitative research methodology, however the abundance and richness of feedback provided strongly favoured a more discursive format.

<sup>6</sup> ‘Live in Australia’ expos – forums for interested skilled migrants who have accrued sufficient ‘points’ to look at working opportunities in Australia where attendant skill shortages exist can talk to Australian authorities about localised needs.

# The International Experience

3. France and Germany have well established training systems with a strong emphasis on higher-level 'artisan' practice, with well-developed senior practitioner<sup>7</sup> roles.
4. Central Europe (and Scandinavia) is affectionately referred to as the 'spiritual home' to prefabrication innovation, techniques and materiality.
5. Both parts of the world work closely together and separately insofar as design and theory are concerned. The ARCOM<sup>8</sup> conference in Cardiff in September 2008 was an eclectic gathering of experts from around the globe, facilitated by Professor Andrew Dainty of Loughborough University in conjunction with Reading University. It proved to be a useful backdrop to understanding British theory and practice-based site issues.
6. British management and construction practices are generally structured similarly to our model. Whilst Australia has more highly developed OH&S regulation and legislation at this point in time, the strong commitment to sound sustainability practices and policy in the UK provide a solid template for integration with the rapidly evolving Australian consciousness about environmental issues and the need to reduce the carbon footprint in building residential structures.

## Research Outcomes

*"Theory without practice is sterile; practice without theory is futile."* - Edward DeBono

Daly's research did not altogether reveal what was expected. He had been looking at potential 'hard'<sup>9</sup> skill deficiencies when in fact it was apparent that substantially 'soft'<sup>10</sup> skills were where the training (or developmental) deficiencies exist. It manifested not so much in the formal *training* carried out, but more so in *professional development*,<sup>11</sup> and this appeared to be largely carried out on-site by employers. Initially it was difficult to identify specifically what skills and knowledge were in evidence, but with the benefit of time to reflect it was clear that it was about superordinate contexts ie what was described as grooming or finishing, actually reflected a substantially more comprehensive 'big picture' view of the industry. It created a situation in which Daly felt, so compelling was the evidence, he had to literally turn about-face with his enquiry and look for ways to make the verbal testimony provided, more qualitatively imperative.

Ironically it was through informal discussions with UK apprentices and their supervisors on-site, Daly discovered that although seemingly similar, the Australian and UK apprenticeship systems (particularly in Wales) are markedly different in terms of what apprentices actually *know and practice* about project-based work in total. Perhaps this is a reflection of the different engagement structure of the UK and European construction industries (employment-based

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<sup>7</sup> Senior practitioner – universally taken to mean a tradesperson (or para-professional) who is highly experienced and knowledgeable about their area of work and who is acknowledged as such by the local industry.

<sup>8</sup> ARCOM – Association of Researchers in Construction Management

<sup>9</sup> Hard skills are trade and occupationally specific skill sets.

<sup>10</sup> Soft skills are skill sets which facilitate hard skills, eg communication, negotiation etc.

<sup>11</sup> Professional development – inter alia, applied and supplemental learning which transcends formal skill-oriented training and engages the learner in producing quality standards of work-personship.

## The International Experience

instead of (sub) contract and project-based) and Australia, and how they are able to translate an understanding of related socio-cultural contexts to the work they carry out on-site, and Daly's observation of their ability to effectively engage and communicate with clients.

In residential building contexts, particularly where refurbishments were taking place, and also in public housing sectors, the value of constructive working relationships with clients is well understood and integrated into UK practice. So much so that in two instances businesses actually engaged an appropriately qualified Community Coordinator<sup>12</sup> whose specific role it is to liaise with clients and schedule work programs, whilst taking account of familial and social needs. Both employers commented that the role pays for itself in terms of productivity and efficiency gains.

At Certificate IV level and higher on the Australian Qualifications Framework (AQF), learners in the Building and Construction Industry are introduced to 'project management' as, among other things, an integral competency in all management and building qualifications. It occurred to Daly that we might take notice of the way in which building (as distinct from carpentry and other associated trades and para-professions) is focussed more on high quality and integrous outcomes by building contractors and prepares journeypersons (as potential builders) for this shift in emphasis *while they are learning their trade*. This does not actually occur in the UK *within the formal competency framework*, but it is manifestly apparent within the working relationships between the employers and the apprentices. UK (second year) apprentices could recount in total, not only an overview of what the building project involved, but all of the internal machinations such as how preparations, constructions and finishing are demarcated, what their roles were in terms of expectations by their employers, and what the quality measures were for handover of the project. They were also across the issue of 'carbon-footprinting' and how to dispose of waste materials according to local authority recycling mandates.

Prefabricated housing was an area of work that all with whom Daly spoke had extensive experience, mostly with erection of pre-built modular formats and internal 'kitset' structures such as pre-built bathrooms and kitchens. It was necessary to demarcate between substantial prefabricated edifices and componentry (it was counter-argued that bricks, mortar, copper piping etc are all prefabricated). The debate was very well engaged by the UK workers, particularly those in middle-management (forepersons, leading hands, etc). They were eager to build on their own knowledge base about international practice and to compare advances in the UK with what was happening in the 'antipodes', because they were already well versed in central European practices. The working relationships with Scandinavia, Holland, France and Germany, in particular, are strong and highly evolved.

In these ways UK apprentices and journeypersons appeared to have a better 'bigger picture' understanding of construction processes. They are also able to clearly identify (and support with documentation, photographs, etc) their own career industry pathway and achievement milestones, and indicate exactly what they intend to do by way of career progression, and how this can be effected.

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<sup>12</sup> Community Coordinator – person engaged by building company to liaise with housing tenants or owners to ensure continuity of work program and address and advocate for any social or community needs.

# The International Experience

Conversely, UK employers were very interested in our builder licensing/registration training, particularly as it related to business management skills. Both areas of strength reflect the commercial structure of business in each locale. In the UK most tradespeople are employed, whereas in Australia the contracting and sub-contracting cultures are very strong.

## Building and Construction – a Broad Stroke of the Brush Overview

*“Hütia te rito o te harakekeke, kei hea te kōmakō e ko? Ko te ui atu nei, he aha te mea nui ō te Ao nei? Ko te kī – he tāngata, he tāngata, he tāngata...”*

– NZ Maori proverb ‘Where will the bellbird go once the flax has disappeared?’

Meaning: *“What is the most important thing in today’s world? The answer is the people, the people, the people...”*

There is a revolution taking place in the Building and Construction Industry - modern learners must be trained and developed (as observed here in the United Kingdom) to understand activities which straddle amongst other things, trade, socio-cultural, environmental, professional, sustainability, cost-financial and health and safety issues, because modern day built forms and construction techniques demand a level of versatility not previously experienced in the industry. We must strive to train builders to be career self-determining, and to seek out ongoing training opportunities to better equip them to become the project managers and industry decision-makers of the future. We must also develop our training resource to ensure quality outcomes for the future. Perhaps we might even consider internationalising training opportunities for the common good of all.

The modern builder is certainly not the equivalent of earlier trade iterations. He or she is the synthesis of school education and all of the attendant conditioning, peer influences, parent and family contributions, formal trade training at Polytechnic colleges, and the polishing provided by employers in a highly sophisticated and rapidly changing workplace.

There is an evolving need to not only access ongoing training and education but to create robust due diligence processes as a means of addressing new ideas in the moment. This is not something formally taught – it is inculcated by wiser old heads on-site.

The current generation of builders must not only embrace industry-based learning for their own practice, but also for the wider industry and for future generations. In Australia we must set out to raise the profile of the industry so that it is seen as an articulated career option of first choice, so that it is welcoming of both men and women at all levels, so that it is free of all the popular, dated and invalid misconceptions which abound. We must address skill shortages and skill deficiencies, and most of all assure the consumer that quality in the built form, whatever it is constituted from, is something they can depend upon, based on an industry seeking to reinvent itself and set universal boundaries for its research and its practices. Our industry is often the harbinger for the wider economy; when building activity lessens, it is a time to take your belts in a notch.

Our consumers, pretty much everyone in our population at some point in their lives, are arguably the best testifiers and advocates for our industry; we want to champion integrity, professionalism, and produce high quality products at affordable prices. Most of all we want to engage widespread public support for well-researched innovation, and the use of new technology and materials. This must take account of a rapidly changing physical environment, resource availability, recycling and sustainability mandates, and produce high quality built forms, which are affordable and durable.

- Excerpt from Daly’s presentation to the Federation of Master Builders Luncheon at Bridgend, Wales, 2008

# The International Experience

Residential building might be simplistically described as a microcosm of building in a larger context, where fewer people carry greater role responsibilities and accountability structures in actual practice are discharged more at voice-level than anything more formal. With bigger projects (such as duplexes, multiplexes and tenement buildings) of course such informality is necessarily less evident. It is more likely, according to feedback from UK tradespeople, that residential ‘builders’ will carry out a wider range of perfunctory<sup>13</sup> tasks associated with other trade roles in Australia so as to ensure project continuity.

The term ‘builder’ is colloquially used in the UK (but not particularly in Central Europe) and it is taken to mean the same as a project manager. Builders are not formally licensed or registered in the UK (as they are in various categories throughout Australia), but they are more likely to be tertiary-educated (as opposed to vocationally-trained eg the Australian Certificate IV in Building and Construction – Building). It is possibly by virtue of the systemic educational and training differences (refer to Attachment 1) that the ‘bigger picture thinking’ manifests.

## Prefabricated Housing

There is neither a distinct prefabricated housing ‘sector’ in Australia, France, Germany nor the UK, but it is unilaterally recognised as comprising a distinct set of skills and disciplines and its practice generally calls upon a background of on-site experience to inform localised activity. Daly was told there is significant industrial opposition to unskilled manufacturer-employed workers being engaged to assemble prefabricated structures on-site in the UK, generally because it is felt that they may potentially compromise the health and safety of trained workers. While this opposition also manifest towards unskilled workers working off-site in the manufacture of prefabricated materials, it is recognised that they receive training on-site, albeit focussed only on the materials being used, and it is an area recognised by the construction industry as ‘on the cusps’ ie it is neither construction nor factory-worker specific. The drive to embody manufacture of prefabricated materials in the UK from the Central European and ASEAN countries markets might in some ways be seen as the industry’s attempt to take ownership of prefabrication in a total sense.

Off-site System	2005 Output	Proportion of UK Total
Timber frame – all types	42,000	18.6% <sup>14</sup>
Light steel frame (LSF)	8,800	3.9% <sup>15</sup>
Structural insulated panel	600	0.3% <sup>16</sup>
Volumetric modular	2,000	0.7% <sup>17</sup>
Hybrid (pod & panel)	300	0.15%

Table 1: Off-site-built technologies in housing (United Kingdom)

<sup>13</sup> Perfunctory tasks – those routine tasks ordinarily allocated to labourers or apprentices and which are demarcated as belonging to other trade groups.

<sup>14</sup> UKTFA (UK Timber Frame Association)

<sup>15</sup> Steel Homes Group (affiliated to the Steel Construction Institute)

<sup>16</sup> The MPBA (Modular & Portable Building Association)

<sup>17</sup> Mtech Group (independent research)



# The International Experience

Prefabricated housing technology has experienced peaks and troughs in its relatively short history. In the late 1950s and 1960s in the UK it was seen as being 'the new order of things' although its widespread application in suburban settings tended to have it viewed as a cheaper, less substantial building form. Ross (2005)<sup>18</sup> states the term 'Modern Methods of Construction' covers a broad range of construction types ranging from complete housing systems built in factories through to new site based technologies.



*Clusters of prefabricated homes in Neath, UK*

Older terms such as 'system building', 'off-site assembly' and 'industrialised construction' are related to:

- Volumetric construction
- Panellised systems
- Hybrid construction
- Sub assemblies and components
- Site based methods of construction

The first four categories are usually manufactured in a factory. The term 'site based methods' covers systems that do not fall neatly into the first four categories. This first part of Ross' guide describes the form and nature of these construction types to provide background knowledge that will aid the identification process.

The intention of many contemporary house builders using modern methods of construction is to produce buildings that appear similar to those that have been constructed in brick and block cavity masonry. This attempts to overcome the problems with building and planning approvals due to the need for building to match its environment.

<sup>18</sup> Ross, K. (2005) *Modern Methods of House Construction: a Surveyors Guide*, Academic Paper, Loughborough University, England. ISBN-1 86081 755 6, BRE Trust, United Kingdom.

# The International Experience



'Buildability'<sup>19</sup> is a term regaining prominence in the UK and France, and it was used in Australia in the 1960s in much the same way it is now used there.

Understanding 'buildability' is seen by project managers in the UK as, among other things, the point at which an apprentice or learner equipped with the necessary experience and skills, can demonstrate an emerging knowledge of what will work on-site (and what will not), and can, therefore, be left to work with minimal supervision. Clearly the concept and attendant practice is enmeshed in all informal site-based learning.

## Training in Context

The apprenticeship system was introduced to Australia in the early part of the 19th century in response to the demand for trade skills in the expanding colonies....

The 90s saw the deregulation of the traditional apprenticeship scheme, with this came the introduction of:

- Industry agreed competency standards.
- Industry agreed testing methods.
- Competency based training formulated to the agreed Australian Committee for Training Curriculum (ACTRAC) guidelines.
- Skills specific training at TAFE Private Providers.
- Industry training packages.
- VET in secondary schools.

<sup>19</sup> Buildability – how what is built informs concept and design. The practical ability of the builder to encapsulate design requirements, geology, physical constraints and materiality to construct the built form so that it matches the customer requirements, structural modifications et al notwithstanding.

# The International Experience

- National credentials.
- Employer driven Industry Training Advisory Boards (ITABs).

All of which impacted on shifting the training arrangements for each individual apprenticeship/trainee from a tripartite agreement (apprenticeship/government/employee) to a training agreement based on industry agreed outcomes which requires only the apprentice to carry the responsibility to gain skills and then demonstrate his or her degree of competence.

[Since then the apprenticeship system has seen further changes and developments.]

- Extract from *A New Model for Skilling the Trades. Master Artisan Framework for Excellence*, ISS Institute, December 2004

The British system has a heritage going back many hundreds (even thousands) of years and at times has been characterised by reports of various forms of abuse by the employers towards the young apprentices, particularly in relatively emancipated times, such as after the Agrarian and Industrial Revolutions.<sup>20</sup> This system has contrastingly undergone a major overhaul in recent years, both in terms of the learning context and the attendant attitudes or the prevailing paradigm within which apprenticeship learning is seated. This may well be a result of the following:

1. The closer economic relationship with places like Germany where trades enjoy a status similar to professionals.
2. The higher school leaving age at commencement of apprentice training.
3. The greater incidence of adults entering apprenticeships.
4. The modern day complexity of building technology and attendant role specialisation.
5. The universal commitment to ongoing continuous professional development.
6. The publicly well-understood complexity of theory, research, and learning materials, particularly computer software to serve project management, building design and estimation.

Learning in an apprenticeship context has become more holistic (what we in Australia would understand as having a 'builder' focus; ie more of a career and responsibility orientation) and strongly focussed on actual site-based activity, taking into account changes in materials, technology and best practice, as well as having an omnipresent respect for sustainability requirements.

Perhaps because those in the UK Construction Industry are more widely, actively and regularly involved in their own training as a part of CPD,<sup>21</sup> the lines of authority are more blurred on-site. Daly noted a definite desire to access training and professional development in the UK and Germany whereas in Australia, most particularly at management level, training is seen first and foremost as a cost-impost and is often invested in only for subordinate staff, where there is a direct relationship between regulation, methodology and/or materials. Senior managers in commercial settings are characteristically well educated at point of entry into their roles.

<sup>20</sup> Agrarian and Industrial revolutions – broadly a time of accelerated agricultural and industrial development between mid 18th Century until mid 19th Century.

<sup>21</sup> CPD – Continuous Professional Development

## The International Experience

Our industry is well served in terms of practical applied training uptake; the areas we might look to reinforce are the so-called soft skills for those in management positions such as communication skills, negotiation, conflict resolution, consultation and demarcating between leadership and management.

Apprenticeships, where the apprentice is contractually bound to an employer for the entire duration of their apprenticeship are, according to UK commentators, more likely to feature informal 'grooming' instruction by the employer (as opposed to that being offered by an external provider) about good business practice and communication/interpersonal skills, particularly in the latter stages of the training contract. This occurs because apprentices more often than not stay on with a good employer and learn how to manage other people as well as refine and consolidate their skillsets. The contract of employment and training is more likely to sustain in the UK than in Australia, as later discussed.

The contrast in Australia is that almost all apprentices graduating from group schemes<sup>22</sup> move into private employment or go 'onto the ABN'.<sup>23</sup> The strong sub-contracting basis of the Australian Building and Construction Industry has resulted in newly qualified journeypersons largely faring for themselves with the attendant weight of expectation by an industry which at times is severely critical of the training system, and yet at the same time demanding of journeyperson standards from those who are still very much learners in the broader industrial context. This Australian situation condenses what the Germans refer to as the optimal period for skill development and consolidation; the period post the formative learning stage of career development, after the core skills have been assimilated and at which time confidence and competence emerge alongside a more mature psycho-social-cultural approach to work.

UK and German apprenticeship completion rates<sup>24</sup> are markedly higher than Australian rates,<sup>25</sup> however the German authorities are apparently concerned by a recent fall in completion figures and this may be on account of several socio-cultural mores such as:

1. In Germany there is a societal inculcation of a learning culture and a higher status of trades as an occupation as compared with for example, lawyers and accountants.
2. The German and UK 'quasi-familial' apprenticeship context where the relationship between apprentice and employer appears to feature significant supplemental learning, oftentimes beyond the scope of staged formal trade-oriented learning and practical skill acquisition. Skill acquisition and other learning offered by the employer often post-dates the formal apprenticeship arrangement and there is often a perception that one does not truly become a journeyperson until after eight to ten years have been served under a craftsman.

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<sup>22</sup> Group schemes – apprentices employed often by a training organisation and hosted out to employers on invoice.

<sup>23</sup> 'Onto the ABN' – local parlance for become self-employed, having registered as a contractor with the Australian Tax Office.

<sup>24</sup> UK and German completion rates in 2006 for building and construction-related trades were published as being 78% in both jurisdictions.

<sup>25</sup> Australian completion rates, according to NCVET in 2006 were at 48%.

## The International Experience

3. The (understandable) concentric focuses of Polytechnic colleges on trade preparation in contrast to the employer focus on standards of crafts-personship. In Scotland, apprentices seek employment after the formal 'classroom' learning requirements and thus are older, potentially more mature, have greater ability to 'hit the floor running' and their ongoing service is un-interrupted by formal study.
4. The significantly greater participation by industry captains<sup>26</sup> in advisory/governance-type roles<sup>27</sup> with all forms of training in Germany, France and the UK. Other than in London, employers were significantly involved in a wide range of training briefs.

In the UK (particularly Scotland) it is possible to completely front-end competency training for a trade apprenticeship at a Polytechnic college<sup>28</sup> before being employed to engage the site-based practical learning. In some ways this structure addresses the Australian concern about producing 'hot-house' apprentices who might never have actually been *tested* in on-site crisis situations; UK apprentices who undertake their competency training as a precursor to site-based training are often slightly older (and arguably more mature) than their Australian counterparts. The ability of UK apprentices to engage clients (particularly in terms of cross-cultural contexts) and take a broader view of construction requirements then may ultimately be about relative maturity. In the UK (notably in Scotland), a significant 78% of construction apprentices complete their apprenticeships<sup>29</sup> compared with an Australian national average of 48%, this figure bearing out Australian NCVER<sup>30</sup> research (2006). This indicates that older and more knowledgeable apprentices are more likely to complete their apprenticeships (and indeed all forms of educational qualifications) than younger, less life-experienced learners.

Australian apprenticeships aligned with vocational training provided by TAFE institutions some forty years ago, and in more recent times in some states and territories, are also aligned with privately-run RTO's.<sup>31</sup> In 2006, completion of the vocational training component was stated by the Council of Australian Governments (COAG) to be the sole indicator for completion of the apprenticeship contract. Some states still operate apprenticeships according to indentureships,<sup>32</sup> and as is often the case in such situations, that apprentices complete their off-site training requirements a full year before they are formally released from their indenture. This procedure is strongly favoured by TAFE as it lends to 'curricularisation'

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<sup>26</sup> Captains – a term used by qualification authorities in the UK to identify industry-based leaders and consultants vitally concerned with application of training activity.

<sup>27</sup> Governance-type role – industry captains are widely consulted as stakeholders in training development, particularly in France.

<sup>28</sup> Polytechnic college – similarities to modern-day TAFEs.

<sup>29</sup> SQA figures – 2007 commissioned study.

<sup>30</sup> NCVER – National Centre for Vocational Education Research, based in Adelaide, South Australia. An August 2005 research paper pointed out that 48% of all trade apprentices engaged, completed their apprenticeships. The confounding variable with this research was the statistics did not take account of transfers between training providers or extended leave periods. Building and construction apprenticeship completion rates reflected similar completion rates in a subsequent informal study carried out by NCVER in 2007.

<sup>31</sup> User Choice policy allows employers and employees to choose their training organisation, according to COAG directives.

<sup>32</sup> Indentureships – a period during which time an apprentice is required to work for a designated employer in fulfilment of an apprenticeship contract of employment.

## The International Experience

of vocational training. Apprentice off-site training seldom occurs outside of the Polytechnic colleges<sup>33</sup> in the UK and Central Europe and closely resembles the New Zealand model where informal (pre) assessment is undertaken by an employer determination of 'assessment readiness', at which time an independent assessor visits the worksite to establish whether competency can be demonstrated. In this way the employer is much more aware of how competency standards are assessed and more importantly, how to prepare the apprentices for this process.

The NZQA and AQF<sup>34</sup> are both in fact descendent from the SQA;<sup>35</sup> the NZQA being slightly older than AQF. In the UK, despite socio-political differences between the four independent 'home nations' a common practice methodology is upheld insofar as vocational training is concerned. In Wales, Ireland, Scotland and England the audit<sup>36</sup> and moderation<sup>37</sup> (called 'validation' or 'verification' in the UK) policies are rigorously upheld by all four countries. In England, qualifications are seen to follow industry mandates as opposed to traditional ones and, therefore, trades such as 'roof and truss framers' (affiliated to carpentry) are recognised by formal qualification pathways.

There have apparently been discussions about demarcating residential carpentry and in turn prefabricated building but these have foundered on account of three issues:

1. Prefabricated housing spans all size and complexity criteria ie it is also commercial (duplexes, triplexes, etc) and open-class (tenement buildings, aged care villages, multi-story housing, etc).
2. Erection of prefabricated housing structures is not seen as the sole domain of carpentry-trained tradespeople.
3. Prefabricated work is generally accepted as an advanced level of practice relying on mastery of primary or core trade and site-based skills.

In Australia, the national (or federal) qualification authority is administered by each state or territory and thus it is more likely that assessment contexts will vary given the lack of any nationally-focussed moderation activity. TAFE institutions participate in internal moderation activity, but do not provide outcomes of this to state and territory authorities. Registered training organisations (RTOs), unless by informal localised agreements, are not subject to external moderation of assessment outcomes at all.

There is a greater compliance requirement in Australia (than in either New Zealand or the UK) on training activity as a forerunner to the determination of competency. Training organisations must be registered and accredited to deliver training as well as to conduct assessment against AQF competencies. The German training system is similarly structured. For this reason in Australia, employers are more likely to supplement formal training provision supplemented by on-site 'tricks of the trades', whereas in the UK employers are independently responsible

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<sup>33</sup> Polytechnic colleges – similarities to TAFEs in Australia; training providers which place an emphasis on technical training and education.

<sup>34</sup> NZQA – New Zealand Qualifications Authority; AQF – Australian Qualifications Framework

<sup>35</sup> SQA – Scottish Qualifications Authority

<sup>36</sup> Audit – review of processes associated with assessment to ensure compliance with Australian Quality Training Framework (AQTF) provisions.

<sup>37</sup> Moderation – overview of assessment activity to ensure consistency and validity.

# The International Experience

to prepare their apprentices for practical skill demonstrations to meet such examinable outcomes as City and Guilds of London<sup>38</sup> certification. UK apprentices can then graduate with their NVQ<sup>39</sup> as well as their 'City and Guilds' certificate.

In the UK as well as in France, tradespeople and professionals carry 'Skills Cards' on which their entire record of formal learning is recorded and they attend ongoing professional development training (in predicated subjects) in much the same way as occurs in some states of Australia. It is far easier in smaller countries such as the UK and New Zealand to manage nationally recognised qualifications (although the Scottish and other UK countries differ in terms of nomenclature – SVQs and NVQs) at a federal or international authority level than in Australia.

In Germany, apprenticeship and trade training is both highly structured and strongly patronised by school-leaving youth. Trades enjoy a status which is significantly elevated by Australian standards. The German trade training system has very high completion rates and to deliver the training for apprentices requires Government certification, and to employ and to educate apprentices requires an AdA<sup>40</sup> licence. This needs to be acquired by training at the Chamber of Industry and Commerce (IHK) Meisterschule.<sup>41</sup> Certification and Meisterkraftsmann status (also colloquially known as 'hoch' status) are levels which follow journeyperson status and are based on nationally-recognised *standards of excellence*.

## Prefabricated Housing – the Fellowship Visits

- Visited New Zealand to see the Pauatahanui BRANZ<sup>42</sup> Centre, where field-testing on prefabricated materials was being carried out and evaluated.
- Visited New Zealand BCITO,<sup>43</sup> to review prefabricated building competencies and skill sets registered on NZQA.
- Visited Hanson Precast manufacturing factories in greater Sydney and environs.
- Visited Strine Constructions, PBS Building, ANU, Gecko and Indigenous Business Australia to look at prefabricated housing technology and practice.
- Visited Welsh, English, and Irish sites in the UK. Visited the respective qualifications authorities and then to the parent organisation based in London.

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<sup>38</sup> London City and Guilds – City and Guilds offers a large number of specific examinations. It is also an accreditation agency ensuring that qualifications bearing its approval reach the appropriate standard. Over 1.5 million learners work towards City and Guilds qualifications every year.

<sup>39</sup> NVQ – National Vocational Qualifications are vocational awards in England and Wales that are achieved through assessment and training. In Scotland they are known as Scottish Vocational Qualifications (SVQ). They are practical qualifications based on being able to do a job. In Northern Ireland the system is similar, but not the same as England and Wales.

<sup>40</sup> AdA - Ausbildung der Ausbilder (education of the educators).

<sup>41</sup> Mesiterschule – Masters School, training establishments for master craftsmen (sic).

<sup>42</sup> BRANZ – Building and Research Australia and New Zealand.

<sup>43</sup> BCITO – Building and Construction Industry Training Organisation.

# The International Experience

- Visited FMB,<sup>44</sup> Cardiff and London – advocates for English builders, project managers and construction workers.
- Attended 'Live in Australia' expos to talk to builders specifically and exclusively to discuss prefabrication issues on-site and how these are addressed.
- Visited German and French partner organisations to the Master Builders. Associated site visits.

## Questions and Answers

### 1. Buildability

- What are the linkages between theory and operational practice in erecting prefabricated housing?
- What role demarcations exist between trade, worker and professionals and how these are managed for best outcomes?
- How do builders ensure integrity of built housing (ie matching design and client specifications)?

As already established, 'buildability' is a term that is widely recognised on-site within the UK, especially in Wales and Scotland. It does not appear to have an official status, but it is seen as a way of describing how project managers translate draft plans and blueprints into reality, taking into account the 'actuals and realities' of the particular commissioned work site. As already stated, the residential building context is a microcosm of larger work sites (eg commercial activity) where fewer people carry out a wider spectrum of work in a more confined working space.



There is a strong patronage in the UK and France to the ongoing use of wooden (or metal) frames, which are largely erected on-site. Project managers are principally concerned with compatibility issues insofar as prefabricated structures are concerned, the juxtaposition of traditional structures, and what is sometimes affectionately referred to as 'clip-ons' ie prefabricated materials. Project managers pay particular attention to how the technologies, prefabricated and traditional, work together and what if any cautions are indicated.

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<sup>44</sup> Federation of Master Builders



# The International Experience

An example of this is where particular gluing or paint fumes might combine with prefabricated materials to potentiate noxious emissions, either at that time or in the future. Because so much attention is paid to 'carbon footprinting',<sup>45</sup> project managers carry out a thorough process of due diligence<sup>46</sup> to ensure that any previously unknown material is researched in terms of compatibility, life span, and environmental impact. In Wales, Daly was told that a project manager must report on what was referred to as material and structural morbidity<sup>47</sup> to satisfy local council regulation. The recent sensitivity to the lifespan of building materials is anecdotally attributed to what is now known about asbestos and the attendant health ramifications.

On site, project managers and tradespeople refer to the 'invisible class structure' that exists between occupations – trades and the professions, especially around 'buildability' issues. Project managers are viewed as the conduit between customer and the vision of the built structure that has been sold.

The project managers that Daly interviewed acted as go-betweens between the professionals and the trades to recommend alternative ideas and thus often, their knowledge of buildability issues embraced the gamut of considerations on the discussion table. Interestingly, the professionals and the trades both relied on project managers in this pivotal role on the sites visited. This might be attributed to the responsibility of the project manager to deliver the built form (as opposed to the design on one hand and assemblage of the constituent parts on the other). The on-site testimony provided, richly illustrated, the two at times diametrically opposed views of either the forest or the trees.

## 2. Materials

- How do builders deal with new materials on-site?
- What information is provided about new materials as a rule?
- What is the underpinning site-based 'due diligence' process for assembling and working with new materials and material selection?
- What is referred to as a guideline for utilisation with new materials?
- What is this based on and who shares the classification system?

For many of the project managers Daly spoke with, new materials on-site were effectively a regular occurrence on each new project. Many commented on the lack of 'quality' information about new materials (often only anecdotally introduced by professionals or off websites). Without the strong informal networks between peers, and access to web-based information about manufacturers, many project managers would be reluctant to use what is recommended. The tool reportedly most used in the due diligence process is the mobile (cell) phone.

Much was made of German, Dutch and Scandinavian innovation, as far as materials were concerned, by the professionals whom Daly interviewed. It was interesting, however, to discover that although this acknowledgement was in place, in the UK locally produced

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<sup>45</sup> Carbon footprint – a measure of the impact that human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide. Source: Wikipedia.

<sup>46</sup> Due diligence – term meaning to thoroughly research or evaluate with the emphasis on an outcome.

<sup>47</sup> Material and structural morbidity – the expected lifespan of materials and what happens to them as they deteriorate.

# The International Experience

prefabricated material was being used with the same abundance as imported material, both on account of availability and transport costs. Project managers also argued that British technology, although often informed by international practice, was still the best equipped manufacturing context to meet unique British building and construction needs. This might seem like an argument with a foundation in nationalism, but project managers rationalised this by saying that the British building context is environmentally and socio-culturally different to the European one. The French argued similarly; only the Germans interviewed were eclectic in terms of their patronage.

The questions asked within the due diligence process are usually similar, and according to responses from a number of project managers, “they evolve”. Project managers also commented that ‘due diligence’ skills are *not* something which is taught as a part of their formal professional training, indeed it is seen as being too broad a subject to ever be so. Due diligence is considered an over-arching skill requirement (much like communication skills).

Of principal and primary concern are the following:

- Cost for application (including transport to site, storage and weather and theft-proofing)
- Durability in raw state (how weather and/or the environment effects the product before it is ‘dressed’)
- Physical attributes; height, weight, density, etc.
- Composition, legislation, regulation, best practice methodology for working with it.
- Binding and cosmetic options; how it is combined with other materials and dressed.
- Environmental considerations; ratings by local regulatory watchdogs, recycle-ability, projected lifespan and attendant considerations, etc.
- Health and safety requirements for use; portability, compatibility, breakdown, emissions, etc.
- Adaptability; can local manufacturers produce the same or similar materials?

Prefabricated housing materials are presently enjoying a renaissance on account of the well-publicised need to reduce the carbon-footprint associated with building and construction activity, and the idea of erecting housing which is environmentally friendly, mostly for energy cost savings.

The commercial manufacturer venture-capitalists have ‘cashed-in’ on the whole sustainability context by popularising the use of recycled materials, particularly in France. Many of the common prefabricated materials currently available to consumers in France have been ‘fashionably’ recycled, and ironically, the marketing strategies engaged are proving to be market-successful. There has also been an attendant dramatic increase in the use of raw traditional materials, in both the UK and central Europe, notably steel and wood, which has had the effect of shifting traditionalist viewpoints.

## The International Experience



*This prefabricated addition to an established mainframe was made in Austria and then transported holus-bolus to its North London location in kitset form. It is a remarkable juxtaposition of traditional and new building styles. The prefabricated building is formed of solid timber, zinc-clad panelling. Not only is timber a less carbon-intensive material than concrete, the builders report it is cheaper and quicker to construct. The timber used has helped to stabilise the building's temperature, further reducing energy requirements.*

UK tradespeople generally indicated a preference for working with traditional building materials, at times dismissing prefabricated materials as consumer 'fads'. Contrastingly, as consumers in their own rights, they will often approve the use of kitset kitchens and bathrooms (to name two examples) on the basis of cost relatively. Project managers reported that prefabricated materials (including materials which have been recycled) are viewed by many consumers as 'foreign' and a cheaper (and by association less robust) option necessitated by shortages and heavy costs of traditional materials. It appears that this public perception is in stark contrast to authoritative and extensive research carried out and published in the UK by, amongst others, Loughborough University.

Most project managers interviewed knew about the 'Boswell Houses' built on the Boot Estate,<sup>48</sup> as the popularised failure in the prefabricated housing chronology.

### 3. Health and Safety (H&S)

- Account for practices (including concrete slabs), to obviate environmental and occupational health and safety issues in the erection of prefabricated housing?
- What H&S training is generic, and what training is specific to prefabricated building contexts?
- How is this demarcated?

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<sup>48</sup> Boswell Houses – see Attachment 2

## The International Experience

*"Health and Safety I guess is an investment and not a cost. It can be a big investment, but then it can save a big cost with all the 'legals' (sic) that go with litigation."* – Dai P, Project Manager, Bridgend

Research in construction health and safety has focussed on improving management strategies and policies that can effectively improve safety performance. The Health and Safety Executive (HSE) in 2005 developed online interactive tools for contractors to assess the cost of accidents to their organisations. Although providing good guidance, these tools developed do not provide sufficient detail to specifically assist contractors and designers in developing effective and efficient health and safety management systems.

Therefore, it is considered important to develop a methodology to enable contractors to assess the true costs of accidents and the associated benefits of accident prevention as part of pre and post contract project evaluation. A framework is proposed based on an examination of economic viability of management of construction health and safety. The method developed incorporates accident cost elements, health and safety measures and benefit elements to improve decision making processes and guide contractors and designers in developing efficient and effective construction health and safety management practices.<sup>49</sup>

There is much underway as far as health and safety practice is concerned, as the UK attempts to play catch-up to Australia as one of the internationally recognised countries of progressive OH&S legislation.

What struck Daly when discussing health and safety issues on-site with project managers in the UK was they were code and regulation compliant, but oftentimes lacked a deepened understanding as to the 'cost vs investment' continuum<sup>50</sup> of sound health and safety practice.

Health and safety compliance practices were in place, in part, because it was simply rationalised as something that had to be done to avoid costly litigation. Conversely, health and safety compliance can be taken up proactively. For example, immediately prior to Daly's trip to the UK and Europe, he visited Hansen Precast Pty Ltd in Sydney. Proudly displayed on their entranceway, was a graph which showed the aggregation of work-hours where there had been no incidents which interrupted work outcomes.

Resistance to change has generally been understood as a result of personal experiences and assessments about the reliability of others. Accordingly, attempts are made to alter these factors in order to win support and overcome resistance. But this understanding ignores resistance as a socially constructed reality in which people are responding more to the background conversations in which the change is being initiated than to the change itself. It is argued that resistance to change is a function of the background conversations that are ongoingly being spoken and which create the context for both the change initiative and the responses to it. In this context, resistance is not a personal phenomenon, but a social systemic one in which resistance is maintained by the background conversations of the organisation. Successfully dealing with this source of resistance requires distinguishing the background conversations.<sup>51</sup>

<sup>49</sup> Paper *Executive Summary* for the ARCOM 24th Annual Conference in Cardiff, 1-3 September 2008 by Elias Ikpe, Felix Hammond, David Proverbs, School of Engineering and the Built Environment, University of Wolverhampton, Wolverhampton, WV1 1SB. UK

<sup>50</sup> Cost vs investment continuum – whether expenditure is a cost or an investment depends on bottom-line outcomes, eg savings in litigation, incident and accident reductions, etc.

<sup>51</sup> Landmark Education Corporation discussion paper on organisational change, 2007.

## The International Experience

On commercial projects project managers were savvier than their residential counterparts, probably because the documentation requirements are more extensive with larger projects. Management of health and safety risk has become a 'big-ticket item' for training and CPD considerations. Workers attend health and safety training because they have to; health and safety coordinators and managers are an area of skill shortage because few are vocationally called to what is perceived as a 'policing' role.

Health and safety<sup>52</sup> documentation relating to operational practice is certainly more visible on UK sites, with even small building projects featuring fully written up work plans on clip boards in weather-proof locations. There was not much reported use of concrete 'slabs' (or tilt-up<sup>53</sup> technology) and this was rationalised as being expensive, particularly because of the attendant weight, erection and transport costs. We have the same situation here in Australia in the residential housing context. It is not to say that concrete 'slabs' are not used in larger scale projects (where it is used prolifically), and where whole sections of external structure can be bolted together in very short spaces of time. The overarching considerations with using concrete 'slabs' from an OH&S perspective, are how to protect workers from misadventure, and ensuring that technology, transportation and lifting mechanisms have current safety certification.

Health and safety documentation on-site in the UK must be displayed *contiguously*. In other words an independent auditor must be able to look at a site shed noticeboard and see a dated, sequenced progression of documentation to chart progress, milestone sign-offs, etc and linkages to procedures for accidents and site inductions for example. Sites can be closed down by independent auditors (who randomly visit sites) on the basis of inadequate documentation. On two sites Daly visited in Wales the health and safety documentation was colour-coded to reflect role responsibility demarcations (also evident on hard hats and PPE).<sup>54</sup>

Health and safety training is predominantly site-based insofar as prefabricated materials are concerned, although manufacturers produce application caveats designed to direct best practice for installation and erection for larger structures. In the UK these are often bulletined through the industrial advocate organisations. The Federation of Master Builders in England and Wales include this sort of information in their monthly circulars, yet unfortunately, they lament, as in Australia, only a small percentage of businesses actually read or catalogue them.

In the Northern Territory of Australia in 2007, the Indigenous Business Agency was awarded a contract to transform a number of shipping containers into homes for indigenous peoples settled in rural townships between Alice Springs and Darwin. It was relatively easy to cosmetically change a 'box' into a home by cutting out external panels and inserting prefabricated inner structures. What started out as an inexpensive housing option quickly became a political nightmare as the potentiating<sup>55</sup> effects of adhesive and paint fumes, intense heat and dryness of the climate rendered the housing unliveable. What made the situation even worse was that workers exposed to this building site did not know to take account of the potentiating effects<sup>56</sup> of materials combined with dressage chemicals.

– Chris Baseler and Steve Burroughs PhD, 'Indigenous Business Australia', 2008.

<sup>52</sup> 'Health and Safety' – the most recent iteration of the occupational and environmental health and safety nomenclature being used in the UK.

<sup>53</sup> Tilt-up – a term taken literally from the activity required to stand concrete slabs in place on a worksite.

<sup>54</sup> PPE - Personal protective equipment

<sup>55</sup> Potentiating – how symptoms can aggregate to cause a reaction significantly bigger than their sum parts.

<sup>56</sup> Potentiating effects – how combinations of chemicals and materials can produce multiple effects above and beyond the sum of the addends.

# The International Experience

This anecdote is widely known in the UK, and in fact is used in training contexts as an example of how situational factors can adversely affect seemingly innocuous combinations of materials. In this case it posed risks to tenants well beyond the construction phase of development, rendering building companies vicariously liable to lawsuits, notwithstanding *force majeure*<sup>57</sup> provisions in contracts and discharge of contract obligations. Workers on-site seem to be well versed in the 'horror stories' as it seems accidents get attention, albeit fascination, wherever in the world they occur.

The Federation of Master Builders in London commented that health and safety incidents on residential sites had decreased dramatically in the last two years, and this is attributed to the greater incidence of visitations by local council and regulatory bodies to sites, to study construction skills and identify building issues as opposed to a more punitive context of ticketing breaches. In this way Daly was told, residential builders have been more open to suggestions for improved practice and successive visits to monitor trial ideas have had the effect of garnering support for 'best practice' initiatives.

## 4. Sustainability

- 'Wear and tear' strategies as a part of current legislation.
- Combinations of a range of materials (potentiating effects?).
- Energy and efficiency markers.
- Advice given to professionals and clients about maximising 'green' potential and minimising carbon footprinting.

*"We've made some big mistakes in our time working with prefabricated materials; it all seems ok in the moment, and...add a few environmental factors and it can all turn sour if you haven't done your homework about the materials used in construction, and more importantly what you expect them to withstand over time."* – Clem B, Project Manager, Leeds

Sustainability was the one area where the high levels of consciousness about 'green' issues invited an enquiry as to how building sites have been able to generate and sustain such manifest and universal environmental 'sensitivity'. It was evident in every on-site discussion.

In Bridgend, for example, on a public works-commissioned housing development site, the waste bins were colour-coded (see photo on following page), and waste materials were demarcated according to their constituent parts as the building activity was being carried out. Daly observed a range of contexts where the waste material was separated in the processing of building requirements, and carefully gathered up and 'binned' according to instructions. Apprentices were able to tell him what would happen to it once 'recycled', and what needed to be done to it before it could be disposed of. In demolition contexts, this meant stripping nails and detritus before it could be appropriately discarded.

Sustainability *per se* is not a specific competency in the training of either staff for Continuing Professional Development (CPD) contexts, or apprentices, but it is an Enterprise Standard<sup>58</sup> and is woven into most site induction and 'tool-box talks'.<sup>59</sup>

<sup>57</sup> Force majeure – literally 'act of God,' a natural disaster which affects the building or site during or post construction.

<sup>58</sup> Enterprise Standard – an organisational level policy which engages national practice standards.

<sup>59</sup> Tool-box talks – daily/weekly gatherings of site workers; so called because of the analogy of sitting on tool boxes while discussing issues of currency. Tool-box talks are an industry medium for relaying important health and safety information to workers.

## The International Experience



*Colour-coded waste bins*

Literature associated with sustainability is plentiful and the NHBC Foundation has produced material which is widely read and practised as an industry standard. In their review papers entitled 'Site Waste Management' and 'Climate Change and Innovation in House Building',<sup>60</sup> NHBC have synthesised a wide range of current thinking into very readable reviews with a stated design of enabling builders, developers, insurers and lenders to have greater confidence in technological innovation, as well as providing them with advice and templates for waste management plans on-site.

French innovation is also strongly supported by academic theory. The French are widely regarded as one of the most 'operationally' innovative countries in Central Europe based on the international modelling of their work, amongst other things, to restore tenement housing with minimal tenant disruption after the Paris Riots in 2006.

In Central Europe particularly, sustainability is an issue which is in constant prominence on building worksites. Every action is predicated around the 'carbon-footprint' it will generate. In London, project plans demonstrate an acknowledgment of environmental policy and regulation by local authorities, and the 'consciousness' about sustainability seems to underpin every building activity. Daly was not used to seeing such a universal participatory commitment to environmental issues in Australia (other than with water conservation) and suspects that this is in part due to the synergies between the building and construction communities in the UK and Central Europe. Many countries literally share large parts of one large itinerant workforce, and with it the attendant corporate knowledge around sustainability issues.

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<sup>60</sup> NHBC Foundation – discussion papers are freely available to UK and international builders on their website [www.nhbcfoundation.org](http://www.nhbcfoundation.org)

# The International Experience

Sustainability is also widely acknowledged as a client expectation and it is canvassed as such by project managers, several of whom commented that clients regularly want to know about the potential environmental impacts insofar as work is concerned. Refurbishment work (strongly influenced by prefabricated materials) is often based around the desire by clients to mitigate their energy use in meaningful ways. As in Australia, there are widespread local authority cash incentives available for residential energy efficiencies such as photovoltaic installations, double-glazing, and fitting approved and insulated inner wall linings.

Loughborough University (Dainty, *et al*), the Federation of Master Builders in England and Construction Skills have published significant papers on sustainability. These are noted in the References.

## 5. Affordability

- In the dichotomy of the built cost versus maintenance/replacement cost, what factors are calculated and how is affordability determined?
- What information is provided to customers?

*What everyone ultimately wants is the best quality option, something that looks good, something that has everything they need built into it – they won't care what it is made out of if you can address these issues at an affordable cost..."* – Xavier H, Project Manager, Leeds

The overwhelming stereotype associated with prefabricated housing is that it is seen as 'cheap' and 'suburban', whereas the reality could not be more significantly at odds with such a perception. The stereotype was apparently borne of 1950s technology which was marketed as 'affordable housing' while Greater London (as one example) was expanding post World War II. At that time affordable became synonymous with 'budget' and the social strata most closely associated with prefabricated homes was distinctly working class. This stereotype is still widely acknowledged today as the prevailing paradigm project managers must overcome when engaging clients about either refurbishment or new home-building work.



*Interesting photo of the juxtaposition between old and new – both prefabricated. The old iron sheet house was to be demolished – it was commented on as shabby but comfortable and homely during its service life. This iron house was apparently about the same vintage as the houses in the Boswell Estate and it reflects, if nothing else, the crude aesthetics of earlier iterations of prefabricated housing – clearly providing ammunition for the perception that prefabricated housing was council-class, cheap and nasty.*



# The International Experience

In inner-London, prefabricated materials are increasingly and widely crafted to match existing structures where the cost of using traditional materials is prohibitive and where heritage or aesthetic value is not mitigated by use of alternative technology.

Transportability, especially in view of the significantly greater cost of fuel in Europe and the UK, mitigates the price differences between traditional materials and prefabricated technology, especially for substantive pre-built options. Although the erection of prefabricated exterior structures is much quicker than use of other materials, in fact overseas manufacture adds the two dimensions of transport and storage costs to the total built project costs.

There is a new pragmatism associated with prefabricated housing from the point of view of affordability in the UK, and this is being led by project managers as the fulcrum between the constructors and clients, many of whom are corporate and public housing providers. It has been found that composite materials, made from recycled waste materials dramatically reduces the built costs for houses, and in most instances can be cosmetically modified in appearance to look like traditional building materials.

As one Welsh apprentice mused *“If it looks the part, it’s cheaper, lasts as long, performs the same or better than brick and meets every other requirement, and best of all it’s made out of recycled materials, why wouldn’t we be using it?”* Such a pragmatic (and at the same time entrepreneurial) attitude at ground floor level of the construction industry is proving to be the catalyst for expanded use of prefabricated materials, especially those made from recycled materials.

It appears that prefabricated technology and available materials visit both ends of the cost continuum with the import of significantly cheaper materials, notably from China and India, and more expensive options (particularly for restoration work) being manufactured locally, or in Central Europe. Cost becomes the axiomatic measure in situations where there is a range of material choices, for detailed and exact duplicate replacements on, or within, historic places. Daly was told there is generally enough finance to simply get what is deemed necessary.

French building engineers wisely realise that ‘affordable’ doesn’t necessarily mean ‘cheap’, and in Paris the Housing Federation undertake a longitudinal analysis before decisions informing use of materiality are engaged, to ensure that the best product is used, taking account of wear and tear, replacement costs, and serviceability.

## 6. Portability

- What is relocatable?
- How is this distinguished?
- What is recyclable?

*“I’ve noticed that when you move prefabricated housing units that the stress points are not only where it is bolted and unbolted – or where you’d expect them to be. You’ve actually got to give the unit a thorough going-over and replace any suspect bits and pieces because portable housing get’s a harder life than permanent units.” – Shane D, Apprentice Carpenter-Joiner, Bridgend*

## The International Experience

Portability has emerged as a recent issue in the UK, although off-site construction of prefabricated house parts and partial combinations, are intrinsic parts of the fabric of prefabricated housing building methodology.



*London-based architect David Adjaye literally 'dropped' this prefabricated house on a residential site in the middle of Hackney (a London suburb) by crane. Adjaye designed this 150sqm house using solid spruce timber building structures as its main structural component. The manufacturer claims that each cubic meter of timber saves almost a ton of carbon dioxide emissions compared with a brick or block structure. The interior was also craned in. The actual build time for the structure of the house totalled five days, including the interior.*

Portability has been taken to mean the relocation of a prefabricated house or housing, fully erected, holus-bolus to another location. It requires internal structural provision for utilities to be 'plugged in', tensile strength to combat movement stress and lightweight construction materials for ease of transportation. Where this is being widely used in a residential context is to provide emergency housing options in the event of catastrophe, and in military applications to house troops.

This pre-built housing option is often literally unpacked (from a flat pack storage situation), plumbed and wired in less than a working day. The installers in the UK are not necessarily construction workers, giving industry-based concerns about the potential lack of attention to issues such as health and safety, attention to 'wear and tear' issues in terms of the materials, and composite parts and 'best practice' building techniques. Manufacturers from Central Europe (the specific models Daly viewed and discussed with project managers were in fact French designed and built) argue, however, that their products can be erected by anyone (as a selling point), and the discussion focussed on whether the industry should embrace such workers, or facilitate their inclusion into some form of 'process worker'

# The International Experience

industrial context. It was argued that what distinguished these workers who were engaged primarily by manufacturers, was that they needed some knowledge of construction techniques to be able to 'troubleshoot' building defects, ageing of materials, and rectify structural problems.

An interesting debate occurred in Scotland at the SQA over whether portable prefabricated housing had a shorter operational life than static prefabricated housing. It was argued that portable housing was subject to much greater and more rigorous scrutiny with defective parts likely to be replaced more readily, whereas static prefabricated housing, once erected, was not ordinarily subject to inspection by external authorities until after a problem had been identified.

## 7. Role Demarcation

- How are synergies created between trades, workers and professionals?
- What structures are in place to obviate work or production stoppages?
- In the microcosm of prefabricated housing (generally smaller building site contexts), how do builders rationalise tasks to meet milestone requirements and project outcomes?

This issue is, in Daly's view, apparent in the operational differences between site-based work in the UK, France and Germany on one hand, and Australia on the other hand. It became apparent through the questions Daly was asking in the UK and subsequently on reflection about the responses provided, that workers are much savvier about the roles carried out by different trades, labourers, and professionals. Further, Daly observed the widespread ability of workers at each level to accurately communicate troubleshooting issues so that resolution could be affected. It was not a conscious observation in particular contexts, but rather a reflection over a series of visits and discussions, and it emerged as a theme relating to continuity. Daly made a point of discussing this with the various vocational training authorities visited in Wales, England and Scotland, as well as with a panel of Welsh Builders, to determine whether such knowledge could be attributed to particular competencies, and this was not the case.

It would seem that this knowledge is inculcated through the school system in the formal education context and it was also seen as a function of the much more clearly defined 'class' structure apparent, particularly in England. Whilst it would be churlish to suggest that British work-sites are more manifestly hierarchical in an operational context, in fact the 'collar and tie' worn by supervisors may subtly underwrite this. In Germany, for example, higher school curriculum relating to a social studies context, includes research into trade career pathways as a vehicle to finance further tertiary study in later years. Daly was told that matriculating German youth are well versed in the building and construction context, and can confidently discuss the various roles of all participants.

It seems that knowledge of attendant roles and responsibilities, alongside an appreciation of project management as a discipline, provides apprentices with the confidence to effectively deal with any and all site based issues, as they know who to talk to. It also provides an enriched sense of milestone completion as a quality measure on-site.

# The International Experience

## 8. Skill Deficiencies

- What skills have emerged as 'new' skills and how/where are these taught?
- What skills become shared responsibilities ('portmanteau'<sup>61</sup> effect) between trades and workers?
- How well does an integrated skill-set orientation account for skilling workers and tradespeople in the erection of prefabricated housing?
- What skills are identified as missing or lacking overall?
- How has this been communicated to construction skills and what has happened to these recommendations?
- What level should these be set at in terms of task complexity and role responsibility?
- What demarcates prefabricated housing skill sets from other prefabricated work in diverse contexts – eg: office and commercial buildings etc?

*"What is a skill deficiency? We identify this as something we observe to be lacking on-site or when someone can't do a task because they lack confidence or haven't done it before. With some new prefabricated housing materials chances are, no-one has done it before so we are all learning together. We have learned to trust each other enough to ask for help when it is needed instead of just trying to do the job and messing it up. This isn't something our apprentices learn in class, this is what happens on-site." – Charlie S, Leading Hand, Inner London refurbishment project at Earl's Court*

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the-job, gleaned from published material, or from working and/or study overseas.

Certainly, there may be individuals or individual firms that have these capabilities. However, individuals in the main do not share their capabilities, but rather keep the IP to themselves; and over time they retire and pass way. Firms likewise come and go.

If Australia is to create, build and sustain Industries, knowledge/skills/understandings must be accessible across the generations through nationally accredited courses and not reliant on individuals.

– Extract from *Sustainable Policies for a Dynamic Future Policy Statement*, prepared by Carolynne Bourne AM, CEO, ISS Institute, revised 2008

The extract above is the area which is the focus of the work of ISS Institute and the Overseas Fellowship Program.

Interestingly, although formal training is only provided in the UK for construction materials, where there are attendant health and safety considerations (such as concrete 'slabs'), provider-driven training is becoming popular, and it is increasingly used as a marketing medium where tee-shirts, beanies, and other paraphernalia are given out at training workshops. In competency training at the Polytechnic colleges, traditional materials are juxtaposed with newer ones in simulated working environments, so that apprentices are exposed to the technology, as well as the working environment and application.

<sup>61</sup> Portmanteau – overcoat effect, blending several roles together

# The International Experience

The finishing trades<sup>62</sup> manipulate prefabricated building materials for aesthetic, utilitarian and cosmetic reasons. A distinct attribute of prefabricated structures as seen in Neath in Wales, was that they can be readily moulded to look like adjacent structures where the buildings have historical significance (other than where local regulation prohibits the use of other than traditional materials to protect heritage value). Daly was shown a line of two-storey houses where renovations had been effected in two of eight houses and it was only by detailed examination that cosmetic differences could be detected. In situations such as this, the project manager was proud of the achievement (an integrated approach to streetscapes whereby new is matched to old) and acknowledged the artisan skills standards required of his charges to meet the challenges of such a specialised undertaking.

Most of the training associated with prefabricated housing is carried out on-site, in Central Europe as well as the UK. Any new materials introduced, necessarily result in new skill requirements, and it is more often than not the well-weathered processes of due diligence which ensure that the new materials can be integrated into the working regimen effectively. Strangely enough, although manufacturers and building codes predicate training and best practice models for use of new materials, in terms of actual competencies, it is not considered necessary by training authorities to introduce specific learning in this area as it is acknowledged as being well covered by on-site by practitioners and is seen as more senior learning than apprenticeship-based.

## 9. Skillsets

- Hard skills: working with materials, trade and professional skills.
- Soft skills: communication, consultation, management and leadership, conflict resolution.
- Social skills: cultural and social synergies, working with people as consumers and customers.

*“We train our apprentices in the basics and then we groom them. We are in these training relationships for the long haul; sometimes I feel like a surrogate father to my boys because we’ve got them through the time they do the most growing and when they settle down. I think that trade training is only a small part of the equation quite frankly – we are developing our boys (sic) to be able to handle anything that happens on-site – anything at all – and they simply have to be able to deal with that...” – Abel N, Foreman, Bridgend site*

Project managers in the UK whom Daly interviewed largely facilitated a ‘learn by doing’ approach to teaching their subordinate staff how to work with prefabricated materials, relying on core trade training to provide the underpinning trade skills. In several situations, notably where projects were using a product that was being actively marketed, site-based training was provided by the manufacturer.

Daly found in all situations a complete willingness to be interviewed when he was on-site, and a curiosity about what was being researched. Apprentices were certainly voluble in their discourses about building practices and materials and displayed a heightened appreciation of project parameters. Although clear social class protocols between employers, tradespeople and apprentices were evident on sites, Daly noted that the latter group were forward in their enquiries about work issues.

<sup>62</sup> Finishing trades – includes, inter alia, plasterers, painters, plumbers, electricians.

## The International Experience

In the UK there was a distinct lack of training specifically associated with 'soft skills', whereas in Germany and France such subjects form the basis of what we would refer to as 'liberal studies' at a college level of education (years 11 and 12). These skills are actually tested at pre-employment interviews in Germany and regarded as quintessential in terms of engagement. In the UK, soft skill development is the domain of employers and is carried out on-site in the context of grooming or professional development.

UK apprentices and learners are likely to confidently engage clients, but are taught from an early stage in their development to facilitate effective referral of the issue to super-ordinate staff for resolution. Daly was impressed in Wales by the ability of apprentices on a worksite in Bridgend to engage his enquiries, provide answers where they could, and identify the appropriate person to further the questioning. Equally impressive at the trade schools in Wales was the research ability of learners to seek out information about their own areas of interest from another perspective, and make contrasts and comparisons accordingly.

# Knowledge Transfer – Applying the Outcomes

*“Lateral thinking is concerned not with playing with the existing pieces, but with seeking to change those very pieces. It is concerned with the perception part of thinking. This is where we organise the external world into the pieces we can then process.”*  
– Edward de Bono

It is one thing to come back to the workplace with a view of the ‘forest’, and quite another to engage a group of practitioners who are used to working with the ‘trees’. We must confront project-based outcomes with a view of the industry future, as predicated by present practices, and then mitigated by the potential that the findings of this Fellowship report indicate.

In Daly’s experience the most successful pathway to integrate change is to facilitate industry experts to embrace the ideas presented as their own, by consulting their experience, skills and knowledge in a workshop setting. The caveat associated with this however, is that it is the industry experts who should be consulted, but they include and are not limited to those who provide the training and education. There is a tendency to put these people forward as the ‘experts’, but as this Fellowship illustrates, the testimony of the practitioner on-site is indeed both compelling and authoritative when it comes telling it like it is.

Daly has talked about the potential fragmentation of industry and those who provide the training and education and the need to have an holistic approach along the entire Supply Chain – where the trades and professions are equal but different contributors to a success build.

## Workshop

An activity is recommended as a first option where industry ‘captains’ are brought together for a consultation about how to package prefabrication within the Building and Construction Industry. This activity is to be convened through the Construction and Property Services Industry Skills Council (CPSISC).

The focus of the activity will seek to address issues in regard to prefabricated house building into a wider frame of reference; the issues raised have both systemic and applied solution contexts along the Supply Chain.

### Targeted Participants

The industry ‘captains’ to be invited are key representatives along the Supply Chain, so that there is communication of prefabricated house building.

The sectors represented are to include builders, architects, engineers, trades practitioners, suppliers, researchers, project managers, government agencies, education and training institutions, professional associations and developers, so an integrated approach is pursued and each sector has an understanding of their particular role, responsibility and skill sets in delivering quality builds.

### Outcome

Workshops to be held as an outcome of this activity for specific sectors such as builders.

# Recommendations

*"We cannot solve our problems today with the same thinking we used when we created them." – Albert Einstein*

- It was clear from the interviews Daly conducted during his overseas Fellowship, that the fundamental difference between the apprenticeship and training systems in the UK, Central Europe and Australasia was the extent to which the employer was franchised as a primary stakeholder in not only the core competency training leading to qualifications, but in the overarching professional 'grooming' which proved to be the domain of soft skill acquisition, sustainable work practice and understanding how projects run. These three areas featured not only within the microcosm of prefabricated house building, but in building and construction training generally.
- British apprentices were generally well oriented towards achieving not only their NVQs (or SVQs), but also their London City and Guilds 'ticket'. These achievements provided the pathway to professional training and education as builders, a term used to connote a similar outcome as in Australia, but without the licensing and/or registration predicators in the UK.
- It was interesting to note that specialisation notwithstanding, all training pathways, especially in Germany and France, were seen to lead to professional outcomes (such as project management, estimators, etc), thus indicating integration of the Polytechnic college, university training and education regimens with industry directives and industry involvement.

The following actions, activities, etc, are recommended to each of the following sectors.

## Government

- Appropriate Government departments (eg DEEWR) to facilitate programs to engender ongoing dialogue between industry and the educational sector to address issues regarding, amongst other things, lack of regulation within the prefabricated building sector.

## Industry

- Drive the research and development of appropriate prefabricated building industry standards.
- Conduct due diligence on new materials and consult with government bodies on the development of regulations in regard to OH&S, sustainability, packaging, handling and transport of new materials.

## Professional Associations

- Develop a register of new and existing prefabricated materials.
- Source the aforementioned data and material and develop informative reports and promotional brochures on new developments/products and regulations for distribution to their association members such as the MBA, HIA and AIA and, in turn, consumers and other stakeholders.
- Conduct education sessions to inform members of new and existing prefabricated materials and related standards and regulations.



# Recommendations

## Education and Training

- Examine the feasibility of shifting the focus of training and education towards producing 'builders' as opposed to trades practitioners, and to indicate that trade training is fundamentally a significant milestone on that pathway. Build into that career-focussed pathway the need for apprentices to keep logbooks with all experiences recorded and authenticated for future use towards obtaining a builder licence or registration.

This impacts on prefabricated housing as a discreet set of skills, and as a means of orienting established practice towards 'building' as opposed to 'assembly'. In the case of relocatable prefabricated housing, while the trend is to engage assembly workers to dismantle and erect the structures, evidence clearly suggests that there are issues that must be addressed, notably wear and tear and health and safety.

- Look at ways to foster greater employer involvement in both site-based training and pre-assessment activity, by offering them the opportunity to undertake the Certificate IV in Training and Assessment (or part thereof) and encouraging them to contribute towards training pathways.
- Provide best practice guidelines for RTOs and employers to introduce the context of 'project participation' as a forerunner to project management, so that learners are able to understand how projects work, milestones as completion points, role delineations, and how project participants are demarcated according to inherent trade and professional roles.

It is an established management premise that people perform best when they know what they are doing, and introducing the 'big picture' to learners during their formative stages of involvement provides them with an analysis of role demarcation, milestones, incremental outcomes, contiguous work practice, and most importantly planning. The Building and Construction Industry in Australia is predicated around sound planning processes.

- Project participation for prefabricated housing is about bringing together both traditional building methodology and new materials in a way that takes account of variations in structural assembly, and introduces the need for accountability for such issues as structural morbidity, material synergies, and replacement strategies.
- Introduce overarching industry standards, that sustainable building and construction practice, resource recycling, and environmental and materials awareness.
- Create a points-system, which rewards highly sustainable building and construction practice and provides diligent builders with transferable credits towards ongoing professional training and/or development.
- Introduce industry-specific communication guidelines, (Daly suggests small purpose-published handbooks supplemented by opportunities to learn formal communication skills), to cover such everyday site experiences as conflict resolution, negotiation, consultation, dealing with anger and cross-cultural, religious, and gender-related issues. Produce these for employers as a set of guidelines for developing the abilities of their employees to engage others productively and purposefully with structured outcomes. These can be readily imported into business and enterprise standards and set benchmarks for 'good practice' within the industry.

# Recommendations

- It is acknowledged that communication skills is an area where considerable development would be beneficial in the Building and Construction Industry, and, by promoting the potential of commercial success, employers are the recommended first point of contact as exemplars of integrated good practice.

## Community

- Create informed consumer choice, provide greater awareness of products, their performance, energy efficiency ratings, design elements, ideas and availability, through exhibitions and trade shows and media.

## ISS Institute Inc

- Develop and deliver education and training activities and events (eg a Think Bank, workshops) for industry/product awareness which are available to the public and stakeholders along the Supply Chain.
- Act as a conduit of communication between industry, education and Government and the public.

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# Attachments

## Attachment 1: Education and Training

Learners tend to approach competency assessment on the basis of their deeply-inculcated experiences of school-based learning (education) – and the two learning models are quite different:

<b>Education model – eg university degree courses</b>	<b>Training model – eg Australian Apprenticeships</b>
'Big picture' <i>understanding</i>	<i>Application</i> of knowledge and skills
Forward looking and <i>descriptive</i>	Outcome oriented and ultimately <i>prescriptive</i>
Examined and graded; levels of 'pass' and 'fail'. Fail usually means whole learning unit is repeated.  Examiners decide on content of examinations – arbitrary albeit designed to test <i>conceptual understanding</i> of learner.	Assessed 'Competent' or 'Not Yet Competent'; Learner must achieve 100% of competency requirements. Not Yet Competent means that only areas identified as insufficient need to be re-assessed.  Transparent process where all requisite knowledge and skills are assessed and pre-existing unilateral agreement about 'judgement' and 'evidence' requirements are in place.
Curriculum oriented (throughputs).	Qualification and competency oriented (outputs).
Linear.	Non-linear and ideally, allows for progression at the pace required by learner inside of a negotiated Training Plan.
Excellence is based on reputation of learning environment, scholarly achievement and esoteric advancement by learner.	Achievement is based on ability to apply knowledge and skills to meet all competency standards. Competency is achievement of threshold standards only.
Until Graduate level, class progression.	Individualised progression possible based on individual (re-negotiable) training plan.
Heavily theory-oriented. How learner can demonstrate understanding to abstract questions.	Heavily practice-oriented. What a learner can do with what they know and have practised.
Fore-runner to applied learning, usually at professional levels.	Provides skills platform for 'big picture' understanding.
Necessary as a pre-cursor to professional training but may stand in its own right as a personal and professional development tool.	Essential pre-requisite for skills acquisition and application.
Essentially campus-based	Essentially workplace-based

## Attachments

When a learner commences an Australian Apprenticeship s/he is inducted by an Australian Apprenticeship Centre (formerly a NAC) and directed to an RTO where the particular qualification or units of competency are delivered according to AQTF standards.

The initial task for the RTO is to generate a *Training Agreement* at which time the learner may present evidence of prior knowledge and skill to address competency requirements so that relevant learning and experience which has taken place prior to the generation of the Training Agreement is recognised (RPL). This learning and experience must wholly or in part satisfy the competency requirements for recognition. (Look closely at the purpose statement, elements and performance criteria within units of competency for guidance) The Assessor then determines the content of the Training Agreement based on what the learner still needs to address. Recognition for partial knowledge and skills is possible where it is supplemented by learning within the training agreement either at the RTO or the workplace.

Once the Training Agreement is signed the learner then enters into a *Training Plan* which timetables both training and assessment schedules. The Learner is provided with pre-moderated resource/learning materials and copies of each of the competencies to be achieved. The assessment guide setting out how each competency is to be assessed, what evidence will be required and what judgments will be used to determine adequacy and sufficiency of evidence is also provided at this time.

When an RTO (including a TAFE) is accredited to deliver training and assessment for qualifications and competencies on the AQF, they are required to produce their training and assessment materials for review. The Auditor who carries out the accreditation process must be satisfied that the training and assessment material to be used has been *moderated* to align with nationally recognised outcomes. *Moderation* is simply the process whereby the *work* carried out by Assessors in RTO's is *overviewed* to ensure consistency and validity across the country and the designated competencies themselves. It is *not* an assessment of the Assessor but an assessment of the assessments s/he has carried out. Moderation ensures that national standards are exactly that.

*Audit* is the process whereby an RTO, found to be inconsistent in their assessment outcomes or as an annual AQTF requirement, undergoes a rigorous internal system review process to ensure they achieve the identified national standard for outcomes. Audit does not *in itself* ensure training and assessment outcomes are consistent between providers; this is the domain of moderation.

In the course of the Australian Apprenticeship, the learner naturally accrues learning both at the work-site and at the RTO. When it comes time to be assessed (the learner may initiate this process at any time and subject to Assessor approval, this request may be acted on) the learner may seek to present evidence from their workplace activity during the tenure of the Training Agreement, to supplement or even stand instead of the pre-moderated assessment material. Learners should not be re-trained or assessed in competencies where they are already able to evidence an existing competence. This material may include:

- **Log Book entries** – correctly filled out and authenticated by signature of employer or supervisor. There is a number of pro-forma Log Books around; the Plumbing and Electrical Industries use them extensively.
- **Photographs, videos or audio tapes** of work completed (with appropriate authentication and attention to confidentiality issues).

## Attachments

- **Documentation** – copies of relevant papers. Letterheads or business stamps and supervisor authentication greatly enhance documents as a source of evidence.
- **Vignettes** – statements written about relevant activities (often where they have been carried out in the absence of direct or complete observation) for which the outcome can be authenticated and attributed to the learner. Vignettes are written in the format of Affidavits detailing the ‘why, where, when, and how’ information about an activity. To understand what a good vignette is, it would, in its presentation, be virtually non-cross-examinable in a court of law.
- **Attestations** – where employer or supervisor, who has been deemed to hold ‘expert testifier’ standing by the RTO, on the basis of having seen the unit of competency (or relevant parts thereof) can match the work done by the learner to the competency requirements and presents a letter on letterhead duly signed to that effect.
- Partial knowledge and skill-sets pre-existing the Training Agreement which have been completed by current work experience and learning.

Assessment is carried out in the recognition that the context for determining competency is an amalgam of both workplace and RTO learning. Assessment must be sufficiently flexible and yet appropriately consistent so as to allow for a diversity of evidence to be presented.

Learners who have been well trained in working with competency-based assessment are able to look at their evidence and demonstrate how it relates to elements and performance criteria in units of competency and moreover, where relevant, how it co-relates to criteria in other parts of their qualification. It is recommended that a segment of any learner’s training includes working with the AQF to de-mystify AQTF terminology and process. This works more successfully when the learner is beyond their induction period as they can then proactively integrate what they know and do with competency requirements. A big issue for learners is to move beyond school experiences of learning as workplace training is quite different.

The most important consideration for an Assessor is to remember that an isolated experience does not demonstrate an ongoing ability to perform a task – where possible evidence should show that the learner has applied the required knowledge and/or skills *in more than one context*. The burden of proof as it were, is for the learner to evidence that any supplemental portfolio of evidence meets the competency requirements. Learners must expect that an Assessor will make enquiries to authenticate material provided.

# Attachments

## Attachment 2: Boswell Houses

'Boswell' type houses were constructed from prefabricated reinforced concrete instead of brick – a measure adopted to save money on building materials and to build the houses more quickly. The design, patented by the Liverpool City Engineer, John Alexander Brodie, was developed by M.A. Boswell & Co of Wolverhampton (hence the name Boswell house) and were largely built on the 'Boot' section of Norris Green – named because Henry Boot was the contractor for this part of the estate.

Due to inherent design defects, serious structural problems were soon discovered with the Boswell houses, and by the 1980s, after many years of literally papering over the cracks, the problems became critical. In many of the properties, the poor standard of concrete that had been used in the construction had been deteriorating over the years. Cracks and holes in the concrete began to appear, allowing moisture into the walls of the houses and attack the metal building reinforcements, which began to rust. By 1985 all Boswells were declared defective under the Housing Act and they were no longer mortgageable.

By spring 2005, of the 1,509 properties, approximately 600 had been demolished and 440 were in the process of being demolished. The vast empty spaces were the Boswells once stood are now returning back to nature, grass and weeds now flourish where concrete once stood. But not for long as according to the Council, *"new development on the estate will consist of 195 residential units together with associated highways and infrastructure. The development east of Lewisham Road will consist of 90 social housing units for rent which will be managed by Cobalt Housing Association."*

Source: <http://www.sw-norrisgreen.co.uk/decline.htm#cobalt>, now offline



*Boswell houses on the Boot Estate awaiting demolition*



*Porchester Road on the Boot Estate in 2005. Green open spaces where Boswell houses once stood*

### **Attachment 3 – French Construction: Training system in the Building Sector. Grant Daly Visit in Paris October 27, 2008**

#### **French Building Sector**

- 318 000 companies
- 1 279 000 people working in the Building Industry of which:
  - 298 000 craftsmen
  - 981 000 employees
  - Turnover 2007: 124 billion € (VAT excluded)
- Structural works: 38% / Finishing works: 62 %
- 30 different trades

#### **(FFB)**

- 57 000 members including 42 000 craft firms with less than 10 employees
- Network of 150 associations all over France including 30 specialized trades associations (plumbing, painting...)
- FFB main tasks:
  - Speaking for the Building industry, watching over its interests
  - Providing answers and strategic tools suited to its members' requests

#### **Construction Data**

- Economical situation
  - Growth: +0,5% +0,8%, slowing down in 2008 due to the economical crisis (2007: +2,6%; 2006: +4,5%)
  - Drop of new buildings and housing
  - New works linked to energy efficiency
- Recruitment needs
  - 100 000/year between 2000 and 2008
  - 60 000 – 70 000 for the years to come due to demography issue and natural departures from the sector
  - 32 000 new jobs in 2008 but drop foreseen in 2009
  - Lack of skilled labor in many trades (not enough skilled young people finishing schools each year)

#### **Training System and Data**

- Initial training organisation: choices
  - Training as a student
    - Professional, technological school or university
    - 4 up to 16 weeks of internship in a company (far more for engineers)
  - Training as an apprentice (working contract)
    - On the job training in a company
    - Formal education and professional training in an apprenticeship centre (1 or 2 weeks/month)



# Attachments

How apprenticeship is funded:

Who pays?

- Companies (apprenticeship tax created in 1925)
- State
- Regional Councils
- Others: Departmental Councils, Training institutions, families

Who receives?

- Companies: less taxes + allowances : 1500€/apprentice
- Apprentices: free training and no taxes on their salary
- Apprenticeship Centres

## Companies

- Apprenticeship tax: 0,50% of the wages (about 1438€/company vs pedagogical costs = 3184€)
- Tax for developing apprenticeship: since 2005, 0,18% of the wages are collected by the State to promote this kind of initial training
- Specific construction tax (created in 1942): 0,30% to finance construction initial and continuing training
- Part of continuing training tax for companies over 10 employees : 0,14%
- In 2007: about 20 millions € collected from building companies for initial training (at school and in apprenticeship centres)
- Construction rate of pay for apprenticeship – national minimum > legal rate of pay
- Certificates

## FFB Training Department – 2008 Main Priorities

- Carrying on communication about trades and building sector and recruitment needs
- Enhancing links with the Department of National Education and Upper Education
- Helping companies to recruit newcomers (young people, women and unemployed) and keep their current employees
- Upgrading employees', craftsmen's and entrepreneurs' competences
- Implementing the upcoming reform of continuing training engaged with Social partners and Government

## Some FFB Actions

- Communication campaigns
- Surveys about future trades evolutions and skills needs
- Observatory for future trades and qualifications' evolutions set up with Social partners
- Coaching entrepreneurs for the development of their workforce's competences
- Health and safety
- Environmental management of Building sites
- Providing training about energy efficiency issues

# Attachments

## Communication

- Building sites opened once a year to the public and schools (2 days in October), called «Behind the Building sites»
- Documentation, leaflets, posters, DVD describing building trades for young people, parents, teachers circulated to schools, training and employment forums
- 2008 TV campaign with 12 portraits of men and women describing their passion for construction
- Awareness campaign for FFB members on energy efficiency

## Surveys

- Surveys have been launched to seek for future trades evolutions and skills needs
- Employment Department of 4 Construction entrepreneurs federations (in 1992 and 2006)
  - Analysis : economic challenges, employment, work organization, human resources and training according to 2 different scenarios
  - Results: necessity of enhancing human resources (middle management, seniors, quality), quality of education and training provision, partnerships with public authorities and better anticipating markets changes
  - Social partners survey
- June 2008: a survey ordered by Social partners (who manage the funds dedicated to the financing of building trainings for employees). It underlines common changes within trades:
  - New obligations and regulations related to energy efficiency and customers' attitude (will to protect the planet, to be more informed, to be in relationship with only one person on the building site, etc.)
  - Changes of techniques and technologies
  - Demography challenge
  - Inadequate number of qualified workers
  - Effect on companies:
    - : Adaptation to new techniques and technologies
    - : Changes of behaviours linked to energy efficiency
    - : Strong control of standards and regulations
    - : Enhancing sales departments
    - : Improving human resources (recruitment, competences management, training...)
    - : Better use of technologies of communication
    - : Being able to set up a global offer
  - FFB future action : work with each of the 30 trades on action plans

## National Observatory

- Social partners of the building sector have created a «National observatory for future trades and qualifications» and a website [www.metiers-btp.fr](http://www.metiers-btp.fr)
  - Objectives: to present the construction sector and its changes to employers, employees and people interested by joining in the Construction Industry
  - Content: description of each trade activities, standards, employment, trends for the future, practices, health and safety, training and practical tools (ie: access to the national data bank of competences)
  - In progress: the site will be updated regularly according to the results of the different surveys cited above

### **Coaching / Competences**

- FFB informs its members on the necessity to develop a competences approach in their company
  - Objectives: anticipation of new markets, improvement of the organization, better knowing of employees' competences, training plan to be set up, recruiting and keeping employees
  - Method: According to their strategy, to help companies to:
    - change their organization,
    - implement management tools such as the annual professional interview
    - build their annual training plan
    - choose consultants for coaching their action plan
    - find how to finance this action plan

### **Recruitment of Women**

- Women represent 9.8% of building strength in 2006 (1.6% among site workers; 13% among site managers and engineers). FFB actions:
  - 2002: agreement between FFB and 6 government departments for common actions
  - 2003-2004: survey about people's perceptions about women on building sites
  - 2004: campaign to encourage women joining in the sector and to encourage employers to recruit women on building sites (leaflets, posters...); FFB will to recruit 30 000 women on building sites at the end of 2009
  - Results 2008: changes of mentalities; growth of women number in initial training (+25% of girls in apprenticeship) and of unemployed women in training; 20 000 at work on building sites; better image of the sector; awards for entrepreneurs who have recruited women

### **Health and safety**

- Issues included in initial vocational training curricula (at school and in apprenticeship centres)
- Compulsory training sessions for newcomers in companies
- Participation in a National safety measures association (OPP-BTP) ruled by Social partners
- Missions: awareness, information (leaflets, CD-ROM...), advice, training sessions
- Participation in Construction specific medical associations: preventive measures and medical follow-up of the workforce
- Setting up of FFB associations to keep disabled people working in Construction or to enable their conversion

### **Environmental Management**

- Objectives – helping entrepreneurs to:
  - Identify the effects of building sites activities on environment
  - Manage waste, water, dust and noise on building sites
  - Advise their clients about energy efficiency issues

# Attachments

- FFB actions
  - Awareness (documentation, seminars...)
  - Training sessions for entrepreneurs, site managers and employees

## **Providing Training on Energy Efficiency**

- In the framework of the Governmental committee on environmental issues ('Grenelle de l'Environnement') and new laws on energy efficiency, FFB decided to:
  - develop awareness and concern of its members (Environmental charter, poster, training...)
  - design specific training courses for employers and employees, called «FEEBat»
- Training objectives
  - 50 000 entrepreneurs and employees trained by the end of 2009 to become « energetic restorers »
  - All trades are involved
  - Entrepreneurs should be able to:
    - get knowledge about innovative techniques and building materials in their own trades
    - advise their customers for a better performance of their buildings/homes
    - sale a global approach on these issues
- Organization
  - 3 different courses (2 days each)
  - 100 approved training providers (including FFB training centres)
  - 95% of the spending refund to companies
  - Funding: EDF (National energy provider)
  - Qualification label «Energy saving»: first step towards a new qualification «Energetic restorer»

#### Attachment 4: Notes on People and Organisations Related to this Report

- Darren Le'Ake is a migration agent based in London who commutes to and from Australia every quarter. Daly spent time with him on his last Australian visit. His organisation, for which he is a Principal, has a database containing 6,000 names of people specifically interested in migrating to Australia with nationally recognised qualifications and experience in the UK Building and Construction Industry. Aware of Daly's brief, he has arranged for him to meet, where possible, on-site, a range of skilled builders and project managers from London, Leeds and also in Stuttgart, Germany who can provide Daly with first-hand testimony about the use of prefabrication in the housing sector and can address the issues he wants to advance. The meetings in Stuttgart will include a collegial peer of Shane West, University of Canberra Senior Lecturer in Building and Construction who is a building lecturer at Stuttgart University.
- Wyn Prichard is the Technical Director for the Welsh Educational Authority in the construction unit of the Welsh Construction Skills organisation. He has arranged a two-part program involving a meeting with the Minister of Housing from Wales and also, based on Daly's review of their Housing policy statement (sent electronically to me a month ago), a meeting with the Welsh Housing Advisory Committee to talk about how the Welsh have independently set up a strategy to meet Welsh housing needs and how prefabricated building techniques factor into the contexts of portability, OH&S, sustainability, affordability and skill demarcations. Daly has agreed to speak to a school meeting about building and construction as a career in Australia. The second part of the visit is devoted to meeting the directors from a couple of the larger builders in Llanelli in Wales, one meeting over dinner the second and third on-site looking at how the trades and para professionals work together synergistically in the microcosm of a residential building site where everything is brought together in a very short timeframe as it is needed, to erect whole houses in remarkably short times.
- Robert Williams is a Welsh builder who will host Daly to visit construction sites his company is working on. He is apparently a champion for education and training and will talk to Daly about efficiencies especially around role demarcations. He is a sitting member on the Construction Skills Advisory Board.
- Cathal Lee heads up the Irish Qualifications Authority. There a number of marked differences between the home nations in terms of how they demarcate and integrate roles in the Building and Construction Industry, no place more so than in Ireland. The housing industry is presently in marked decline, but not so the commercial sector, where large scale refurbishments on housing estates in greater Dublin are being carried out by kit-setting interiors and without relocating the tenants. This requires a highly integrated model of sequencing professionals, trades, finishers and the ability to not only manage OH&S issues for workers but tenants also.
- Leeds provides an example of 'green-fields' prefabricated housing development, where there is a strong focus on integrating new technology into an established setting. It is also seen as a 'depressed' area with a highly mobile workforce in building and construction. Many of the Leeds-based builders sojourn to Europe to ply their trades in home down-time.
- The Federation of Master Builders is a multi-disciplinary advocacy and membership organisation for both construction workers and employers alike, making it less partisan than the Australian models. It does not provide other than core training and education but brokerages this, providing industrial relations advice, training analyses and a range

## Attachments

of other services for membership. FMB are aware of Daly's Fellowship brief and have undertaken to provide him with an overview of the prefabricated housing work done in England, and how the English Construction Industry has generated a comparatively higher participation rate in training and education, especially for residential builders, and the flow on effect this has in terms of working synergies. The UK has used 'skills cards' for workers to aggregate their learning and there are a number of grades of 'carpenter' for example, only some of whom can actually work with prefabricated materials. Trade training is largely carried out on-site as is skill assessment; this places a high demand on employers in terms of their ability to meet nationally accredited outcomes.

- Bauindustrie Deutschland is a brother organisation to Master Builders in Australia and Daly has made initial contact with their Technology Executive. Their raison-d'être is based on their passion for using wooden products (albeit not exclusively) and having read some of their seasonal papers, they have done some remarkable work in the prefabrication context. German training is much more highly structured and indentured than Australian models and their tradespeople are much more able to carry out what Australians would call trade and professional 'cross-over' roles on-site. It appears they are able to use fewer skilled people to produce high level outcomes. The interviews with German tradespeople and para-professionals at the Trade Show will provide Daly with insights into a model which is distinctly different to Australian practice. They also have a 'hoch' classification for artisans which parallels Australia's licensing and registration models in terms of on-site capability.
- The Scottish Qualifications Authority is one of the oldest qualifications authorities in the world with the one of the most significant histories of structural review, particularly in the construction industry. The Australian AQF and New Zealand NZQA are modelled on a previous iteration of construction training. The Scottish, sensitive to the demands of an industry undergoing rapid change, especially in the areas of technology and new materials, have a full suite of competencies relating to prefabricated building and these are articulated through various levels of trade and para-professional endeavour. This evolution provides us with a passageway to specialisation, which they encompassed despite Union apprehensions about role fragmentation, much like in Australia.
- Pat Bowen was Daly's original contact and is a former project manager with 30 years experience whose role in the Construction Skills organisation now accounts for integration of all home nations training regimens. It was he who asked Daly to consider the context demarcation of 'prefabrication' (focus on greater parts rather than individual componentry eg bricks, copper piping etc) as this provides us with insights into identifying skill deficiencies which for the main part are site-based and more construction-oriented.
- Daly is visiting FFBatiment Français, a sibling organisation for Master Builders. He will visit to two French prefabricated housing developments which were essentially large-scale refurbishments following the Parisienne riots a year or so ago. Daly reads French reasonably fluently, and papers describe these projects as landmark projects because the activity was undertaken in a very short time frame using a mix of French leadership and significant European materials and labour. It was also very outcomes-focussed and allowed for a departure from 'traditional' building processes. The French context is quite different again to German and British construction because it is strongly driven by the Government who play a large role in housing, working with a policy of 'deconcentration' as opposed to 'decentralisation'. This is an additional consideration as far as prefabrication is concerned because it is heavily predicated on refurbishment and 'knock-down rebuild' in high traffic and densely populated areas.