EXPLORING RELATIONSHIPS OF OPTIMAL SPATIAL CONFIGURATION AND PRIVACY IN DUAL OCCUPANCY SETTINGS

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Abstract. With urban and suburban blocks squeezing to make room for new developments, neighbours are becoming closer than ever before. The current housing shortage coupled with the high rental rates in Australian cities suggests a growing need for dual occupancy housing. Current BCA (Building Codes of Australia) and Australian Standards or regulations give little consideration or guidance in terms of space and planning for occupants in close proximity. To intercede, this research aims to explore various regulatory requirements and assist in better design outcomes in a dual occupancy setting. This paper is separated into three broad phases including a theoretical approach, a practical phase, and an analytical outcome focused phase. The theoretical phase investigates different cultures and backgrounds and sees how their level of privacy is measured, along with observing a range of case studies from which a list of analytical methods (privacy measurement) and their design solutions could be observed and interpreted. The practical phase is undertaken with a more practical approach where three identical sites were created in design form with an existing dwelling in the front and an appropriate area in the rear where a dual occupancy is possible under the regulations of Australia. Furthermore accessing the codes and regulations across three English-speaking nations (Australia, New Zealand, and United Kingdom) with the aim of understanding how they differentiate from one another. To finish the analytical outcome focused phase involved analysis of literature and practical designs created in order to set guidelines to help better improve privacy issues in dual occupancy settings. This knowledge aims to inform designers and architects for future developments and comprehension of these regulations which allows us to resolve modern issues of privacy and can help improve design outcomes for further dual occupancy dwellings developments.

Keyword: Privacy, Spatial Configuration, Dual Occupancy, Regulatory Standards, Culture

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1. Introduction: Research Aims and Motivations

To maintain appropriate level of design, a set of technical provisions are applied within any country, the Australian regulations standards is better known as the BCA (Building Codes of Australia). Additional regulations are visible such as the Development Control Plan, Apartment Design Guide, and the Local Environmental Plan, along with further regulations within each council. These regulations provide guidelines for future developments. Current Building Codes of Australia and Australian Standards or regulations give little consideration or guidance in terms of space and planning for occupants in close proximity. With urban and suburban blocks squeezing to make room for new developments, neighbours are becoming closer than ever before. The current housing shortage coupled with the high rental rates in Australian cities suggests a growing need for dual occupancy housing.

To intercede with this issue, this individual research project aims to explore various regulatory requirements and assist in better design outcomes for dual occupancy settings in Australian cities. Thus, the purpose of this paper is to outline measures by which maximum land use, including privacy features, can be obtained through a limited space or block of land. This paper aims to achieve this by comparing the country building regulation codes across three English speaking nations: Australia, New Zealand and United Kingdom (UK), to demonstrate similarities, differences, and understand how with changing regulations, privacy design outcomes can be improved in dual occupancy settings. Primarily, these outcomes of this study are for designers and architects to seriously consider implementation of these design strategies to improve Australian housing privacy designs. Furthermore, this study was carried out with a broad mindset of assisting citizens in obtaining affordable suitable renting conditions in Australian cities. For example, such designs can benefit single mothers with low incomes in urban Australian environments to acquire a sustainable standard of living in the Australian context.

This purpose was chosen due to the fact that, upon literary review, other studies have not reflected identical aims. Some papers have explored similar but not identical aims. For example, Remy and Vyzoviti (2014) developed a design tool to achieve acoustically efficient origami based partitions for open plan spaces. However, this design tool has not explored broader issues off privacy, aside from acoustic privacy in Australian cities. Furthermore, Sailer, K (2011) has demonstrated that relationships between

physical layout in workplace design and organizational creativity are only recently being studied by very few researchers without an overall agenda to address such concerns holistically. Individuals are merely analyzing singular aspects of this relationship between space and creativity. In light of this, the idea of privacy, a similitude to creativity, and its maximum use in a limited dual occupancy dwelling, can be considered such a niche area that requires study and also lacks such overall coherent research. These are the reasons this study was chosen to be undertaken. The relationship between the physical layout and design of workplaces on the one hand and organisational creativity on the other hand has only been studied very recently, and by few scholars only. Moreover, there is no coherent research agenda; rather, individual scholars have analysed different and singular aspects of the relationship between space and creativity (Sailer, K, 2011).

The key findings of this study are primarily concerned with the knowledge gained through literary review and developing design iterations undertaken. The similarities found were that across UK, New Zealand and Australia, the parameters of codes were very similar. The key differences were with regards to materials used to create the dwellings, with different wall material types leading to differences in levels of acoustic privacy. Another key difference was building height restriction variances, with UK being only permitted to build single storey structures 4 meters high, whilst New Zealand and Australia are permitted to build 2 storey dwellings.

With regards to the key outcomes obtained through this study, it is firstly apparent that it can debated thickness of wall type can be considered a noise barrier for acoustic privacy. Thus, this is a key element of focus designers need consider to obtain maximum land use in dual occupancy settings. These aims and further findings are illustrated in this paper according to the structure outlined in the table of contents.

2. Research Observations and Objectives

The objective of this research is to understand the criteria around privacy particularly in a dual occupancy setting. It aims to build on existing knowledge around rules and regulations and understanding how privacy, particularly in dual occupancy dwelling can be improved. To achieve this, a three phase approach which includes a theoretical approach, a practical approach, and an analytical outcome focused approach has been undertaken. Going through these processes, this paper investigates different cultures and backgrounds and sees how their level of privacy is measured along with observing a range of case studies from which a list of analytical methods and their design solutions could be observed and interrelated.

3. Research Questions

Prior to commencing this project, the issue of everyday problems faced by residents in society was reflected on. This was considered with regard to, for example, single parent families with two children and posing the question of how they can live sustainably according to a suitable standard of living in the Sydney housing market. It is well known, for example, that residents experience immense difficulty with housing affordability and renting in Sydney. Sydney today is amongst one of the top 10 most expensive cities in the world to be a tenant. A survey in 2017 reported that Sydney is the 10th most expensive cities for tenants after comparing the cost of renting across 120 cities (CHOICE, National Shelter and National Association of Tenants' Organisations, 2017).

The current housing shortage coupled with the high rental rates in Australian cities suggest a growing need for dual occupancy housing. With the issues listed, this study poses the research question. "How can the understanding of spatial configuration, aid in creating privacy and space, in a dual occupancy setting?" Some further questions reflected on include:

1. *Can the exploration of various regulatory requirements assist in better design outcomes in a dual occupancy setting?*

2. *In what way does housing shortage coupled with high rental rates in Australian cities suggest a growing need for dual occupancy dwellings?*

3. *In what ways can sounder spatial configuration and better usage of common spaces aid in creating privacy?*

4. Methodology

Methodology to determine measures, by which maximum land use, including privacy features, can be obtained through a limited space or block of land. This was attempted by comparing the country building regulation codes across three English speaking nations: Australia, New Zealand and United Kingdom (UK), to demonstrate similarities, differences, and understand how with changing regulations, privacy design outcomes can be improved in dual occupancy settings.

This issue was tackled using a literary review and hypothetical design methodology. This process can be separated into three broad phases including a theoretical approach, a practical phase, and an analytical outcome focused phase.

4.1 THEORETICAL PHASE:

This phase investigated different cultures and backgrounds and assessed how their level of privacy is measured, along with observing a range of case studies from which a list of analytical methods (privacy measurement) and their design solutions could be observed and interpreted.

4.2 PRACTICAL PHASE:

This second phase was undertaken with a more practical approach where three identical sites were created in design form with an existing dwelling in the front and an appropriate area in the rear where a dual occupancy is possible under the regulations of Australia. Furthermore, the codes and regulations across three English-speaking nations (Australia, New Zealand, and United Kingdom) were accessed with the aim of understanding how they differentiate from one another. In addition, with the three design iterations which were produced (plans, sections and elevations), each model was directly correlated with their country codes and regulations. Through comparing the codes and regulations from three culturally similar countries, this paper identified the similarities and differences. The implementation of the three design iterations side by side provides a strong initiative to resolve the initial issue of housing privacy as the practical side of this paper.

4.3 ANALYTICAL OUTCOME FOCUSED PHASE:

This phase involved analysis of literature and practical designs created in order to set guidelines to help better improve privacy issues in dual occupancy settings. In this phase, research was extrapolated with regards to current issues in privacy faced today and design solutions that have been implemented to somewhat resolve those issues. This research was then synthesized and corroborated with the design iterations, with the aim of extrapolating relevant and useful information that can be advised to Australian designers. Thus, this phase was a small comparative study across key findings from the first two phases (theoretical and practical design iteration phase), which aimed to summarise the key outcomes which may help understand some of the areas where privacy issues can be resolved with design solutions methods in Australia.

5. Background Research

The current housing shortage coupled with the high rental rates in Australian cities suggests a growing need for dual occupancy housing. The New Australian Bureau of Statistics (ABS) state that the state of NSW grew with more than 120,000 in the year to last September, large due to the fact there were 98,000 new migrants ("Australian Demographic Statistics, March quarter 2018", 2018). As a result, Sydney is running out of properties to accommodate residents, due to which cost of living is increasing ("Australian Demographic Statistics, March quarter 2018", 2018). Upon literary review, Current BCA (Building Codes of Australia) and Australian Standards or regulations give little consideration or guidance in terms of space and planning for occupants in close proximity.

Over the years Architect and designers have found several ways to alter a design for the better using limited space to work with. "Space is one of the elements of design of architecture, as space is continuously studied for its usage. Carving space out of space creates architectural design, creating space out of space, and designing spaces by dividing this space using various tools, such as geometry, colours, and shapes it is an undefined expanse of land given to an architect to define" (Alfirevic, 2016, pg.24)

6.1 ACCOUSTICALLY EFFICIENT ORIGAMI BASED PARTITIONS FOR OPEN PLAN SPACES

A thesis paper by Remy and Vyzobiti (2014) investigated "the management of acoustic and privacy problems in open-plan spaces through the implementation of lightweight architectural partitions developed by origami tessellations." This was a useful tool; however this design tool was only useful for internal privacy issues. The design tool did not explore broader issues of privacy aside from the acoustic privacy the paper mentioned.

6.2 SHAPE THE DESIGN WITH SOUND PERFORMANCE PREDICTION

A thesis paper by Alambeigi, Pantea, Chen, Canhui, Burry, Jane, Cheng and Eva (2017) their study "promotes a design method that offers a strong relationship between the digital simulation of sound performancce and design development. By improving the speech privacy of meeting space by means of purely form, geometry and design decisions, the significance of

architecture in tuning the sound performance of a spae is investigated. Similarly to the design by Remy and Vyzobiti, this design also did not explore broader issues of privacy aside from the acoustic privacy the paper mentioned.

6. Case Study

As stated briefly in the abstract, this project is divided into three phases, which was a theoretical approach, a practical phase, and an analytical outcome focused phase. With the aims of understanding how each country code or regulation differentiates from one another, in order to correctly identify these issues, this section will address the following phases of development:

- State Environmental Planning Policy (Affordable Rental Housing)
- Creating a Site
- Creating a Dual Occupancy Dwelling (per individual country code)
- Identifying differences and similarities between each of the design iterations
- Analysis Methods & Design Solutions

6.1 STATE ENVIRONMENTAL PLANNING POLICY (AFFORDABLE RENTAL HOUSING)

In 2009, the NSW Government released the State Environmental Planning Policy (SEPP) to allow affordable housing. This permits all residential home owners with a property larger then 450m² (which also has a minimum 12m street frontage) to build a granny flat on their property, if their property is considered to be compliant (The Department of Infrastructure, Planning and Natural Resources, 2002). A granny flat is an individual self-contained small dwelling which also has a maximum living space of 60m² which can be built in the backyard of an already existing house considering, that it complies with all the regulations. If property still does not meet all the conditions required to be a Complying Development, a granny flat development can still be approved by lodging a Development Application (DA). This is where the council accesses the situation and gives a decision accordingly (NSW Government, 2018).

6.2 CREATING A SITE

In order to evaluate privacy as an eminent issue for dual occupancies, it is necessary to visualize the issue. In order to create a site in NSW, it must meet the minimal standards necessary by a NSW residence. Minimum site requirements include the following codes from The Department of Infrastructure, Planning and Natural Resources (2002):

- "Property must be a minimum of 450m2 in area. (Different rules apply to larger lot sizes (refer to "Figure 2" below)"
- "Property must have residential zoning"
- "Property must have a minimum 12 metre width at the building line of the existing dwelling"
- "Maintaining a 3m setback from the rear, 0.9m setback from the side boundaries"
- "Maintaining a distance of 3m from any existing trees over 4m in height"
- "Maximum $60m^2$ external area for the granny flat"

This summery above has been prepared to highlight the more important site planning requirements which need be comply before designing a granny flat for development. Other requirements must also be completed but these are just the main points which need to be considered.

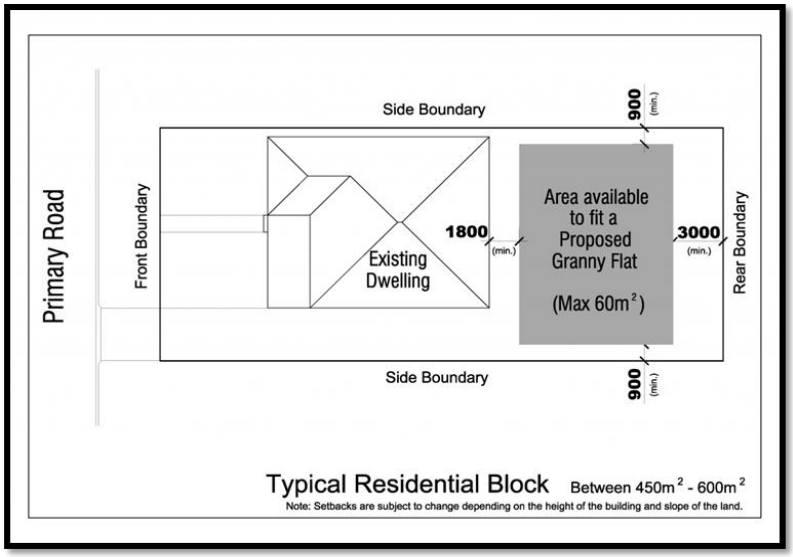

Figure 1.Typical Residential Block (NSW Government, 2018)

Lot Size (in square meters)	Minimum Frontage (in lineal meters)	Site Coverage (%)	Total Floor Area including house (in square meters)	Side Setback (in lineal meters)	Rear Setback (in lineal meters)
450-600 m2	12 m	50%	330 m2	0.9 m	3 m
600-900 m2	12 m	50%	380 m2	0.9 m	3 m
900-1500 m2	15 m	40%	430 m2	1.5 m	5 m
> 1500 m2	18 m	30%	430 m2	2.5 m	10 m

Figure 2. Lot Sizes Table (NSW Government, 2018).

A figure 2 diagram illustrates typical lot sizes between 450m²-600m² all the way up to 1500m² and their floor area requirements for existing dwellings. It also lists the site coverage and the appropriate setbacks required.

Lot Size (sqm)	Min Side Setback	Amended Side Setback Formula	Min Rear Setback	Amended Max Rear Setback
	Height <=3.8m	Height >3.8m	Height <=3.8m	Height >3.8m
450-900	0.9m	0.9m + (0.25 + H/3.8m)	3m	8m max
900-1500	1.5m	1.5m + (0.25 + H/3.8m)	5m	12m
1500+	2.5m	2.5m + (0.25 + H/3.8m)	10m	15m

Figure 3. Building Height & Setback Table (self made).

6.3 CREATING A DUAL OCCUPACY DWELLING (PER INDIVIDUAL COUNTRY CODE)

Studying through the codes and regulations of each country, there appeared to be many similarities. For example, if the BCA requirements say make one specification; another council regulation may further add to the clause in some way. Thus, there is a vast area to cover in terms of regulations. However, there is extensive similarity between the Australian Standards and New Zealand standards. Consequently, this project sought to compile three iterations which all follow the same external wall layout path with adjustments with types of materials used according to availability of each country and also adjustments for each design after following each of the countries' regulations. As for figure 4, which is the site analysis, it is visible there is an existing dwelling in front which complies with the NSW Affordable Planning Policy SEPP, and the new proposed dwelling in the rear.

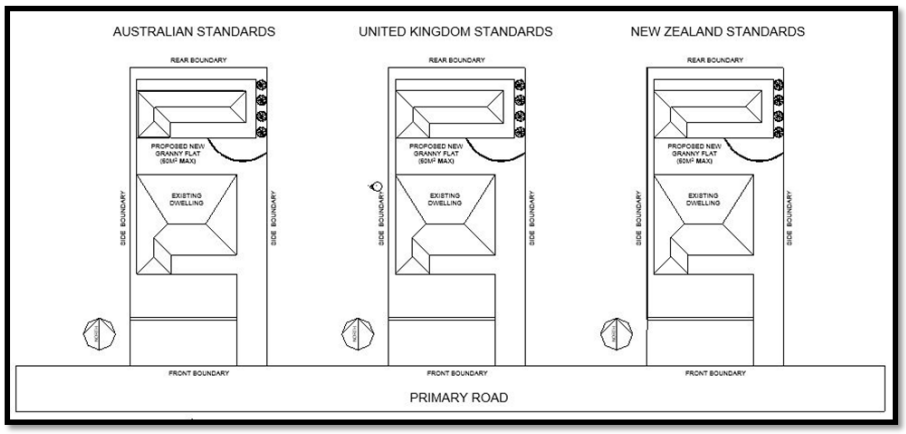

Figure 4. Site Analysis (self designed)

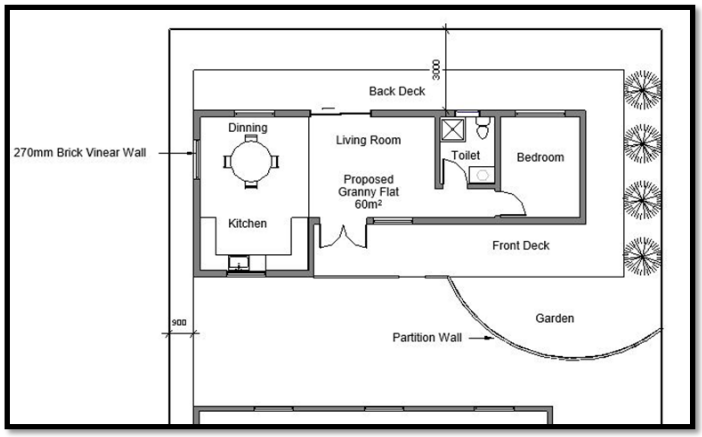

Figure 5. New Proposed Granny Flat Floor Plan Design (self designed)

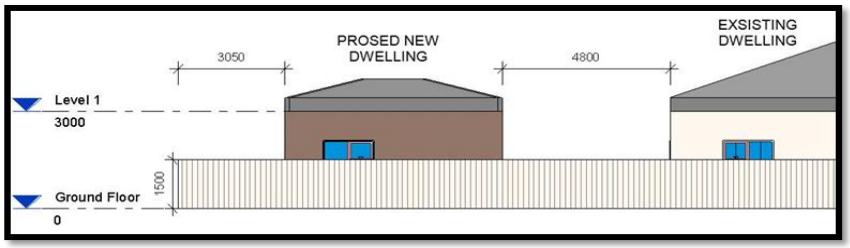

Figure 6. Elevation (self designed)

6.4 IDENTIFYING DIFFERENCE AND SIMILARITIES

This is now the second phase of the project where it is linked to the practical side. This is because at this point, this project investigated further literature, found privacy measures for analysis methods and their design solutions.

Some of the design outcomes do not directly reflect in any BCA regulations. As for the example on wall types, it is not listed that a particular wall type must be used. However, it is recommended that wall types must follow coherence with adjacent properties and neighbourhood. Wall types most commonly used for construction methods in Australia and New Zealand cities are 270mm brick veneer, however in modern traditional UK houses, houses are built with internal brickwork and external walls are made of stone. These wall types have been followed in the design brief. It can be debated that the thickness of wall type can be considered as a noise barrier for acoustic privacy.

Further examination demonstrated that window placement plays a vital role in a person and their view from inside the dwelling looking out or their view from outside the dwelling looking inside. Having seal heights higher according to floor to window seal height are beneficial ways to increase privacy. Furthermore, adding louvers, frosted glass, tinted glass, type to window are also useful tips and are considered and recommended across all 3 country's regulation codes (Department of Infrastructure, Planning and Natural Resources, 2002).

Furthermore, creating a multi level dual occupancy or granny flat is permitted by Australian Standards as listed in the Affordable Rental Housing State Environmental Planning Policy that granny flats can be built on the floor above an existing home, as long as the height of the building does not exceed 8.5m (NSW Government, 2018). Whereas in the UK granny annexes (as they call it) are also allowed to be built, however must only be single storey and no more than 4m high with a dual pitched roof, or other maximum of 3m as stated under the Permitted Development Plan ("Extensions, Alterations & Additions – Planning UK Gov", 2018).For New Zealand, which is the same as Australia, as stated under the Timaru District Plan, a multi level dual occupancy is permitted ("District Plan Online – NZ Govt", 2014) but there are a few clauses which differ to Australian regulation as well. This is an important issue because; if one is allowed to design where they are given more space, they can ensure private spaces are distanced from spaces which lack privacy.

Further in discussing similarities between Australian and New Zealand building regulation codes, it is useful to note that Standards Australia has developed internationally cohesive Australian Standards (AS) and engages in activities regarding standards that produce national advantages. Both Australian AS and Standards New Zealand have cooperated to establish joint standards (AS/NZS) ("Wikipedia – Standards Australia", 2018).

	Australian Standards	United Kingdom Standards	New Zealand Standards
Wall Type	270mm Brick Veneer	300mm Concrete Blocks	270mm Brick Veneer
Slab Type	200mm Concrete Slab	250mm Concrete Slab	200mm Concrete Slab
Window Tint	YES	YES	YES
Louvers	YES	YES	YES
Privacy Screens	YES	YES	YES
Multi Level Granny Flat	YES	NO	YES

Figure 7. Differences and Similarities in building regulation design across UK, AUS and NZ (self made)

6.5 ANALYSIS METHODS & DESIGN SOLUTIONS

6.5.1 Sunlight Study

Objectives for louvers (Department of Infrastructure, Planning and Natural Resources, 2002):

- "To ensure that daylight access is provided to all habitable rooms"
- "To provide adequate ambient lighting and minimise the need for artificial lighting during daylight hours"
- "To provide residents with the ability to adjust the quantity of daylight to suit their needs"
- "The louvers not only ensure the adequate amount of sunlight is available but also can be used as a privacy screen"

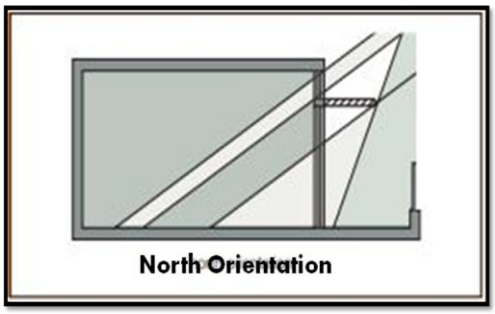

Figure 8. North Orientated Louvers
(Page. 84, Part 03 (Department of Infrastructure, Planning and Natural Resources, 2002)

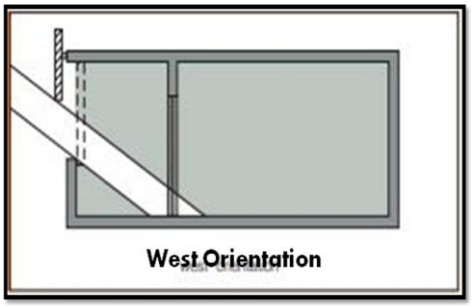

Figure 9. West Orientated Louvers
(Page .84, Part 03 (Department of Infrastructure, Planning and Natural Resources, 2002)

Figure 8 exhibits the property that on north facing windows, projecting horizontal louvers permits winter sun into the room, while shading the summer sun. However, figure 9 illustrates that on west facing windows, vertical louvers panels or sliding screens protect from glare and low afternoon sun.

6.5.2 Acoustic Privacy

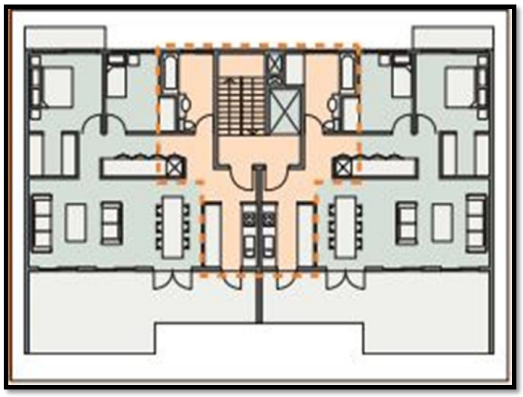

Figure 10. Typical Apartment Floor Plan
(Page .84, Part 03 (Department of Infrastructure, Planning and Natural Resources, 2002)

Acoustic privacy is a measure of sound insulation between external and internal spaces. Designing for acoustic privacy relates to the location and separation of buildings within a development and the arrangement of internal and external areas of a dwelling. In order to utilise the site and building layout to maximise the potential for acoustic privacy, designers need to provide adequate building separation within the development and from neighbouring buildings.

In figure 10, it can be seen that a typical apartment floor plan locates living spaces away from noise sources, such as lifts and stairs. Quiet bedrooms are also located separate from main living areas. Also visible in figure 11, is that from the floor plan which was completed earlier for the proposed granny flat, the bedroom is placed in one corner of the design. Thus, to mask acoustic and visible privacy, decking the surroundings and providing a partition wall must be in place. Furthermore a small garden space in front to keep the area isolated to the rest of the site is also conducive to privacy. Also, it can be seen that the kitchen dinner and living area are together as they are usually the nosier areas in a house design.

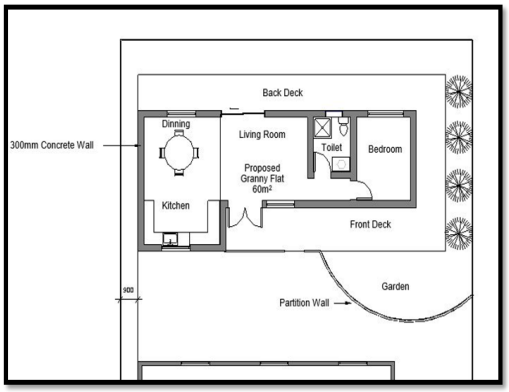

Figure 11. Proposed Granny Flat Floor Plan (self designed)

6.5.3 Relocation of Entry & Gardening

Relocating entry points as shown in figure 12 from Residential Flat and Building Design are for improved design practice. It allows the following privacy measure for dual occupancy and flat design plans (Department of Infrastructure, Planning and Natural Resources, 2002):

- "Balancing privacy requirements and pedestrian accessibility"
- "Providing appropriate fencing, lighting and/ or landscaping to meet privacy and safety requirements of occupants while contributing to a pleasant streetscape"

- "Utilising a change in level from the street to the private garden or terrace to minimise site lines from the streets into the apartment for some apartments"; and
- "Increasing street surveillance with doors and windows facing onto the street."

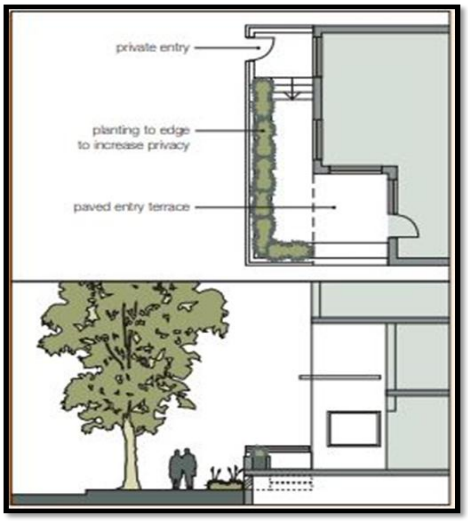

Figure 12. Alternative Entry Access
(Department of Infrastructure, Planning and Natural Resources, 2002, Page .77)

7. Significance of Research

Current BCA and Australian Standards or regulations give very little consideration or guidance in terms of space and planning for occupants in close proximity. This knowledge aims to inform designers and architects for future developments and comprehension of these regulations can assist in resolving modern issues of privacy and can help improve design outcomes for further dual occupancy dwelling developments. Additionally, this study hopes to help in enabling designers to look beyond regulation and improved design options, for future dual occupancy developments.

8. Evaluation of Research Project

It could be concluded that this research provided an initial step towards minimizing privacy concerns faced today. The outcome which was intended for this project was the knowledge acquired around the criteria for privacy across different nations and how this differs/ or is similar. This knowledge is aimed to inform designers and architects for future development and comprehension of these regulations which allows addressing of modern issues of privacy and can help improve design outcomes for further dual occupancy developments. Regarding future implications, this study could be a step towards an opportunity to develop a computational tool to capture the logic of the regulations and or test levels of privacy in actual or speculative design examples towards enhancing better privacy outcomes.

9. Conclusion

This paper explores methods by which privacy design issues can be improved to maximise land use in urban Australian cities. Investigating regulatory code differences between cultures will assist in understanding how diverse cultures view privacy and how they resolve privacy issues. There are always alternative ways to increase privacy such as privacy planting, fences, panels, pergolas, portable partitions, glass styles, window styles, using fountains to mask noise and many more. This can provide guidance on how to resolve privacy issues in an Australian urban setting and elicit ideas on solving privacy issues in future or modern urban environments. Additionally, this can also improve understandings of how common spaces in urban Australian settings can be utilised more effectively.

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