Reclaiming the Urban Environment
Mixed Use Architecture as a means towards Urban Sustainability

An Explanatory Document submitted in partial fulfilment of the requirements for the
degree of Master of Architectural (Professional), Unitec New Zealand, 2010

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Abstract

This project investigates the mixed-use building type as a form of sustainable urban architecture for the city of Auckland, New Zealand. Auckland lacks higher density architecture that applies sustainable techniques of building and stimulates local sub-centre economic developments. The city's inner suburbs offer opportunities in this regard: they are zoned for higher density and easily find tenants for a mix of secondary retail shopping, creative industries offices and studios as well as small apartments. As a location for these businesses and social activities the inner suburbs have become significant, and have started to generate high property values in the last decade. Assuming that architecture can be highly influential in changing the perspective of our lifestyle choices, the proposal in this study is a mixed-use building type, occupying half a city block between three streets in Eden Terrace, offering sustainable and convenient work-live-play lifestyles.

The design is based on extensive research into urban design strategies and mixed-use architecture from Australia, America and Europe. Topics relevant to the project are urbanism, place, colour and building materials and services, all of which have relationships with environmental sustainability. The resulting concept design, while mainly driven by an unconventional and complex programme, is also highly site-specific. Nevertheless, it represents a model applicable on many similar sites in Auckland. This type of architecture should be equally attractive to the city council, property developers and owners, and several types of tenants. As such, it represents the future of Auckland's inner suburbs' economic regeneration and physical renewal.
Acknowledgements

I would like to thank my Supervisors, staff of the Architecture School, Unitec, and my peers whom I’ve studied with over the last five years. The ongoing support and inspiration from all of these people helped me in achieving the completion of this work.

Most importantly I’d like to thank my mother who has supported me throughout my architectural studies. Her guidance and encouragement has helped me in completing this journey.
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1.0 Introduction

1.1 Research Question

How can Urban Architecture bind together and express a mixture of functions and environmental strategies to create a vibrant hybrid building suitable for the economic, demographic and cultural needs of Auckland?

A mixed-use building type can offer a range of solutions to the many problems that we all face in our modern society: the pressures of work, feeling like we have little time in the day, keeping up with healthy lifestyle choices and social and environmental responsibilities. Good Architecture can tackle this level of complexity. This project demonstrates how it is possible to do so through a rational design process, based on appropriate theory. It also shows that this alternative architectural type, already used in other places around the world, can work for our unique social and climatic conditions. The future for these typologies is promising – this is a prospect that can surprise and delight those who are presently unaware of the possibilities of higher density city life. New Zealand must begin to show that the ‘clean and green’ image that we portray to the world belongs to our built environment as well as to our natural scenery.

1.2 Aims and Objectives

The aim of the project is to create a visually stunning building that expresses sustainability and function through quality architecture that readies the area of Eden Terrace for an influx of vibrant, creative residents and businesses. Key objectives are as follows:

- Programme a Property Development Project that will become home to a range of creative industries in Auckland
- Stimulate urban renewal through architecture in an undeveloped inner city suburb
- Increase the density of the site and improve the amenity of the area through a niche market
- Successfully create a piece of architecture that will incorporate several features of sustainability – social and environmental – thus starting a trend of future urban architectural development
1.3 Project Outline

The project expects to achieve a balance of built form to urban spaces and provide a mixture of uses to promote urban sustainability. In effect, it will become a ‘place’, a centre to which the wider community will contribute. The design will have incorporated a selection of innovative technologies in the form of passive and active service systems for space and hot water heating and rain water collection. Most importantly, the finished design solution will be an original approach to urban design and environmental sustainability not yet experienced in New Zealand.

Key aspects looked at in order to better serve the design process and finished design are:

- Past and present urban practices in New Zealand and how they affect us today
- An insight to circulation patterns at city, local and building scales to find how they affect architecture and the relationships between living, working and recreational spaces
- Form (mass) and Space (void) balance as a means towards better architectural and urban environments
- Sustainable approaches to Urban Design and Architecture
- The role of the Architect in achieving Sustainable Urbanism and Architecture in New Zealand

Architecture needs to regain dominance in our urban landscape, forming closer relationships in-between built forms and thus creating a sense of place. Though there is much talk about improving urban design - several documents have been recently released on how Auckland intends to solve these issues - there is little if any discussion on architecture as a solution to these problems.

1.4 Justification

This project is justified on the basis of the growing need for denser architecture and better open spaces, which will thrive socially and economically, and be able to adjust to changing functions and environmental conditions. We currently have no clear examples of mixed-use architectural developments that respond to population growth and environmental strategies in New Zealand. There are many pockets around the
fringe of Auckland City that would benefit greatly from this kind of urban renewal strategy.

Documents such as the Urban Design Protocol by The Ministry for the Environment, and online resources by Auckland City council - Designing Great Places for our People, It’s My Backyard and the Urban Design Framework –reflect how the development of Auckland City is foreseen. The Framework specifically recognises the key challenges that Auckland faces in trying to become a denser, sustainable, liveable and, as a result of all this, a more successful City. The key words that are used by the Council are relevant as a link to this research project: Distinctive, Compact, Connected, Sustainable, Beautiful and Human.

The acknowledgement of these characteristics by Auckland City Council reinforces the need for developments as the one proposed here: architecture that intertwines aspects of living, working, environmental sustainability and ultimately a sense of place. All of these reflect contemporary social issues. Satisfying the demand for urban intensification means understanding the origins of the vibrancy seen in areas around Auckland that we currently recognise as being successful pockets of the city, such as Ponsonby, Newmarket, and Mt Eden. The common factor between these areas is the historical presence of the live-work typology. It enabled a sustainable lifestyle because of dependency on walking, public transport and a local market base. They were very social streets, as the architecture catered for a mix of activities, creating variety in building frontage and an overall sense of place.

In more recent attempts to increase density while also improving inner city living, projects such as Beaumont Quarter and Soho Square were proposed by developers and accepted by the city council (though the latter remains unconstructed). There are plenty of initiatives in place to make Auckland City the best that it can be, but few developments have been presented that offer an alternative way of living and working whilst adding density to the inner city and ultimately supporting and increasing the demand for public transport systems.
1.5 Scope and Limitations

The scope of this project covers issues of place and new forms of urbanism in order to determine how these principles can be applied in complimenting Auckland’s urban environment. At the level of a single building we were looking at how the influence of circulation and sustainable design techniques and colour can be incorporated into a piece of architecture.

The research and design operated at two levels:
1) A master plan for a city block, that proposed a portfolio of strategies in order to deal with the diversity of situations within the area;
   And,
2) A building design that concentrates on: a mixed use programme of functions, environmental strategy, circulation strategy, building systems and materials (limited to building structure and envelope), sustainable energy use and generation and, water collection.

Affordability is not part of the scope, nor are market price values relating to the site procured. However, it is foreseen that a building of this calibre would be a government-led initiative and thus would require property management in order to ensure maintenance of the facilities and properties that make up the built form and urban space. Also, because it is a government-led project it can be assumed that sale of individual tenancies would be undertaken by a managed procurement method as opposed to a first-in first-serve scheme, thus initial functions will work in terms of the brief.
1.6 Definitions

- Circulation: the way in which people move through a building. This typically entails an interaction with elements such as elevators, escalators and staircases that should be positioned to optimise movement through and around a building.
- Environmental Sustainability: the ability to meet the needs of the present without compromising the needs of the future.
- Intensification: Increasing the density of people and land uses in the urban environment.
- Live-Work: A building that supports both functions with a degree of separation.
- Mixed-Use: architecture that is able to provide for three or more functions or uses.
- Movement: to move or be moved; moving part of a mechanism
- Social Sustainability: the act of all users such as community, local authorities and government taking responsibility for the use and maintenance of the environment.
- Sprawl: A rational system of housing design that denotes low-density living. It is characterised by a house befitting, generally, a single family unit and is dependent on the motor vehicle for travel to social centres and work places.
2.0 Methodology

“True towns take time; a designer can only provide the ingredients and conditions most likely to lead to a mixed-use future.”

2.1 Project Strategy

Initial strategies in this project were the ones commonly used for architectural projects: an analysis of appropriate background information from literature and architectural precedence’s, followed by collecting and analysing site conditions.

The direction taken can be broken down as follows:

Observation → Interpretation → Application → Integration

The information gathered was used to make informed decisions about the many factors involved in reaching a sophisticated design resolution.

This methodology is appropriate for this project because of its unique functional properties. Mixed-use architecture is uncommon, and so it becomes necessary to breakdown the outcomes into individual components and interpret how they could work as an integrated method of design for future urban architectural strategies.

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2.2 Research Methods

2.2.1 Literature Review
A review of current theoretical knowledge was an important tool in order to define aspects of the project that cannot be resolved in the visual resolution of the design such as historical and quantitative information. Theory was also useful in determining whether a certain direction taken along the design process was appropriate, or indicated possibility to be proven wrong.

2.2.2 Case Studies
The selection of architectural examples to learn from was an integral part of the research process. Case studies give the ability to visualise the level of detail and scale that relates to the project best. These were the most helpful in terms of visualising the potential the finished design could have, particularly in regard to current innovations in materials and technology. For instance, sustainability goals vary from building to building, country to country. It then becomes a matter of what ideas and techniques are most significant and applicable for this specific design project.

2.2.3 Design Exploration
The design process is the most vital part of answering the architectural question at hand. It takes all the relevant information gathered and begins to interpret the possibilities of a final design solution. This is an ongoing rational process of trial and error, and analysis.
The approach throughout this design was primarily through physical and digital modelling for urban, form and space exploration, hard line and CAD drawing for finer details.
3.0 Review of Current Knowledge

3.1 Auckland: How we live

New Zealand’s urban societies and its urban forms have revolved around the private individual dream of owning home and section. Seeing it as a land of opportunity, many people came to New Zealand from Europe in the 19th Century to colonise and escape the overcrowded and unhealthy conditions of living in the urban squalors of their homelands. The early 1900's saw many debates about what were considered adequate living conditions in reaction to accumulating urban slums. The solution came in the form of encouraged suburban living and later the Labour Government’s Housing Scheme, introduced after their electoral win of 1935. A high value was placed on the suburban paradigm, in such a way that over time it has become the norm for the way we live. This included relying on private transportation to get from home to work, shops, restaurants, and friend’s and family’s homes.

Looking back now, we can see that this leap into suburban living has determined certain consequences to our present day lifestyles and urban architectural development. The architectural landscape of Auckland has become a heavy concentration of central functions and workplaces, abruptly separated from the sprawling residential areas of the suburbs. Buildings had once been set apart wide enough for several lanes, serving a buzzing variety of traffic options: pedestrians on foot, horse drawn carts, trams and some private motor-vehicles. To better serve the post-war way of suburban living (that saw the city centre population drop by half), the roads were cleared of horse troughs and tram lines by the end of 1956 and replaced with bitumen rubber to make a sealed road surface for cars to move easily in and out of the city. And though traffic engineering was widely used, the ‘parking problem’ very soon came to be a prevailing issue. This has effected architectural and urban design, reduced the convenience and importance of pedestrians, and placed designing for the car as the first priority.

Today we see the change from traditional ways of living. A growing number of single person and working couple ‘households’ have emerged now as a typical demographic

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profile. To accommodate their busy lifestyles they do not require a large living space and prefer living where amenities are close – so they can save on time and money. However, typical apartment designs are in the form of single aspect high-rise apartment buildings, where quality of living conditions are poor and the journey to a single apartment is dull because of the independent journey using the elevator and a bland hallway of anonymous doors.

Other recent events which are cause for concern are the ever rising prices of oil and commodities that puts New Zealand in an awkward position relative to the rest of the world. As an island nation what do we do when these resources are unable to make it to our shores?
3.2 Auckland Urbanism: What is our ‘Place’?

The idea of ‘place’ is a concept that is difficult to translate in terms of Auckland because of the manner in which Auckland has been developed. Auckland as a ‘place’ or ‘region’ is broken up by suburbs spread around a city centre. The nature of a suburb is not able to be translated as a ‘place’ either as it typically does not consist of a social centre of which a community gathers. Norberg-Schulz describes notions of place and identity as follows:

‘The identity of place is assured by routine ways of building and by architectural style and this means that space, form and figure constitute a formal language that makes possible an unending array of new interpretations, in relation to specific tasks of building’  

Suburbs break up the ‘place’ we know of as Auckland. Copious amount of roads and individual houses, however, do not contribute to the greater public as a sense of ‘place’. The concentration of the built environment has a clear visual separation between inner city and suburban living as seen in the satellite image below.

Figure 3 : Google Earth Map of Eden/Albert area, Auckland

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So what does make a ‘place’? In the first instance we can relate to a ‘place’ in terms of its appearance. When we can see that there is a kind of unifying force amongst our surroundings there can be either a sense of belonging or displacement. In the case of belonging there is then a sense of community, an area of which people can feel safe, familiar and sociable with one another. New Urbanism is concerned with these aspects in terms of how it becomes a more sustainable way of building in order to become adaptive and resilient with the inevitability of climate change.

Many benefits exist to living and working in a ‘place’ in the microcosmic sense. Aspects that would be desirable to some people may be the reduction in cost and time, monetary wise to the individual or family as well as environmentally. Perhaps it is the convenient location and proximity of the ‘place’ itself in relation to other desirable nodes. It could also be that one can be at the heart of social activity and still have the ability to retreat into a place of privacy. These are not very typical aspects of living and working conditions of Auckland due to the dependency on private-vehicle ownership. The Urban Design Framework for Auckland anticipates that it will ‘inform the public on how urban design can contribute to improving the city’s urban structure, form and the experience of living and working in Auckland’.

However, an alternative phrase to the word ‘place’ is used to describe certain areas of urban build-up that does hold to the characteristics of place: local centres. Local Centres are the areas of recent and historic urban intensification that run adjacent to public transport infrastructure. Locations such as Kingsland and Mt Eden are examples of historic local centres that are high in value and are always buzzing with social street life. That in itself is a noticeable difference to the quiet and empty suburban street, for, as Norberg-Schulz explains:

“The term “use of place” entails not only the use of the buildings in which we work and live, but also the use of the place itself, as a whole.”

The success of these areas are due to a more traditional urban and architectural design approach that has a sense of uniformity, balance of space to built form, and an ability to carry out differing functions within the local area, which for areas such as Kingsland, becomes second nature. The timelessness of these areas is proof that such

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intensification is a successful way of designing as they remain today as icons of the past and have evolved to meet our contemporary social needs.

Thus far, mixed-use building is limited to theory and master plan zoning⁸ (see Figure 4) in the context of Auckland. There does not seem to be a fear of working and living within close proximities as observation of suburban areas shows that there are many who will run a small private business out of their home garage⁹ and many new home plans accommodate a ‘home office’ or ‘study’ room additional to the three bedrooms already provided. What has been omitted is an opportunity for a working professional, couple or family to occupy a mixed-use place in order to satisfy their living and working mode of life.

Issues that Auckland must face in the suggestion of a new mixed use development, local centre and place, are of identity, quality and acceptance of a different approach to living and working then what is currently on offer. In a global competition for the ‘best’ city, identity becomes important at local and non-local scales. Quality and change are both characteristics that need addressing in the proposition of a new development as integrated approaches: the change of lifestyle needs to show positive benefits in order for communities to develop and grow around it and quality of the design work must ensure enough leeway for participants to contribute to the customising of their surroundings.¹⁰ Therefore an overall sense of investment, ownership and belonging occurs, satisfying a range of functions, creating a new identity and place that is timeless.

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⁸ Zoning maps can be found on the website It’s My Backyard that uses a colour coding system and key to distinguish what is residential, commercial or industrial and in some cases the intended densities of these.

⁹ For example, my old neighbour in Massey ran her tailoring business from the single car garage on the property rather than housing a car in it. They have since moved the single car garage to the front lawn to run the business from, a double car garage has taken its place in the backyard, as well as another 2 bedroom house.

3.3 The Extent of Sustainable Design in Auckland

We find that in Auckland sustainability is a large component in the agenda for how we will build for the future. As such, one of the many key objectives of the Urban Design Framework, Urban Design Protocol and other strategies that have been active for the past decade, is how they intend to deal with the issues of climate change:

‘Urban Design’s main contribution to sustainability in Auckland will be in creating a more sustainable urban form for the city – more high-quality, compact, mixed use communities with higher densities, served by better public transport, which will reduce the need to travel long distances.’

Proof that such strategies are failing is evidenced by a further $866 million to be spent on widening the north western motorway by a further two lanes (one in each direction) and sacrificing 65 homes to do so. If taken seriously, efforts towards sustainability should be directed as of more importance to the city than to other areas of urban growth, with sustainability as the presiding agenda of modern design projects. The following section discusses further ideas on circulation, but it is certain that Auckland’s agenda remains as one that supports, most likely for gaining revenues, the private-transportation agenda.

This project is partly based on assumptions as to the way that Auckland and other major urban regions in New Zealand (Wellington and Christchurch) should try becoming sustainable. By becoming urban regions rather than just cities, these areas can support further growth independently from the networks of infrastructure that is now in place and thus begin to be self-sufficient, self-supplying areas. At the same time architecture can better use the networks already in place. There are opportunities to begin the process of intensification along these networks now.

Technology is an aspect of sustainable design that in some areas thrives while others are underutilised in New Zealand. Krier, however, believes that today architects are vainly trying to fulfil the need to design a type of ‘modern architecture’:

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12 Stephen Forbes, “Home owners face anxious wait for update,” Western Leader, October 08, 2009
‘Those architects who claim today to be inventing the architecture and urbanism of the twenty-first century are clearly even more foolish than the masters of historic “modernism.”’ 15

What could actually be seen now is that architects are working with urban design principles as they have been applied before modernism (New Urbanism) with the exception that we are now using technology as a means to become resilient and adaptive16 to climate change. The ideology is not necessarily that the building ‘is a machine’ through the use of technology, but that now it is a requirement to use certain technologies in an effort to reduce the loads of energy and water supply from main civic infrastructures, which may come in the form of passive and active systems. Therefore we can look at this as being an adaptive architecture and urbanism of the twenty-first century.

However, as the taxpayer dollar is being granted to further develop motorways, so it is not being used to contribute to more sustainable energy sources. For example, the use of solar water-heating panels is becoming more popular as individual homeowners have recognised that this is far cheaper than mains electrical hot water heating over time. The same can be said for photovoltaic use, which is a source of energy for many successful contemporary designs overseas, but is yet to be seen as beneficial to large scale design in New Zealand. Though our conditions are optimal for their application, minimal funding from the government renders them inaccessible as a popular source of energy collection.17

As a building type, it is suggested in the Urban Design Framework that a goal of sustainability is to become a compact city where ‘town and neighbourhood centres become thriving, vibrant, mixed-use centres – where walking is an attractive option.’ 18 Mixed-use is an ideal building type option to increase density that is supported by New Urbanism theorists such as Krier who writes:

‘Traditional urban design and architecture allow for the articulation and organization of contrasting social activities into coherent, meaningful, and ecological organisms. They

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become second nature, without explanations and justifications; their techniques transcend time and space, and are universal constituents of all enduring civilizations." ¹⁹

This can be further emphasised by Norberg-Schulz:

‘Vernacular architecture is at the origin of the art of place as a response to the question of living, or inhabiting.’ ²⁰

As a suggested building type by many theorists and the Auckland City Council itself, the area of mixed-use is limited in architectural design in Auckland with one known building of this nature, the Axis Building in Parnell, a retrofit by Patterson Architects (see Case Studies for further information). Other buildings in Auckland that denote mixed-use, however only serve two functions of combining ground level retail with either offices or apartments, but not both.

Auckland and New Zealand respectively, is a young city and country, relative to the age of the world as a whole. Because of this, we have evolved architecturally in a way similar to that of the United States and Australia in terms of a particular kind of urban growth – sprawl. For Auckland, urban centre growth was stunted by the dream of the citizen that was to escape intensive urban areas for a place they could call home – the individual and ‘independent’ suburban home. The council’s principal function concern has since then been to deal with networking traffic as opposed to accommodating inner-city living.

The Auckland City Council defines its focus of urban design as the following elements:

- The spaces and connections between neighbourhoods and buildings.
- The relationship between buildings and spaces in terms of size, appearance and uses.
- How the various elements of cities work together with a focus on the public realm.
- How people interact and move through an area or place.

‘Most importantly, urban design is based on time-honoured objective principles of “place-making” found in successful spaces around the world – not on subjective decisions around taste or style alone’.

These aspects lie mainly in the configuration of spaces and how they are used as nodes of circulation to better serve the pedestrian public realm. However, we already have in place a network of different transportation nodes that supports motor-vehicle movement. The proposition should be that architecture be developed in areas that support public transport initiatives, which compliments pedestrian movement and street life as well as a focus on public space. These should be co-initiatives rather than separate ones. It would be un-sustainable to remove or reconfigure buildings to provide ideal spaces. And citizens should not be afraid to allow new urban spaces to be developed in their neighbourhoods for fear of the ‘undesirables’. As discussed above, places and ergo public spaces are areas that flourish with life and activity that most

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21 I placed ‘independent’ in quote here because those who live in suburbia live under the misconception that they are living more independently due to their location and lifestyle. For example, private transportation is now threatened by the rising costs of oil supplies, which now has car-owners realizing their dependence on this system of travel.

22 Auckland City Council, Designing great places for our People,

23 This was a term used in a previous project that proposed a space that would be open to the public at all hours, and was rejected as an area that would become filled with ‘undesirables’.
people become part of, not because they need to be, but because they want to be there.\textsuperscript{24}

As a design approach for new architectural and urban development, arterial routes, main roads and all possible pedestrian paths should take precedence as the ability to move through and around architecture is usually its defining characteristic and ultimately a measure of its success. Bill Hillier recognises that:

‘The configuration of the space network is, in and of itself, a primary shaper of the pattern of movement.’\textsuperscript{25}

In the configuration of circulation, particularly pedestrian, space then begins to shape patterns of ‘co presence’ and ‘co absence’ which makes our centres feel more organic in their ability to be extremely busy followed by periods of extreme emptiness.\textsuperscript{26} Current nodes of movement in Auckland are now strong enough that they support areas that attract high market value for future development. Activities that attract pedestrian movement such as retail will attach itself to an area where movement flow already occurs. Thus, intensifying the city should not begin by searching for an area that will distribute attractive functions as this is generally the product of the space network. \textsuperscript{27}

\textsuperscript{24} Jan Gehl, Lively, Attractive, and Safe Cities – But How? In New Urbanism and Beyond, ed. Tigran Haas (New York: Rizzoli International, 2008),107
\textsuperscript{25} Bill Hillier, The New Science of Space and the Art of Place, In New Urbanism and Beyond, ed. Tigran Haas (New York: Rizzoli International, 2008),30
\textsuperscript{26} Ibid, 30
\textsuperscript{27} Ibid, 31
3.5 Colour as a Tool for Urban Design

Though colour is not mentioned a great deal in theory work on urban design, it can be considered of interest to this project as an additional design strategy towards better urban design. *A Deeper Shade of Green* does not consider colour in terms of urban sustainability as it is not considered in any section about building materials or use of colour in design practice, with the exception of the preference to using natural colour pigmentations when choosing paint supply in renovation or new design.\(^{28}\) *New Urbanism and Beyond* chapters examine many different aspects as to what makes good and bad urban design situations, but limits regional solutions to being more about local identity and culture, which colour could be assumed to be a part of though not spoken of exclusively.

Le Corbusier looked to colour to further the experience of Architecture. He procured the knowledge through painting and travelling and then applied his new ideas to his “purist” buildings of the 1920’s. Natural pigments, which were widely accessible in the form of powdered colours, were ‘responsible for the psychological and physiological effects in painting.’\(^{29}\) Hence, to Le Corbusier, their importance in the bigger scheme of the world: buildings and urban spaces.

Colour is a source of harmony in the natural environment and so it should be in the built environment if the achievement sought is one of long-life sustainable architecture. Peter F. Smith explains that use of colour in the built environment was lost during the post-war period due to a preference towards function as the means of an architectural style.

‘What post-war planners failed to realise was that harmony depends on disequilibrium. Fundamentally it concerns a clash between dissimilar entities within a single logical frame of reference.’\(^{30}\)

Functional post-war architecture was about a pure object amongst the built environment and was a suppressed art in favour of a unified conformity of style.\(^{31}\) However, in terms of contemporary design, it is acknowledged that if identity and

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\(^{29}\) Le Corbusier, *Polychromie architecturale*, (Basel: Birkhauser, 1998), 1

\(^{30}\) Peter F. Smith, *The Dynamics of Colour*, In *Colour for Architecture Today*, edited by Tom Porter and Byron Mikellides (New York: Taylor and Francis, 2009), 18

\(^{31}\) Ibid, 18
culture are applied to the design of urban spaces colour must then become of some importance if it is to be accepted by the wider public. This can be disputed if it is assumed that this is the primary force of the overall design of the space, however, as an integrated part of the design process, it can add value to the successful design of building tectonics and urban spaces.

Auckland City is generally monochromatic by nature, consisting of many grey concrete walls, the darker grey of the asphalt road and glass facades reflections of the road and neighbouring buildings. Even the Sky Tower, quite easily Auckland’s most iconic building, uses coloured light in order to create delight amongst Auckland’s evening skyline. And again, if we look to our local centres, they too participate in the application of colour through the mix of natural materials with either their natural finish or an applied colour finish. By default, suburban colour application is limited to neutral and natural colours as these are inoffensive and therefore reflect the obedient nature of a suburban community.

Concepts on the application of colour can be done in various, yet generally rational ways. Coloured lighting such as on the Sky Tower is effective though limited to darker backgrounds for best experience. Building materials are the most obvious and common forms of natural colour implementation and therefore the most sustainable way of applying colour to urban environments. Ironbank, by RTA Studio on Karangahape Road is a wonderful example of the use of naturally oxidised steel panels as an inner city cladding choice. Applied colour may be used as a form of identifying important focal points to a building or complex, such as the yellow lift tower of Beaumont Quarter.

Decisions on which colours to use may also vary. ‘Environmental Colour Mapping’ is one such way of selecting colours from the immediate environment that one may choose to apply in order to blend and unite a whole area. This tool has been developed over the past three decades and has proven itself as an ideal way to identify architectural colour schemes in order to reflect regional and local distinctions in the built environment.32

Selection of colour is also subjected to individual response and what may be accepted by one group of people may not be accepted by another. An individual’s full perceptual experience relies on both hemispheres of the brain to carry out their respective roles

of analysing the individual parts of the design before piecing it back together to judge the components as an aesthetic whole. Difficulty lies in satisfying all those that may occupy the space.

A design strategy may be a more sympathetic approach to the site by selecting natural and artificial colours of the area and applying them to the architecture and urban space; the use of environmental colour mapping. Or a more radical approach could be taken that uses such a colour map but as a process of elimination: by choosing specifically not to use the colours found in the area and apply a scheme that is brighter and more vivid in order to stand out amongst its neighbours.

The two approaches can be named accordingly as being either sympathetic or radical finishes, though both are rational concepts. As a design choice, the concept chosen would ultimately be a reflection of the functions and cultures of the local urban centre it is applied to. Materials are also a factor in choice of colour application as either concept must acknowledge that the design process is an integrated one and thus there may be limitations to how colour may or may not be applied to cladding materials. Furthermore, the implications of what constitutes a sustainable choice should be considered.

From Left to Right
Figure 5: Sky Tower, Auckland with Purple lighting
Figure 6: Sky Tower, Auckland with Green and Red lighting for Christmas
Figure 7: Beaumont Quarter, Auckland. Lift Tower painted Yellow
Figure 8: Samson Corporation Limited, Newton Auckland by RTA Studio. Cor 10 Steel Cladding naturally weathered

33 Peter F. Smith, The Dynamics of Colour, in Colour for Architecture Today, edited by Tom Porter and Byron Mikellides (New York: Taylor and Francis, 2009), 19
4.0 Project Development

4.1 Dominion Road – Past, Present and Future

Dominion Road forms an historic mark in New Zealand’s past, mainly that as a main travel route between the Manukau Harbour and Auckland City Centre. It was one of many areas that supported the electric tram system throughout the early 20\textsuperscript{th} Century.\textsuperscript{34}

The Vision for Dominion Road is to make it a livelier road made up of several villages rather than a mere, yet significant, arterial bus route. That is to say, its mark today is not significant past its use as a main road. Expression of interest from the Auckland City Council on the development of Dominion Road is primarily based on improving public transport systems, secondarily on built and urban environments.

The project Dominion Road 2016 began in 2003. It established ‘An urban design and streetscape plan’ to improve the urban qualities of the Valley Road and Balmoral Shops (see figure 13). Most of the strategies are based on improving the public transport route and cosmetic upgrades to the streetscape (see figure 14). The points proposed that are most relevant to this project include the following:

Improved passenger transport and an upgraded street will:

- establish Dominion Road as a place to stop and linger, rather than pass through
- make the street and properties on and around it more attractive
- ensure Dominion Road's neighbourhoods are safe places for people and businesses.\(^35\)

And,

- Activating the street environment behind the shops and creating active public spaces with planting, art, seating and lighting\(^36\)

The streetscape upgrades are important, though they only target areas that are already thriving socially, but appear worn and dated. The specific areas along Dominion road that are targeted by the Council are those which are significant connections to entertainment areas, such as Eden Park or St Lukes shopping centre.

This project targets a site that is not in the Council's immediate attention for development but from an architectural perspective has a lot of potential for urban renewal under other strategies such as the *Urban Design Protocol* and the *Designing Great Places for our People* urban design framework.

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Figure 13: Map of the Eden Valley Main Street upgrades programme

Figure 14: Proposal of Public Transport upgrade
Site for project is within circled area
4.2 Site Information

4.2.1 Physical Location and Attributes

The site is the northern end of Dominion Road, the west side of the road itself. The larger site area is approximately 46,000m². It contains a mixture of medium density residential, commercial and industrial buildings. The immediate site is half of a city block, approximately 5800m², which is framed by Dominion Road to the east, Charles Street to the north, Tawari Street to the South, and neighbouring buildings to the west.

Commercial and industrial buildings are generally one or two level high concrete panel structures. Most if not all have set backs or are completely detached from the road front to accommodate parking for employees and customers, though the short roads have little moving road and foot traffic over the day. There is minimal response between the building frontages and the street, nor is there a relationship between each building and business: the built environment is fragmented spatially, and also socially. Dominion Road itself creates a wide corridor between buildings for traffic moving to and from the city, though many buses are diverted down View Road and pedestrians are left with a wide footpath that is empty and mostly exposed.

Figure 15: Photo of site taken from Mt Eden
Clockwise from top left
Figure 16: Map of New Zealand, Auckland highlighted
Figure 17: Satellite image of Eden Terrace, Auckland; Site highlighted
Figure 18: Eden Terrace; Site highlighted
4.2.2 Site Analysis

Current forms of buildings over the site are simple and self serving, and spaces are broad and lifeless. As it stands the site lacks interest in building detail and suffers from an absence of identity. But these weaknesses become advantageous as a blank canvas for the enhancement of an architectural development and detail scheme. The site is already defined as ‘mixed-use’ and thus has the potential to give definition to the urban pocket through a master plan and infrastructure that can offer variety and a sense of place between city and suburb, for those who occupy it and for those passing through. The site has great prospect to become another thriving local centre by turning what is an under-developed and under-utilised site and transforming it into an urban centre that celebrates sustainability and community.

Key elements to this site that prepare it as a strategic centre are:

- Excellent northern aspect for solar access and therefore opportunity to invest in technologies not yet in common use in Auckland
- Railway network to the north provides an important link to public transport infrastructure
- Bus routes heading south along Dominion Road and to city centre via Mt Eden to the east of the site further supports public transport initiatives
- Area is supported by a range of functions and popular local destinations within walking distances, such as Eden Park, Mount Eden, and other centres such as Balmoral, Newton, Kingsland and Mt Eden
- Opportunity to ‘present’ Dominion Road and Eden Terrace Centre as a Place
- Opportunity to provide public space
- Views to the north of the city centre are desirable for apartment living

Figure 19 shows the relation between the denser commercial and industrial lots amongst the suburban sprawl of Eden Terrace. Building mass increases and tends to fill more of the available land space in the commercial and industrial area. Figures 28 to 32 are examples of the context that shows the ‘low rise’ trend of the site. Buildings are typically two or four levels high and made of concrete block and concrete panel walls.
Figure 19: Figure ground map of site and surrounding context
From Top to Bottom
Figure 21 : Site Map showing D72 and Target buildings
Figure 22 : Photo of the D72 building, Dominion Road
Figure 23 : Photo of the Target Building, Dominion Road
Figure 24: Site Map showing various apartment buildings
Middle left clockwise
Figure 25: Charles Street apartments
Figure 26: Dominion Road apartments
Figure 27: Apartments, corner George Street and Tawari Street
Figure 28: Akepiro Street apartments
Clockwise from Top left
Figure 29: Site map showing various industry buildings
Figure 30: Dunbar Sloane - Antique Auctioneers, Akepiro Street
Figure 31: James Dunlop - Textiles Manufacturers, Akepiro Street
Figure 32: S3 Architects, Cover Systems International and other design related businesses, Akepiro Street
Figure 33: Model Tech (laser cutting), Dilana Rugs, Akepiro Street
4.3 Case Studies

The following case studies are evaluated on how they fulfil the theoretical aspects of design in terms of Place, Sustainability, Circulation and Colour.

4.3.1 Axis Building, Auckland

Pattersons Architects
Parnell
1991

The Axis building is a mixed use development providing apartments, offices and a ground level restaurant and cafes. Its location is not along any distinct path of transportation network and it is not well known as a destination. Its aspect of place then is restricted to those who occupy it regularly and to the business district that surrounds it. It may be popular amongst immediate community locals but it is not addressing the wider public of Auckland.

Once the home of the Nestle Chocolate factory the building was converted from being mono-functional to multi-functional. It can only be mentioned as being minimally sustainable because it is a retro-fit design at full occupancy. However, it does not apply any sustainable technologies or solar orientation principles.

The circulation of the building was designed around the central courtyard space (see figure 36). Movement around the site is primarily by private motor-vehicle and pedestrian. Public transport does not reach this area of lower Parnell.

Colour remains neutral and natural as the materials remained and their colours left exposed: art deco concrete panel design (see figure 33), brick and applied white surfaces to remaining areas including the roof.

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37 Patterson Architects, Axis Building, http://www.pattersons.com/#/gallery/AxisBuilding/
38 Ibid
Clockwise from top left
Figure 34: View of front corner of Axis Building, Parnell
Figure 35: View of rear corner of Axis Building, Parnell
Figure 36: View of Inner Courtyard, Axis Building, Parnell
Figure 37: Aerial view of Axis Building site, Parnell
4.3.2 Prisma, Germany

Joachim Eble
1997

Prisma is a mixed use building that applies sustainable strategies such as energy saving principles with the intention of revitalising the area of Nuremburg, Germany.

The location of the block is central and thus has the ability to have a high density, mixed-use building concept. It provides two semi-public spaces for occupants, which connect to the urban neighbourhood. Its central location means that it has close connections to the tram, bus and underground networks of transportation. The community that is made from building occupancy in direct contact with the central city provides a small place amongst a much bigger place.

Environmental controls and passive solar design are well thought out in the complex design as it was a requirement by the client to have a cost-efficient and sustainable development. Systems that are incorporated include: Rainwater treatment, collection and storage; passive solar orientation and support for space heating through envelope design and natural ventilation; and displacement ventilation using water walls to cool office spaces.

Movement is aimed largely at pedestrian and public transport use. Circulation through the complex engages with the semi-public areas, which gives the impression that there will be a strong community base and safety of occupancy would not be an issue. Planning is done through the section drawing where each floor level has a function appointed in terms of level of privacy required for the function to be carried out.

It is uncertain as to whether there was a process towards the choices of colours and whether they have a relationship to the area surrounding the site. What can be seen is the use of natural materials with their raw colour exposed, such as timber, as well as a range of steel and aluminium frames applied with a white finish.

The project is a success even during a time of an unhealthy real estate market. The building’s exceptional quality of sustainable systems and supported urban functions are understood by the users who choose to live and work in a place as a healthy lifestyle choice.39

39 http://www.greenbuilding.ca/gbc98cnf/studies/Germany/st-d-th.htm
Clockwise from top left
Figure 38: View into ‘glasshouse’ from upper deck, Prisma, Germany
Figure 39: Exterior view looking at glass roof, Prisma, Germany
Figure 40: View from ground floor of covered courtyard, Prisma, Germany
Figure 41: Outdoor Corridor, Prisma, Germany
4.3.3 Centre Georges Pompidou, Paris

Renzo Piano, Richard Rogers
1971 – 1977

The primary characteristics of the Pompidou are similar to the scheme proposed for Auckland: the urban form and space design principle, technology of skin, structure, flexibility and movement, dedicated to improve the qualities of the existing built environment.

In order to enhance the diversity of the site, Piano and Rogers dedicated half of the ground level space to a public square and chose to increase the density and overall height of the building instead. This was due to an understanding that this area of Paris was in a state of deterioration. Due to their design imperative, the area and neighbouring districts now flourish with life and art. The building and public space created were adaption’s of the city for the benefit of the people.

The sustainable nature of this design lies in its ability to adapt to differing functions as required. As a result of the qualities of technology and space principles adhered to through design concept it has also become a timeless piece of urban architecture.

Circulation is uniquely designed as a primary, visual aspect to the design of the building. This system of escalators is the primary mode of horizontal and vertical movement for the public to engage with the building and subsequent exhibitions and building spaces. The system is a popular local and tourist attraction as the view over Paris is vast and free of charge.

Colours are used to highlight the large service pipes to the rear of the building. These stand as coloured beacons amongst an area filled with traditional stone clad buildings and historical paved squares and roads that makes up a dense, monochromatic sea.
Figure 42: Isolated view of Pompidou Centre services, Paris
Figure 43: Contextual urban view of Pompidou Centre, Paris
Figure 44: Ground level view of Pompidou Centre Services, Paris
4.3.4 Jubilee Campus, Nottingham and Earth Centre, South Yorkshire

Jubilee Campus – Make Architects, 1999
Earth Centre – Peter Clegg, 1999

These two pieces of architecture are selected as case studies in order to understand the versatility of photovoltaic designs and how they are building integrated. Auckland has the ability to produce 40% more energy through use of photovoltaics than Germany\(^{40}\) and it is surprising that this source of sustainable technology is not seen more often as an integrated design aspect of new and old buildings.

The Earth Centre is one of very few photovoltaic canopy structures and is particularly large in scale. The artificial nature of the photovoltaics is paired with the more organic structure of rounded timber poles with steel joints. Together the elements have an appearance of lightness, shelter and place. It is a static symbol of a system that is constantly moving but invisible to the eye.

Jubilee Campus is of interest because of its integrated use of photovoltaics in atrium spaces. Though they do not mask the entire surface area of the glass roof, you can still see that they are very much semi-transparent. Their appearance could be used well to manipulate different levels of transparency between public and private spaces.

Both of these pieces of superb architecture exhibit a sophisticated application of solar energy collection that was part of their respective design briefs. Issues of sustainability are global and should be treated at local levels wherever possible in order to reduce the amounts of atmospheric damage caused by polluting energy supplies such as coal and oil plants.

Clockwise from top left
Figure 45: Atrium from ground level, Jubilee Campus, Nottingham
Figure 46: Campus Buildings, Jubilee Campus, Nottingham
Figure 47: View of Photovoltaic’s on Atrium roofs, Jubilee Campus, Nottingham
Figure 48: Photovoltaic Canopy, view from distance, Earth Centre, South Yorkshire
Figure 49: Photovoltaic Canopy, view of span, Earth Centre, South Yorkshire
Figure 50: Isolated detail view of Photovoltaic Canopy, Earth Centre, South Yorkshire
4.3.5 Case study Summaries

The Case Studies highlight good practice in urban architectural design that can be applied to the context of Auckland and begin to satisfy intensification and sustainable practices.

Places are made when many aspects of life are able to congregate in high concentrations in a particular area of interest. These are areas that are generally supported by a network of pedestrian flows and lively ground level activities of which the public are welcome to participate. Space and buildings work together to define the areas of interaction and are most successful when a variety of functions are able to be served within walking distances.

Sustainable Design is limited in Auckland and examples of architectural precedent are satisfying only for single and dual functioning buildings that do not include public spaces or large scale sustainable technologies. Photovoltaics in particular are an underutilised source of energy collection. Buildings are still heavily reliant on civic amenities. Urban fringes are left as poorly articulated areas and little development occurs to improve them, with the exceptions of certain local centres.

Supporting current networks of public transportation (Circulation and Movement) with urban architectural interventions presents alternative living and working situations for citizens. They will benefit from lowering day to day costs from reducing the running of a vehicle and decrease their individual impacts on the environment. Time spent alone in a vehicle will be replaced with social interaction by using public transport and engaging with street level activities.

Colour can support the long term success of the urban place by being part of the vibrancy created by an active public. Used in several different ways, colour can bring delight to an audience and be a reflection of the community’s identity.

The four aspects of design of which the research was based formulate a design strategy rationale that will be used in order to fulfil the requirements of the brief. Each aspect is complimentary to the other and will contribute to the success of the design intention.

41 For example, those areas which are already rich in urban life – Kingsland, Mt Eden, Newmarket – that are continuously upgraded, whilst other areas that are deemed unimportant for urban intervention will remain undeveloped for longer periods of time.
4.4 Structural Systems

The choice of structure will inform the external expression of the building, the building's ability to change and its life-cycle. It is expected that the lifetime of the building should be 100 years, and no less than 50. The ideal system for a development of this kind should support the longevity of the building whilst allowing for possible functional changes over time.

The two most available construction materials are concrete and steel. Neither of these materials may seem like sustainable choices because of the materials and processes used to make the components. They are however strong and resilient with a very high life expectancy. They become sustainable because it is intended that they are made for the building only once and used for a considerable amount of time.

The functional requirements of the building are a major factor in deciding the most appropriate material. The structural configurations need to be adaptive so that internal spaces may be divided or added to each other to meet the demands of certain space sizes. This will also determine aspects of the envelope in terms of fenestration and panel design.

Steel frames are ideal for their slim designs, high structural integrity and light, quick construction. They are often referred to as skeletal frames. The frame itself makes up the primary and secondary structures, and will use a separate material, typically concrete, for flooring. Envelope materials may vary. A steel frame will use less overall space in terms of the floor plan giving more usable space. They are easier to transport and put together than concrete frames. What steel frames do require is fireproofing.

Concrete construction is a more robust and bulky looking frame. Like steel, concrete can make up both the primary and secondary structures but using larger components. Thus, in plan views, they will take up more floor space than a steel frame. The advantage of concrete over steel is that concrete is already a fireproof material and therefore requires no more surface treatments other than what is required aesthetically. Concrete’s biggest disadvantage over steel is the overall size and weight of components that more than likely will need to be transported to the site. Tilt up or Insitu options will be more difficult to use because of limited ground space available to accommodate machinery.

Both concrete and steel could be used for different elements of the structure. Steel would be more ideal for the primary and secondary structures because it will allow for
adaptation of the building functions. Concrete will be more ideal for floors and walls for soundproofing, external cladding and internal separations.

Resist is a program recommended as a guiding tool for choosing construction methods. It is based on New Zealand conditions and asks basic questions about the soil conditions, wind and gravity loads, and a simplified version of the building's expected size. By suggesting a certain method of construction suitable for the building type, the program is able to answer whether the building will fail on certain criteria. This will help with making a decision on what the final construction material will be based on the elements of functional and aesthetic requirements.

The largest proposed building heights and widths were used for the example analysis in Resist. The reports can be found in Appendix B. It is important to note that the most simplified approach is used and therefore the images shown are not necessarily what the building construction would look like. However, they do indicate some of the visual aspects that may prove difficult to work with, such as Concentric or K Braced Frames. These frames would become visible from the interiors of the spaces and take up valuable room space.

Using these reports alongside the design process helps to support decisions on functional resolution, environmental strategies and formal expression. A structure that does not impose on the interior spaces, is easy to transport to the location and allow for several cladding options would prove to be the most desirable system.
4.5 Service Systems

The success of the building will rely heavily on the systems chosen in order to heat and cool spaces and water supply. An original aim and objective of the project is to provide a building that is sustainable socially and environmentally. Other factors that will inform the service system’s concept include:

- What are the individual needs of the differing function types?
- What passive systems can be applied first?
- What mechanical systems can be applied to achieve required tenancy needs when passive systems will not be adequate?
- What systems can be used that can be integrated into the design of the building?

Ideally, an entirely passive system is desirable. However, this is not achievable in building design due to health and safety regulations in New Zealand Legislation:

“Duties in respect of facilities at every place of work....(2) The facilities referred to in sub clause (1) of this regulation are - ....(f) Ventilation providing either fresh or purified air: (g) Means for controlling humidity that arises from any work process or activity: (h) Means for controlling atmospheric conditions to be controlled as closely as possible to their source....”

An understanding of these regulations means that a sympathetic approach to aspects of commercial design can be addressed. An employer will be unable to lease a workable space without certain internal working conditions.

Space heating is an important factor for the design as the different functions may require varied levels of heating or cooling at different times of the day. A ‘user pays’ system means each unit is responsible for their own consumption of energy; a more tactful way of dividing responsibilities amongst the different user groups. Passive space heating through solar orientation will be the first initiative taken, with a secondary source such as heat pumps or boilers made available as integrated parts of the building design.

As stated earlier in the document, Photovoltaics are an underutilised method of energy collection in New Zealand. This design has the opportunity to involve this technology

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to become a BIPV (Building Integrated with Photovoltaics) or have an urban intervention of a significant scale. In conjunction with Solar Hot water heating, the overall energy consumption levels of the building should be lowered. Designed well the photovoltaics can make the building an iconic centre for Auckland sustainability.

Rainwater collection is another aspect that can be adapted into the design. It is not commonly used in city centres because clean water is a health requirement and basement levels of buildings are best reserved for car park spaces. Because it is intended that this development will be lowering the necessity for private motor vehicle use, the basement level will be an ideal location for a series of water storage tanks that can subsidise water use around the complex as grey water consumption: for washing clothes and for toilet cisterns.

Taking into account the aspects of services beyond passive systems, the building will become a unique centre not yet experienced in New Zealand. Its foreseen success will be due to these systems that will make ideal living and working environments alongside principals of good urban design techniques and strategies.
4.6 Brief

In recognition that Auckland is home to 50% of the country’s creative industries sector, the aim of this mixed-use local centre is to accommodate these minds in an area where they can thrive by being in close proximity to different design sectors and other everyday activities. The social interaction of this area will in turn attract those within and around the community to also participate in social activities and gatherings.

The attractive location, zoned for higher density will house tenants for a mix of secondary retail, creative industries offices and studios, and a range of apartments and thus offer sustainable and convenient work-live-play lifestyles for the immediate and local community.

The concept design will be highly site-specific though the principles behind the design would have the ability to adapt to other sites.

The program of design is as follows:

- A master plan that will determine the best location within the site for a mixed-use building to act as the initial social centre that contributes to the future intensification of the whole site.
- Circulation patterns are to describe best placement for public space and built form elements.
- Suggestion and application of appropriate technologies to minimise reliance on civic amenities such as energy on space and hot water heating, and rain water collection.
- All decisions made must adhere to sustainable principles – passive and active where appropriate - and be supportive of existing circulation paths.
- A variation of apartment types must be provided to accommodate several industry demographics, for example, individuals, couples and families.
- The structural system will determine the adaptability level of spaces, i.e. whether they can expand into larger spaces or be divided into smaller spaces.
5.0 Design Process

5.1 Master Planning

There were two ways of dealing with the site: firstly to offer a completely radical change by reconfiguring the overall layout, including roads and zoning; the second would be to work with the current system layout and adapt the local centre and architecture to the pre-existing site conditions. The sustainable, and rational choice, is to adapt the architecture to the pre-existing conditions. The infrastructure will become a supporting latticework of pedestrian circulation and movement between surrounding areas of residential zoning and the denser community zone.

Of the five blocks that the site covers the choice of where to develop an architectural project was made by accounting for the pre-existing and potential additions to circulation and best solar orientation. As Dominion Road is also the dominant arterial route the design should include this as its primary facade. With the sacrifice of a few existing buildings, the centre block would be able to compliment the strength of Dominion Road’s width, served by bus stops. This being the case, it would be very radical to suggest replacing or retro-fitting the Target Building, which is already home to many office tenancies and a strong ground level retailer. The three blocks at the north and west areas of the site are unsatisfactory as ‘central’ development areas as their relationship to Dominion Road are too weak and therefore would not be able to perform as strong visual elements.

Proposition of a train station stop at the north end of the site is welcomed and supported. It will provide the area with an alternative mode of transportation and thus reduce the need for private-vehicles. Reducing the priority of private-vehicle use will allow for pedestrian flow to dominate whilst actively reducing emissions to the environment, thus fulfilling further the initiatives of an overall sustainable design strategy.

Circulation of pedestrians promotes the ‘human' nature of the design. Well designed patterns of movement will ensure maximum use of the spaces and pavements provided and increases street level activities. With the site choice being the concentric centre, there is a dynamic of movement crossing through and around the site which will add to the essence and vitality of the local centre.
Three areas of development are suggested as being the first to be conceptualised: the mixed-use building (the design outcome of this project), moving the already established Asian supermarket to the northern block and the proposed train station. This would be followed by further intensifying the surrounding site blocks by increasing their density and community population.

The pattern of the streets and unused car parks around the site constitute areas that can be incorporated into the design. The unused car park behind the Target building could become a minor office block development with a pedestrian street that connects onto the building site. Akepiro Street that heads north to the train station, could also become solely a pedestrian street with the road connecting with my site by using an alternative ground surface to unite them.

Guidelines for the sustainable development of the whole site are necessary in order for it be a self-supporting ecosystem of community and technological strategies. It is advised that where possible, existing buildings be adapted or have additions made to them, and that all future development in Eden Terrace primarily supports the public transport nodes provided by reducing the amount of motor-vehicle space allowance. An ideal standard would be one car park space per three bedroom residential units and one car park space per commercial floor unit. All other spaces provided should be for scooters, motorbikes and cyclists.

Any existing buildings looking to renovate or retro-fit and any new developments must also begin to apply sustainable technologies to facade treatments and relief towards energy and water consumption. The sooner it is made that buildings must start to become self-reliant and responsible for their impact on the environment, the sooner the area will become an example of adaptive and resilient urban design, capable of withstanding current and further climate changes.
5.2 Space and Built Form Arrangement

There is now a site area of approximately 5,800m$^2$ of which to apply a mixed-use development. Two factors are involved when identifying the best choices for placement of built form or forms on the site: primary and secondary patterns of pedestrian movement and solar orientation. This becomes a rational process of design as some factors are now pre-determined as to how the built form and urban spaces will be laid out across the site.

The site area and location is ideal for an urban public space. The placement of such a space can be determined by setting it as either a primary or secondary design factor, i.e. will the built form determine the space or will the space determine the built form. The site conditions do not allow for the space to be the dominant design factor due to several issues. The first suggestion might be that the eastern edge of the site beside Dominion Road be used as the public space. However, it would create an unusually large space to form ratio: low building levels of neighbouring buildings and the wide and fast paced expanse of Dominion Road’s six lanes make this idea unrealistic. Presenting public space immediately to the street will feel uncomfortable and therefore unlikely to be used.

The layout of the built scheme now appears as a ‘u’ shape that runs along the edges of the site though cutting short on the north side to align with Akepiro Street, and open air space would become the public space within these built forms. A third point of entry has also been introduced at the south east corner in order to guide pedestrians through the space as a more direct route between the bus stop on Dominion Road and the train station to the north.

In order to determine building height and amount of levels required to include the mix of uses – apartments, creative industries offices and retailers – sections were drawn and scale models made representing possible floor heights and variations of heights between each wing. It was determined that the south wing should be the highest of the two buildings whilst the northern wing be the shortest. This was in recognition of existing building heights and considerations as to how these heights may increase in the future. The floor levels for each wing are as follows:
South Wing:  
- ground level retail
- second level office spaces
- third level office spaces with double height ceilings and mezzanine floor spaces
- fourth, fifth and sixth level apartments
- rooftop service floor for solar panels

East Wing:  
- ground level retail
- second to fourth levels office spaces
- fifth level plant room

North Wing:  
- ground level retail
- second level offices
- third and fourth level apartments
- rooftop service floor for solar panels

Restriction was made on how many levels should be dug out of the existing ground level to accommodate car parking for users of the area. Visitors will only have street parking available to them. Only one level is to be dug out, which will house a series of water tanks for rain water collection and made available to building occupants for grey water usage. The remaining space will have 50% car parking and 50% parking for cyclists, scooters and motorbike riders.

At key points of the built forms there are suggested areas dedicated to the vertical movement of building usage. These have been dubbed Circulation Towers and it is envisaged that these will be able to access the roof where a series of solar panels will placed for hot-water heating for the apartments. These elements will be clad differently to the main body of built forms to accentuate their function as communal spaces. They suggest a connection with the street by extending or withdrawing from the building edge. These towers also become a source of power and transparency as the cladding system along the north edges will be a system of photovoltaic cells and glazing.
Due to the climatic conditions of Auckland, a large portion of the public space will be covered by an elegant photovoltaic roof as part of the sustainability agenda of this project. There was some debate as to whether this could indeed be called public space in its true sense. However, most can agree that the majority of the year, the only real exception being summer, we hide ourselves away from the elements of rain and wind. In order for the space to be utilised all year round, partially covering the space seems like a reasonable proposition and the site is primarily equipped for maximum solar gain that it would be worse to not take advantage of the abundant energy source available. The remaining uncovered urban space can therefore be available to hold outdoor events such as local parties, small concerts and market days.
Figure 51: A series of Space and Mass models showing variations of built form arrangement over the site.

Concept 1: Looks at a large building block with a public space between the building and Dominion Road.

Concept 2: Looks at a large building block with a public space perpendicular to Dominion Road.
Concept 3: Looks at the building mass continuing to frame Dominion Road with further built form to the west of the site and a public space between these parallel to Dominion Road.

Concept 4: Looks at splitting the length of the site into three with the built forms and space perpendicular to Dominion Road.
Concept 5: Looks at a perimeter block format where the built form now frames a public space. Openings allow for pedestrian circulation through the site.

This is a follow on from concept 5 that opens another pedestrian access point and uses the neighbouring buildings to frame the site.
Concept 6: Looks at keeping the three different access points but squares off the Dominion Road corner.

Concept 7: Looks back to the perimeter block and bevelling corners. This arrangement is the best to maximise circulation within and around the built forms.
Dispersing the functions vertically was a very straight-forward approach. In order for ground level activities to flourish retailers and hospitality industry would be based at street level. Offices occupy second and third floors because they are more direct with the public areas and it will reduce the amount of mechanical services used to transport people between floor levels. Apartments occupy to top levels of the North and South Wings.

The East Wing was seen differently. Because it does not have a northern aspect it was not suitable for apartments in terms of sustainable approaches. Instead the upper levels of the East Wing would be dedicated to more office spaces. This is more befitting of this elevation as it directly faces the D72 office building.

So it is established that the ground level is a public space with a building forming a perimeter block. Ground level activities include retailers with some spaces dedicated for cafes or restaurants. With three points of entry for pedestrian access and movement the question arose of where to place the access way to the basement level for vehicles. Because of the open space to the north side of the site, it was suggested that the entry for vehicles be placed there. But that would not work as a safe position as it is intended to be full of pedestrian users, and it would become detrimental for the flow of the site if traffic becomes at odds with pedestrians while trying to park or pass through the site. Instead a penetration was made on the South Wing of the building and where a space for a store or cafe could be located the built form was pushed out to the northern side of the South Wing. This piece of built form now becomes an anchor between the two differing treatments of the urban space provided.

The office levels above are divided into fewer but larger spaces than the retail level below. To access the offices a stairwell was designed directly from the ground level to the office landing so that the lifts are used primarily for apartment dwellers or to transport large loads or special needs peoples. The landings of the Circulation Towers become a kind of ‘meet and greet’ area: it is a social ground that can be used to talk to colleagues or meet with clients. It provides a visual link between the outdoor urban spaces and the interior spaces.

Apartments occupy the higher levels which is ideal for many reasons. Firstly, the northern aspect and the added height allows for better passive space heating. Secondly, access to the apartments can be separated more securely from the offices by having only the elevators available for getting to and from the apartments. This of
course excludes the idea that the fire escape stairwell would be used for any reason other than an emergency. Thirdly, the views from this height look toward the city centre.

*The New South Wales Residential Flat Design Code* was used as a guide for the sizes and layouts of the apartments. The *cross over* apartment scheme is used for the majority of the units. The interior layout of the apartments is not entirely important to the extent of which all of them would need designing. Providing the recommended amount of space per dwelling was enough to justify it working. However, a few different types make appearances in their respective floor plans as evidence of their ability to perform as a part of the entire building system.

The following collection of photos shows the progression of a model of the built forms. The circulation towers are dominant forms and the layers of the planning are visible.
Clockwise from top left:
Figure 52 : Photo of model – North east corner
Figure 53 : Photo of model – North Wing
Figure 54 : Photo of model – South Wing, South Wall
Figure 55 : Photo of model – South west corner

Clockwise from top left:
Figure 56 : Photo of model – North east with apartment layouts
Figure 57 : Photo of model – South wing
Figure 58 : Photo of model – South wing looking from south
Figure 59 : Photo of model – Cross sectional view of south wing
5.4 Materials and Technologies

The structure of choice for this development is a Steel Moment Frame. This is due to its level of adaptability of space arrangements and the overall construction method. It is easy to transport and quick to erect. According to Resist concrete was only an option if used as shear walls in conjunction with a steel frame.

Systems for space heating began as a simple plan of having individual heat pumps for each unit. This way the units can also be stacked one above the other with façade treatments to ventilate the heat pumps in their own separate rooms without being visible – a building integrated approach. A screen would be sufficient in achieving this.

The photovoltaic roof system links to the plant room at the top level of the east wing. Rainwater is collected in tanks in the basement level and pumped to units closest to each tank. Hot water is heated by an array of solar hot water heating systems located on the roof level, one per unit. Though these systems may not make the building completely self sufficient, there is a significant reduction of civic amenities that will need to be used to supplement the complex.

Choice of cladding materials to give the overall aesthetic look of the building was a difficult task. Because the building is representing the area and the creative industry sector it was important to look at material and colour choices over the site and using or rejecting certain aspects to achieve the final look. Environmental colour mapping was the first tool used followed by drawn analyses of the proportions of materials used on the buildings.

A radical colour scheme was seen as the best option because the lack thereof around the site. A system of horizontal panels was chosen to give the building height as well as a way of accentuating the dominant nature of the Circulation Towers. This also becomes a directly different approach to the strong, horizontal nature of the D72 building across the road. Its visual appearance will make it stand out as an iconic piece of urban architecture for Eden Terrace.
Figure 60: Environmental Colour Mapping of street and site
Figure 61: Environmental Colour Mapping of buildings
Figure 62: Colours and Texture of brick work
Figure 63: Colour and Texture of D72 metal mesh rainscreen
Figure 64: Colour mapping looking at different uses of corrugated iron
Figure 65: Proportions of the Dunbar Sloane cladding system
Figure 66: Series of conceptual sketches for Dominion Road elevation
Figure 67: Concept for Photovoltaic Canopy
Figure 68: Alternative concept for Photovoltaic Canopy design
6.0 Critical Appraisal of the Finished Work

6.1 Analysis of theoretical process

The aim of the theoretical part of this project was to obtain a design rationale that could be applied to this site in Eden Terrace as well as many similar areas and sites amongst Auckland’s built environment. It was important to highlight what the urban architectural conditions of Auckland are, and how they would be improved with the application of the four aspects of design: Place, Sustainability, Circulation and Colour. A ‘Theory of Architectural Design in Auckland’ could benefit from this information as a contribution towards tackling debates on sustainability issues and whether our culture is able to adapt to changing methods of living and working in our built environment. Designing for future density and intensification are inevitable and the ability to address several key issues and solve them in a single, though small, city block is an essential start.

The process began as a search for the mixed-use building type and its common design applications. What became a more useful way of finding relevant material was breaking down the different elements that would make up the project and researching the individual ideas. It was a matter of taking these ideas and moulding them together during the design process to find the solution most appropriate for Auckland conditions.

Once basic design strategies and an overall theoretical knowledge were gained, research moved onto more specific design details about how the building would work. These details were applied in order to display how sustainable strategies are easily catered for in Auckland’s current urban environment.
6.2 Application of Research to Design

6.2.1 An Urban Solution

The initial idea for the project came from observing the lack of medium to high density developments in Auckland. Presently, growth of the city is seen mainly through hi-rise or suburban scales.

The focus became more a question of density and mass in the built landscape of Auckland. How big could it be? What would be a comfortable size of building to introduce a mixed-use development into the community?

The live-work typology of historic building was used as the first step to establishing the divisions between ‘home’ and ‘work’ conditions in terms of physical separations and circulation. These same conditions were compared between the suburban home and various work and entertainment environments that are common place today.

Analysis of the site showed further potential for growth in the built environment and other possible strategies that would activate the area as a major sub centre; suggestions of further connections to popular nearby locations and an opportunity for a central public space were made possible.

Reducing Auckland’s ecological footprint through the intensification of the city, another key initiative of the Auckland Regional Council, was also advanced by planned reduction of private transportation and reduction in reliance of buildings on civic utilities.

Turning this area of Eden Terrace into a local centre has worked out very well. It provides a sufficient amount of ground level movement and supports the network of established public transport alongside a vivid building design. The use of photovoltaics as a large cover system makes the area more versatile throughout all our seasonal changes. The site has become an icon for the area by providing a colourful envelope to sit beside the monochromatic neighbours of the Target Building and D72. It succeeds because of its connections outward and inward and through the area.
6.2.2 An Architectural Solution

How can Urban Architecture bind together and express a mixture of functions and environmental strategies to create a vibrant hybrid building suitable for the economic, demographic and cultural needs of Auckland?

In this project binding functions together in urban architecture is a matter of stacking differing functions in a vertical manner – one above the other. This is not a new idea in terms of building mixed use development as it is understood that the live-work typology of historical building was used this way; a living space above a work space. What was difficult in terms of the design was how high could the building be? This would affect how many layers of each function that could be incorporated and how they would relate to the context of the site. It could not be left as an overall single height of four levels because it would not fulfil the potential for growth. Nor should it be above the seven levels it reaches on the South Wing because it may become overbearing on all the neighbours. Thus the strategy was to split the Wings into different heights in order to relate it back to the existing context.

To express the functions it was important to record what the needs of each different function required in terms of a building space. What this exercise highlighted was how service and construction requirements were the same for each function with the exception of specific internal layouts. The opportunity to express the differences becomes a matter of facade treatment through cladding type and fenestration. A unified cladding pattern was better for defining the development. The horizontal nature of the design gives an impression of height. The Circulation Towers stand out and enforce the vertical nature of their function.

Urban Architecture can bind together and express a mixture of functions by taking site specific gestures of circulation and matching them with a social demographic need. Public interactions at certain levels of a scheme are unlikely to be any different to urban building designs of the past - because it works. That is why retail activity is a ground level aspect while offices and living spaces will be designed above them. By designing this way in Auckland now the variety and essence of local areas can be more specifically defined and thus more areas will have a sense of place and identity; their own iconic centre.
6.3 Contribution to Architecture

This project reveals the possibility of the mixed-use building type as being an appropriate method of future urban development. Improving Auckland city’s built environment needs to be a citywide venture through architecture rather than the cosmetic suggestions given in council documents.

The building that has been established from this project is not only an architectural upgrade from what the area currently offers, but supports other urban initiatives as a complete model from which to further develop and interpret. The inevitability of urban growth and environmental degradation means that architects should, now more than ever, begin to evolve architectural systems into being part of the city organism, rather than a static, self serving object in space.

What is also revealed by this project is that building development does not need to be seen as a hierarchy spread across a horizontal plane; it can be done equally as well, if not better, vertically to increase density. Urban pockets such as the one designed here will be more desirable as the population rises and land becomes scarce.

Figure 69: North East View of finished design
6.4 Conclusion

The question itself has been answered well, particularly in regards to this being a unique solution for the Auckland environment. An alternative live work strategy has been proposed and executed in a building design that endeavours to be the future prospect of Auckland architecture. It is a way of designing that requires site specific aspects but uses the same guiding principles in order to arrive at a one of a kind scheme.

The design fulfils the original objectives and incorporates the four design principles researched: Auckland Urbanism, Social and Environmental Sustainability, Circulation, and Colour. The theory was an appropriate match to the design particularly because it was researched as different aspects of urban design and brought together to inform the decision making process for this project. Looking at Auckland urbanism was important to gauge the historical nature of our city and what we are missing in terms of future architectural types.

The final outcome of the building has fulfilled the aims that were set as objectives at the beginning of the project. It had to be ‘a visually stunning building that expresses sustainability and function’.

The Property Development Project designed is ideal for the creative industries sector due to its ideal location and supporting amenities. These are important to design industries because time and closer interactions are important tools that can be enhanced by appropriate architectural design. The circulation towers provide neighbourly interactions between commercial offices and apartments on their own respective floor levels.

The urban renewal of the area is seen as a success because of the ability to move through the site in order to connect with both current businesses and future additions to the area. The proposal for a train station, the existing bus stops and other local centres will enhance pedestrian life and thus be a benefit not only for the centre proposed here but to the neighbouring centres as well. Eden Terrace will flourish with the influx of creative industry peoples and thus become popular with the greater population of Auckland.

The development is now capable of housing a much larger population for business and living than it originally had. By targeting the market of creative industries, and having several different apartment types, the areas established businesses, creative industry
or not, should see an increase in business behaviours. For example, local dairies and Laundromats will have more people to cater for, and those who are already established in the creative industry (such as those mentioned in the site analysis Figures 29 to 33), will receive more recognition and be given the chance to interact with the wider community of industry peoples.

Circulation was a key part in designing a successful socially sustainable environment. The division of the site as a perimeter block with three entry points means that it is easy for pedestrians to move in and around the site, making the most of the travel options available and increasing street life activities. The circulation towers funnel those who will work or visit those businesses and apartments at different vertical levels; the lobby staircases only lead to businesses and thus separating the functions directly between homes and offices. The apartments starting at either second or third levels rely more so on the lifts than stairs as this is predicted as the primary mode of transportation due to the height necessary to get to them.
7.0 Bibliography

7.1 References


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Jacoby, Sam and Christopher C. M. Lee, Ed. Typological Formations: Renewable Building Types and the City. Belgium: Cassochrome, 2007


New Zealand REAL ESTATE Special Issue. 150 Years Of Housing. September 1990 – Vol 41 No.8


NSW Department of Urban Affairs and Planning. Residential Flat Design Pattern Book.

Patterson Architects, Axis Building,
http://www.pattersons.com/#/gallery/AxisBuilding/1


Appendix A : Declaration

Name of candidate: Remita Dzivulski

This Research Project (Design and Explanatory Document) entitled:

Reclaiming the Urban Environment

is submitted in partial fulfilment for the requirements for the Unitec degree of
Master of Architecture (Professional)

CANDIDATE'S DECLARATION

I confirm that:

• This Research Project represents my own work;
• The contribution of supervisors and others to this work was consistent with the
  Unitec Regulations and Policies.
• Research for this work has been conducted in accordance with the Unitec
  Research Ethics Committee Policy and Procedures, and has fulfilled any
  requirements set for this project by the Unitec Research Ethics Committee.

Research Ethics Committee Approval Number: ...........................................

Candidate Signature: ................................................................. Date: 14-05-2010

Student number: 1179178
Appendix B : Resist Reports

RESIST(NZ) - Preliminary Lateral Load Design
Architectural Report

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Andrew.Charleson@vuw.ac.nz

RESIST is an application for the simplified evaluation of the structural performance of lateral load-resisting systems in a building under seismic and wind loads. Designed to be used in educational settings as a guide for the sizing of lateral load resisting systems for Architectural and Civil Engineering students, the software should not be used for the final design of a building.

Project: Dominion Road
Modeller: Pamela Dziwulksa

Analysis Results

Results are percentage of max. allowable: <= 100% is OK; > 100% is Failure

<table>
<thead>
<tr>
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Wind Vibrations

The building does not appear to be susceptible to wind vibrations or other serviceability problems caused by wind. H^1.3/M = 1.60 (should be less than 0.234; where H=building height, M=Mass of building per unit height of building)

Building Construction

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RESIST(NZ) 3.03.04
Dominion Road
Pamela Dziwulska
Faculty of Architecture and Design
UNITEC

Structure in Y direction
Reinforced Concrete Moment Frame

Wind and Terrain Information

Wind Region
II
Basic wind speed
45.0 m/s
Terrain category
City Centre
Site elevation
98.5m

Seismic Information

Zone factor (Z): 0.60
Soil: Intermediate

Lateral Load Structure, X Direction

Type
Reinforced Concrete Moment Frame
Design method
Limit-state
Number of frames
2
Number of bays
10
Bay length
8m
Floor width supported by beam
14m
Column size
Depth: 0.5m, Width: 0.3m
Beam size
Depth: 0.5m, Width: 0.3m
To anchor the lateral resisting component against tensile uplift, provide 200mm diameter tension resisting piles. These piles will probably have bulbs or bells at their bases to provide the tension resistance. Note that these piles also provide bearing for compressive loads.

Lateral Load Structure, Y Direction

Type
Reinforced Concrete Moment Frame
Design method
Limit-state
Number of frames
11
Number of bays
1
Bay length
14m
Floor width supported by beam
14m
Column size
Depth: 0.5m, Width: 0.3m
Beam size
Depth: 0.778m, Width: 0.3m

To anchor the lateral resisting component against tensile uplift, provide 200mm diameter tension resisting piles. These piles will probably have bulbs or bells at their bases to provide the tension resistance. Note that these piles also provide bearing for compressive loads.
Dominion Road
Pamela Dziwulska

Faculty of Architecture and Design
UNITEC

RESIST(NZ) - Preliminary Lateral Load Design
Architectural Report

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RESIST is an application for the simplified evaluation of the structural performance of lateral load-resisting systems in a building under seismic and wind loads. Designed to be used in educational settings as a guide for the sizing of lateral load resisting systems for Architectural and Civil Engineering students, the software should not be used for the final design of a building.

Project: Dominion Road
Modeller: Pamela Dziwulska

Analysis Results

Results are percentage of max. allowable: <= 100% is OK; > 100% is Failure

**X-Direction: Steel Concentric K Braced Frame**

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**Y-Direction: Reinforced Concrete Moment Frame**

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Wind Vibrations

The building does not appear to be susceptible to wind vibrations or other serviceability problems caused by wind. $H^2 \times 1.3/M = 1.60$ (should be less than 0.217, where $H=$building height, $M=$Mass of building per unit height of building)

Building Construction

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<td>Structure in Y direction</td>
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RESIST(NZ) 3.03.04
Wind and Terrain Information

Wind Region: II
Basic wind speed: 45.0 m/s
Terrain category: City Centre
Site elevation: 98.5m

Seismic Information

Zone factor (Z): 0.60
Soil: Intermediate

Lateral Load Structure, X Direction

Type: Steel Concentric K Braced Frame
Design method: Limit-state
Number of frame-lines: 2
Total No. bays/frame-line: 13
No. braced bays/frame-line: 7
Max No. adjacent bays/frame-line: 1
Bay length: 6m
Floor width supported by braced-bay beam: 14m
Brace size: Depth=200mm Width=200mm
Column Design (Each end of bay(s) with braces): Column Length=4m; Depth=900mm; Width=900mm
Beam Design: Depth=327mm; Width=167mm

Lateral Load Structure, Y Direction

Type: Reinforced Concrete Moment Frame
Design method: Limit-state
Number of frames: 11
Number of bays: 1
Bay length: 14m
Floor width supported by beam: 14m
Column size
Depth: 0.5m, Width: 0.3m

Beam size
Depth: 0.778m, Width: 0.3m

To anchor the lateral resisting component against tensile uplift, provide 200mm diameter tension resisting piles. These piles will probably have bulbs or bells at their bases to provide the tension resistance. Note that these piles also provide bearing for compressive loads.
RESIST(NZ) - Preliminary Lateral Load Design
Architectural Report

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Andrew.Charleston@vuw.ac.nz

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Project: Dominion Road
Modeler: Pamela Dziwulska

Analysis Results

Results are percentage of max. allowable: <= 100% is OK; > 100% is Failure

X-Direction: Steel Moment Frame

<table>
<thead>
<tr>
<th></th>
<th>Wind</th>
<th>Seismic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drift</td>
<td>6%</td>
<td>59%</td>
</tr>
<tr>
<td>Shear</td>
<td>22%</td>
<td>44%</td>
</tr>
<tr>
<td>Moment</td>
<td>24%</td>
<td>78%</td>
</tr>
</tbody>
</table>

Y-Direction: Reinforced Concrete Shearwall

<table>
<thead>
<tr>
<th></th>
<th>Wind</th>
<th>Seismic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drift</td>
<td>17%</td>
<td>18%</td>
</tr>
<tr>
<td>Shear</td>
<td>3%</td>
<td>48%</td>
</tr>
<tr>
<td>Moment</td>
<td>2%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Wind Vibrations

The building does not appear to be susceptible to wind vibrations or other serviceability problems caused by wind. H^1.3/M = 1.60 (should be less than 0.222; where H=building height, M=Mass of building per unit height of building)

Building Construction

<table>
<thead>
<tr>
<th>Building Importance category</th>
<th>Buildings with Crowds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of storeys</td>
<td>7</td>
</tr>
<tr>
<td>Length X</td>
<td>81m</td>
</tr>
<tr>
<td>Length Y</td>
<td>14m</td>
</tr>
<tr>
<td>Inter-storey height</td>
<td>4m</td>
</tr>
<tr>
<td>Floor</td>
<td>Weight type: heavy, Dead load: 5.30kPa, Live load: office(3.00kPa)</td>
</tr>
<tr>
<td>Interior wall</td>
<td>Weight type: medium, Dead load: 0.82kPa(over floor area)</td>
</tr>
<tr>
<td>External wall</td>
<td>Weight type: heavy, Dead load: 3.10kPa(over wall area)</td>
</tr>
<tr>
<td>Roof</td>
<td>Weight type: heavy, Weight type: heavy, Height: 0.5m, Dead load: 4.80kPa(over floor area), Live load: 0.25kPa(over floor area)</td>
</tr>
<tr>
<td>Structure in X direction</td>
<td>Steel Moment Frame</td>
</tr>
<tr>
<td>Structure in Y direction</td>
<td>Reinforced Concrete Shearwall</td>
</tr>
</tbody>
</table>

RESIST(NZ) 3.03.04
Dominion Road
Pamela Dziwulska

Faculty of Architecture and Design
UNITEC

Wind and Terrain Information

Wind Region: II
Basic wind speed: 45.0 m/s
Terrain category: City Centre
Site elevation: 98.5m

Seismic Information

Zone factor (Z): 0.60
Soil: Intermediate

Lateral Load Structure, X Direction

<table>
<thead>
<tr>
<th>Type</th>
<th>Steel Moment Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design method</td>
<td>Limit-state</td>
</tr>
<tr>
<td>Number of frames</td>
<td>2</td>
</tr>
<tr>
<td>Number of bays</td>
<td>10</td>
</tr>
<tr>
<td>Bay length</td>
<td>8m</td>
</tr>
<tr>
<td>Floor width supported by beam</td>
<td>14m</td>
</tr>
<tr>
<td>Column size</td>
<td>Depth: 0.5m, Width: 0.375m</td>
</tr>
<tr>
<td>Beam size</td>
<td>Depth: 0.671m, Width: 0.252m</td>
</tr>
<tr>
<td>Foundations</td>
<td>To anchor the lateral resisting component against tensile uplift, provide 300mm diameter tension resisting piles. These piles will probably have bulbs or bells at their bases to provide the tension resistance. Note that these piles also provide bearing for compressive loads.</td>
</tr>
</tbody>
</table>

Lateral Load Structure, Y Direction

<table>
<thead>
<tr>
<th>Type</th>
<th>Reinforced Concrete Shearwall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design method</td>
<td>Limit-state</td>
</tr>
<tr>
<td>Number of walls</td>
<td>6</td>
</tr>
<tr>
<td>Wall length</td>
<td>14.000m</td>
</tr>
<tr>
<td>Wall thickness</td>
<td>250mm</td>
</tr>
<tr>
<td>Penetrations in structural walls</td>
<td>Penetrations for doors, windows and services up to 15% of the wall length at ground floor, and greater above are allowed.</td>
</tr>
<tr>
<td>Minimum thickness</td>
<td>The minimum thickness to prevent wall buckling is 213mm.</td>
</tr>
</tbody>
</table>

RESIST(NZ) 3.03.04
RESIST(NZ) - Preliminary Lateral Load Design
Architectural Report

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Project: Dominion Road
Modeller: Pamela Dziwulska

Analysis Results

Results are percentage of max. allowable: <= 100% is OK; > 100% is Failure

<table>
<thead>
<tr>
<th>X-Direction: Steel Moment Frame</th>
<th>Y-Direction: Steel Moment Frame</th>
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</thead>
<tbody>
<tr>
<td>Wind</td>
<td>Seismic</td>
</tr>
<tr>
<td>Drift</td>
<td>6%</td>
</tr>
<tr>
<td>Shear</td>
<td>22%</td>
</tr>
<tr>
<td>Moment</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>57%</td>
</tr>
<tr>
<td></td>
<td>43%</td>
</tr>
<tr>
<td></td>
<td>76%</td>
</tr>
</tbody>
</table>

Wind Vibrations
The building does not appear to be susceptible to wind vibrations or other serviceability problems caused by wind. $H^{1.3}/M = 1.60$ (should be less than 0.238; where $H$=building height, $M$=Mass of building per unit height of building)

Building Construction

Building Importance category
Number of storeys 7
Length X 81m
Length Y 14m
Inter-storey height 4m
Floor Weight type: heavy, Dead load: 5.30kPa, Live load: office(3.00kPa)
Interior wall Weight type: medium, Dead load: 0.82kPa(over floor area)
External wall Weight type: heavy, Dead load: 3.10kPa(over wall area)
Roof Weight type: heavy, Weight type: heavy, Height: 0.5m, Dead load: 4.80kPa(over floor area), Live load: 0.25kPa(over floor area)
Structure in X direction Steel Moment Frame
Structure in Y direction Steel Moment Frame

RESIST(NZ) 3.03.04
Dominion Road
Pamela Dziwulski

Faculty of Architecture and Design
UNITEC

Wind and Terrain Information

Wind Region II
Basic wind speed 45.0 m/s
Terrain category City Centre
Site elevation 98.5m

Seismic Information

Zone factor (Z): 0.60
Soil: Intermediate

Lateral Load Structure, X Direction

Type Steel Moment Frame
Design method Limit-state
Number of frames 2
Number of bays 10
Bay length 8m
Floor width supported by beam 14m
Column size Depth: 0.5m, Width: 0.375m
Beam size Depth: 0.671m, Width: 0.252m

Foundations

To anchor the lateral resisting component against tensile uplift, provide 300mm diameter tension resisting piles. These piles will probably have bulbs or bells at their bases to provide the tension resistance. Note that these piles also provide bearing for compressive loads.

Lateral Load Structure, Y Direction

Type Steel Moment Frame
Design method Limit-state
Number of frames 11
Number of bays 1
Bay length 14m
Floor width supported by beam 14m
Column size Depth: 0.6m, Width: 0.45m
Beam size Depth: 0.827m, Width: 0.289m

RESIST(NZ) 3.03.04
To anchor the lateral resisting component against tensile uplift, provide 300mm diameter tension resisting piles. These piles will probably have bulbs or bells at their bases to provide the tension resistance. Note that these piles also provide bearing for compressive loads.
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Modeller: Pamela Dziwulska

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<tbody>
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<td>Wind</td>
<td>Seismic</td>
<td>Wind</td>
</tr>
<tr>
<td>Drift</td>
<td>3%</td>
<td>35%</td>
</tr>
<tr>
<td>Brace</td>
<td>1%</td>
<td>45%</td>
</tr>
</tbody>
</table>

Wind Vibrations
The building does not appear to be susceptible to wind vibrations or other serviceability problems caused by wind. \( H^{1.3/M} = 1.60 \) (should be less than 0.23; where \( H \)=building height, \( M \)=Mass of building per unit height of building)

Building Construction

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<td>Roof</td>
<td>Weight type: heavy, Weight type: heavy, Height: 0.5m, Dead load: 4.80kPa(over floor area), Live load: 0.25kPa(over floor area)</td>
</tr>
<tr>
<td>Structure in X direction</td>
<td>Steel Concentric K Braced Frame</td>
</tr>
<tr>
<td>Structure in Y direction</td>
<td>Steel Concentric K Braced Frame</td>
</tr>
</tbody>
</table>

RESIST(NZ) 3.03.04
Wind and Terrain Information

Wind Region: II
Basic wind speed: 45.0 m/s
Terrain category: City Centre
Site elevation: 98.5m

Seismic Information

Zone factor (Z): 0.60
Soil: Intermediate

Lateral Load Structure, X Direction

Type: Steel Concentric K Braced Frame
Design method: Limit-state
Number of frame-lines: 2
Total No. bays/frame-line: 13
No. braced bays/frame-line: 7
Max No. adjacent bays/frame-line: 1
Bay length: 6m
Floor width supported by braced-bay beam: 6m
Brace size: Depth:300mm Width:300mm
Column Design (Each end of bay(s) with braces): Column Length=4m; Depth=900mm; Width=900mm
Beam Design: Depth=340mm; Width=169mm

Lateral Load Structure, Y Direction

Type: Steel Concentric K Braced Frame
Design method: Limit-state
Number of frame-lines: 2
Total No. bays/frame-line: 1
No. braced bays/frame-line: 1
Max No. adjacent bays/frame-line: 1
Bay length: 8m

RESIST(NZ) 3.03.04
Dominion Road  
Faculty of Architecture and Design  
UNITEC

Floor width supported by braced-bay beam  
8m

Brace size  
Depth: 400mm Width: 323mm

Foundations  
To anchor the lateral resisting component against tensile uplift, provide 1400mm diameter tension resisting piles. These piles will probably have bulbs or bells at their bases to provide the tension resistance. Note that these piles also provide bearing for compressive loads.

Column Design (Each end of bay(s) with braces)  
Column Length = 4m; Depth = 600mm; Width = 600mm

Beam Design  
Depth = 327mm; Width = 167mm