ANTICIPATING
THE BIG ONE
Exploring the role of landscape architecture in preparing Wellington’s CBD for a major earthquake
By James Fischer
Anticipating the Big One: Exploring the role of landscape architecture in preparing Wellington’s CBD for a major earthquake

By

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I would like to take a moment to express my sincerest gratitude to my supervisor, Penny Allan, for all her support and encouragement throughout the duration of this thesis. She has managed to make sense of many of my more tangent thoughts and ideas, keeping me on task and focussed on completing my thesis.

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Finally, a big thanks to my family and friends for your support and for putting up with my university provoked rants and distant gazes for the past five years.

Thank you
“Risk of urban disasters is no longer a phenomenon that we can stop, avoid or deter, but rather they are part of complex ecological processes from which we are inseparable and must design with, in preparation for the next imminent disaster.”

Miho Mazereeuw
(Mazereeuw, 2011. Pg 85)
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CHAPTER ONE
This chapter outlines the content and format of the thesis and indicates the structure of each of the following chapters.

CHAPTER TWO
As an introduction to the study, this chapter outlines and explains the research problem, intent, theoretical background, scope, and context of the research. It is here that the thesis argument is introduced and the background for the research is set.

CHAPTER THREE
This chapter communicates the design method used to explore the thesis question. Firstly, it describes the design led research process and the selection of a sample area in which experimentation will take place. Secondly, this chapter describes the five phases of my design led research process—‘Brainstorming Designs’, ‘Grounding the Issue’, ‘Conceptual Development’, ‘Concept Deconstruction’, and ‘Development through Reflection’.

CHAPTER FOUR
This chapter discusses ways in which landscape architecture can begin to make a significant contribution to pre-disaster planning. This is done through the investigation of ‘Preemptive Design’, ‘Bottom-Up Design’, and ‘Loose Space’
as strategies for creating an overall preemptive strategy to reduce the impact natural disasters have on our day-to-day lives.

These strategies are then supported by international precedents that are typically unrelated to pre-disaster planning, yet explore design in a unique way that reflects ideas extrapolated from the literature.

CHAPTER FIVE
This chapter analyses the chosen sample site within Wellington's CBD in preparation for design intervention. This analysis begins at the larger Wellington scale investigating the city wide vulnerabilities to natural disaster. It then looks specifically at the Lambton Quay segment of the CBD, analysing opportunities and weaknesses. This chapter then addresses the various typologies between the Terrace and the Waterfront and their potential for design.

CHAPTER SIX
This chapter explores the preemptive strategy developed through the combination of the literature review, the existing site conditions, and the design led research process. It describes the function and structure of the design and explores room for further development. It then investigates the idea of access down to a detailed scale as an example of how these emergency spaces could be designed.

CHAPTER SEVEN
This is the final chapter of the thesis and, as such, discusses the final design intervention and its implications as a preemptive strategy, before concluding the thesis.
This thesis explores a landscape architectural approach to pre-disaster planning and attempts to develop a preemptive strategy to mitigate the effects of the impending seismic hazard that threatens the heart of Wellington City. The research focuses on pedestrian access ways and open space as they are both in short supply within the Wellington CBD, yet they both become significant ‘lifelines’ during a natural disaster.

PROBLEM STATEMENT
In the wake of the 2011 Christchurch earthquake New Zealanders have been reminded that we do indeed live within the ‘Pacific Ring of Fire’. This rude awakening has brought back into the spotlight the general concern that Wellington is overdue for a major earthquake that could devastate the city. Located between the motorway and the harbor and running the length of Lambton Quay, a large portion of Wellington’s CBD lies on relatively flat, low-lying, reclaimed land that is vulnerable to liquefaction, ground shaking, and tsunami inundation. This means that, in the event of a significant earthquake, deficiencies in access ways, open space, and accessible high ground are very real threats that could increase the risk of human casualties as pedestrians will be exposed to falling debris and fluctuating water levels with nowhere to run.

In relation to this, the Wellington Earthquake Risk Assessment Study suggests that there is a 10% chance that a worst-case scenario magnitude 7.5 earthquake could erupt near Wellington in the next 50 years. It is estimated that, within Wellington, it could kill over 300 people and leave another 2,850 seriously wounded.
RESEARCH INTENTION
The main intention of this research is to demonstrate the potential of landscape architecture to play a major role within the field of disaster planning and mitigation as a preemptive strategy that could save lives in the event of a major earthquake.

THEORETICAL BACKGROUND
Rising from ecological origins, Resilience Theory is described by Brian Walker and David Salt as the ability of a system to absorb change and disturbance, and still retain its basic function and structure.\(^3\)

In the context of pre-disaster planning, urban resilience could be thought of as the way a city adapts and absorbs change without affecting the health and wellbeing of the public and the infrastructures that affect our day-to-day lives. Turning towards urban resilience as opposed to traditional methods of disaster preparation is an example of the changing mind-set that is beginning to occur within the field of disaster planning and mitigation. Rather than just building structures that resist and deter natural disasters, people are beginning to investigate new ways of mitigating natural hazards through non-structural means.\(^4\)

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3 (Walker & Salt, 2006) – Pg 1
4 (Ruchelman, 1988) – Pg 53
METHODOLOGY DESCRIPTION
The design led research approach is one that seeks to understand or expand on an existing body of knowledge through direct intervention by the researcher. It is about actively deploying design to provoke a response or to discover something new.

My personal design led research began by using design as a means to discover a problem, rather than using a problem to influence design.

This process informed the scope of my literature review and dictated the topics and strategies that were investigated in relation to the sites weaknesses and opportunities.

This theoretical standing then reconfigured the design strategies I was using to approach the problem, triggering a series of design interventions that evolved through an iterative process to form a final design that attempts to answer the problem.
SCOPE OF RESEARCH
The physical context of this research is within the confines of the Wellington CBD, but the findings and strategies could be applied to other disaster prone cities in New Zealand and, possibly, around the world. A limitation to the research is that there is no consultation with the public or with building owners regarding the design of this emergency infrastructure, as this is a purely theoretical and speculative design exercise. In the real world it would be crucial to the success of this project to involve building owners, the public, Wellington City Council, and any other stakeholders in the design and planning process of this preemptive strategy to ensure the engaging design of a time-less new infrastructure.
Within the realm of disaster planning, it has become commonplace to prepare a city for a natural disaster by looking towards both architectural and engineering solutions that resist or deter the natural hazard\(^5\), leaving landscape architecture as a post disaster clean up tool. However, with designers focusing more frequently on the idea of urban resilience, there is a greater potential for landscape architecture to contribute to pre-disaster planning, potentially saving lives in the event of a significant natural disaster. Rather than trying to control or deflect the forces of nature as many engineering solutions do (Tsunami sea walls, levees, etc.), landscape architecture offers new ways in which we could live with natural disasters, reducing the impact they have on our day-to-day lives.

In recent years, particularly since the 2011 Christchurch earthquake, New Zealanders have become far more aware of the seismic activity around the country and, as a result, there has been growing speculation that Wellington is overdue for a major earthquake. In relation to this, work has already begun on trying to make Wellington a far more earthquake resilient city, from the council issuing strengthen or replace notices on earthquake prone buildings, to the Wellington Lifelines Group reviewing the estimated restoration times of our vital infrastructure (power, gas, telecommunications, water, wastewater, and land access)\(^6\).

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\(^5\) Cigler, 1988 – Pg 48  
\(^6\) Mowll, 2012 – Pg 15-16
However, what strategies are being put into place that keep pedestrians safe during and after an earthquake? This gap would suggest that there is a niche developing in Wellington’s pre-disaster planning for an inner city preemptive strategy that prioritises the safety and well-being of the pedestrian public during times of natural disaster.

**ACCESS AND OPEN SPACE**

The Wellington earthquake risk assessment study estimates that, in a worst-case scenario earthquake (magnitude 7.5), casualties caused by building collapses and other building damage within the city could be up to 346 dead and 2850 injured. These figures do not include injuries or lives lost to possible tsunami inundation or the spread of fire and other post-earthquake hazards. With difficult access to safe high ground and open space within the CBD it is highly likely that these numbers would grow. This indicates the need for an emergency infrastructure that prioritises the safety of the public by improving access to safe high ground and open spaces.

**LATENCY VS QUALITY DESIGN**

It is becoming common for landscape architecture to contribute to pre-disaster planning in the form of vast open spaces with the intention of becoming refuge areas during a natural disaster. However, it is uncommon for these vast open spaces to thrive as inner city parks for day-to-day use. Too often these spaces become empty voids in the city as they fail to combine emergency function with quality urban design for everyday use. This suggests that a primary concern of creating an inner city emergency infrastructure is that it not only has to aid in saving lives during a natural disaster, but it also needs to operate as a functional piece of quality urban design.

7 (Davey & Shephard, 1995) – Pg 48
Auxiliary Functions

Exploring the Structure of the Street

Design 1: Opening up an area

Preempt Earthquake

Access

Buffering roads from building collapse

Permeability

It's obvious or it that no new or creativeness if one sticks to a design process gets in a mess.
Five Design

Proofing the CBD

Once you think about thing, no originality is going to emerge rigidly to an orderly in which one never

Pedestrian Safe Access

Weak Structures

Design Method
“It's obvious, once you think about it, that no new thing, no originality or creativeness, is going to emerge if one sticks rigidly to an orderly design process in which one never gets in a mess, never loses touch with one's pre-conceptions, never lets go of THE KNOWN”

John Christopher Jones
‘Essays In Design, Pg 139’
METHODOLOGY
METHOD DESCRIPTION AND DESIGN PROCESS

Design led research is an interesting thesis approach as it seeks to understand a typology, a problem, or a site, and their context through direct intervention by the researcher, as opposed to the more traditional research led design approach in which an in depth study leads to a calculated design. The design led research approach allows the researcher the freedom that is required to test hundreds of ideas and record the findings, forcing design concepts to evolve and mutate into innovative interventions that would otherwise never have been conceptualised. What is unique about this method is that it actively deploys interventions as tools to develop and expand a growing body of research. This continuous testing and analysing begins to provoke design responses and new discoveries that push what can be learned from direct intervention.

QUALITATIVE OVER QUANTITATIVE
For the design testing and exploration of this thesis a qualitative approach was chosen over a quantitative method as the field of disaster planning is typically dominated by design responses that focus on the measurable forces, amounts, and other quantifiable factors. This emphasis on quantifiable designs for disaster preparation has left a gap in knowledge for qualitative pre-disaster planning, an area where designs can begin to focus on quality of living during both the everyday and emergency situations.
SELECTION OF SITE AND SAMPLE AREA
The sample area chosen for intervention was selected due to its range of typologies, weaknesses, opportunities, and location within the larger CBD site. It is a typical sample of the CBD area, running from the waterfront to the terrace, slicing through a range of typological issues from liquefiable soil and inundation potential, to building strength and a lack of accessible open space (See Chapter 5). The purpose of this sample is to discover a wider range of preemptive landscape architectural solutions and explore them in greater detail than would be possible if looking at the CBD as a whole.

MY DESIGN LED RESEARCH PROCESS
This chapter explains my personal design led research process, exploring why it revolved around the premise that landscape architecture can make a significant contribution to pre-disaster planning through the adaptation and retrofitting of access ways and open space. My particular design led research process consisted of a 5-phase conversation between the site, the design, and the theoretical research. Throughout this process there were many precedent design influences that operated as a constant source of inspiration across the duration of all 5 design phases (see figure 3.6).
DESIGN PHASES

PHASE 1: **Brainstorming Designs**: This was conducted to generate an array of differing ideas and concepts in response to earthquake related issues, loosely defined by Wellington as a site. During this stage quick hand drawings were used as a design technique to rapidly display and record a cluster of interesting ideas.

PHASE 2: **Grounding the Issue**: This entailed defining a site within Wellington and grounding designs within that context in order to discover the problem specific to that site, i.e. what are the issues and in what ways can design begin to approach these problems?

PHASE 3: **Conceptual Development**: Conceptual development entailed taking an idea generated in phases one and two and developing it into a design concept that began to test the limitations of the site and push the boundaries of the problem. It was about blurring the edges between the buildable and the surreal, real life and the utopian. This phase involved the generation of an idea, the development of that idea, and then a reflection of why that idea was or was not successful.

PHASE 4: **Concept Deconstruction**: For this phase the conceptual design was deconstructed and dissected into the following three questions: What elements make the design successful? Do these elements distract from the intent of the design? And can the design still be functional without them? This phase is about getting to the core of the design and tearing away the layers that are blurring the intent. If you remove your strengths you are left with weakness, and this phase investigates, through design, how to turn weakness into strength.

PHASE 5: **Development Through Reflection**: This final phase was carried out to rebuild the design with a clear intent and solid theoretical foundation. This phase was about reflecting on past designs, identifying their strengths, determining what aspects were successful, and what elements could be recycled back into the current design. The point of this phase was to revisit past ideas and review them in the current context of my project.
BRAINSTORMING DESIGNS

GROUNDING THE ISSUE

CONCEPTUAL DEVELOPMENT

CONCEPT DECONSTRUCTION

DEVELOPMENT THROUGH REFLECTION
DESIGN TIMELINE
DESIGN PROCESS FROM MARCH TO DECEMBER

Design Iterations

MARCH
Mar 19th
Design Workshop

Workshop Presentation
Initial Design Concepts
Initial Design Strategies
Central Park Concept
Hunch Development
Walkway Concept
Walkway Concept Development

JULY 15th
JULY 15th

Precedent Influences

Belval Square Mile Quarter
Citadel Skyscraper
New Urban Ground
The High Line
Central Park
M. Van Valkenburgh: Elevated Walkway
Central Park
Victoria Park
Komunitas Siaga Tsunami
Sky Trains of Tomorrow
Frits Lang’s Metropolis
Linked Hybrid
Hong Kong Walkway
The above diagram represents my design process and the order it followed from the beginning of March to the end of December.
Phase one occurred at the very beginning of my design process and as such, neither a site nor a problem had been clearly defined. This resulted in a design exercise that responded to the widest range of earthquake related issues, the sole purpose of which was to generate ideas related to the idea of preemptive design in an attempt to create a more earthquake resilient Wellington City.

1) Removal of weak buildings: new buildings should be set back from the road to prevent debris cluttering post disaster access routes. 2) Vast open space transforming to a post disaster refugee camp. A typical landscape contribution to disaster planning. 3) Increase safe access routes out of hazardous areas. 4) Robust structure fortifies laneway and protects pedestrians from falling debris.
5) Multiple forms of access are important in a post disaster city. As such, there should be a more boat accessible Wellington waterfront. 6, 7) Highly liquefiable areas need to be identified and retrofitted with some kind of soil stabilizing structure. 8) Suggests a wayfinding light system that operates on solar power in case an earthquake occurs during the night and the power goes out. 9) Identifies the importance of safe pedestrian access routes out of hazardous areas by proposing a robust spine running down the centre of wide streets.
10. Car Park as Emergency High Ground

11. Car Park as Converted Green Space

12. Hybrid Car Park Building

13. Tsunami Defence Structure

10, 11) Car park buildings are a typology that have the potential to become elevated green space in a city that lacks open space. 12) Investigates the idea of merging both green space and a car park building to create a sort of hybrid park. 13) An attempt at creating a tsunami wave break with the intention of slowing the force of a wave before it hits land.
14, 15) Tries to conceptualize how a tsunami wall structure might begin to facilitate a range of programs and activities. 16) Distributes emergency information to the general public by strategically displaying earthquake information in spaces where people stand around looking for something to do, such as bus stops.
PHASE TWO
GROUNDING THE ISSUE

PERMEABILITY
17) Identifies a lack of permeability from the waterfront to natural high ground (i.e. the Terrace) as a potential hazard during a natural disaster. Laneways from Lambton Quay to the Terrace need to be more frequent to make high ground readily accessible in an earthquake.

LAMBTON ENHANCEMENT
18) Identifies Lambton Quay as a hazard area due to high pedestrian activity combined with little open space and low connectivity to natural high ground. It tries to solve these problems by finding ways to increase the amount of open space in that area.

ECOLOGICAL AXIS
19) Addresses the CBD’s lack of ecological diversity and tries to find ways to include a greener city centre into pre-disaster planning.

At the beginning of phase two, the area running the length of Lambton Quay between the motorway and the harbour was chosen as a site. This brought with it a number of problems that began to be addressed through the design process. These design propositions revolved around the central problem of difficult access through the CBD connecting the Waterfront to the Terrace.

Laneway Variations
Redesign of Lambton Quay
Lambton to Terrace Green Laneway
17) Identifies a unique problem within Wellington’s inner city, which is the shortage of safe access routes in and out of the CBD, potentially becoming very hazardous during and after an earthquake. 18) Proposes some interesting strategies for the Lambton Quay area, especially for creating more open space in an area that has very little. 19) Although this idea originally interested me due to my own desire to design green space, it lacks depth and fails to identify any issue largely relevant to pre-disaster planning.
ELEVATED AXIS

This strategy was developed from three main issues: a lack of accessible high ground to avoid tsunami inundation, a lack of open space to provide refuge from falling debris, and the need for a connection from the exposed waterfront to natural high ground. This concept is very crude, yet it touches on an idea that could be far more tangible. It proposes that perhaps the solution to these problems lies within finding a way to occupy high ground for both the everyday and the emergency.
CENTRAL PARK

This concept proposes the creation of a central park within the CBD area. The purpose of this would be to rectify deficiencies in green open space, provide the inner city with a safe refuge area, and also create an elevated pedestrian network that connects the waterfront to the Terrace. However, to create this design two blocks of existing buildings would have to be removed, which isn’t very realistic, yet the idea of layering pedestrian activity is one that could be investigated further.
PHASE THREE
CONCEPTUAL DEVELOPMENT

This phase began with a hunch concept that informed the conceptual development of the project. The purpose of this design phase was not to create a realistic solution to the problem, but to re-invent the city in an almost utopian way that brought the problem to the foreground of the design. This was done in order to fuel the creativity of a conceptual idea without restricting it by the limitations of the site and the real world, the product of which was an idea that could then be tested and reconfigured as it developed.

20) Was about the idea of snakes and ladders and how a city could use this idea as an emergency infrastructure. The ladders would work to frequently connect the street to the elevated network of rooftop parks. This open space network would then operate as both an emergency refuge and evacuation system, whilst rectifying deficiencies in urban green space for day-to-day use.
21) A large scale walkway network that winds its way around the city, providing frequent access to high ground, whilst connecting various rooftop park spaces to one another. 22) An example of a very basic Laneway connecting the Terrace to Lambton Quay with access being its sole function. 23) A pocket park concept that could be used as an elevated refuge area during a natural disaster. The larger walkway network would then connect these pocket parks creating one larger life saving system.
WALKWAY DEVELOPMENT

24 Looking Towards Brandon St.

25 Featherston St. looking West down Grey St.

26 Post office square looking South

WALKWAY DEVELOPMENT This concept is a development of the previous iteration, exploring ways the elevated walkway may interact with existing ground level open space, trying to push the idea of a layering of pedestrian activity. 24) Explores how the walkway network may begin to interact more with existing structures. 25) By making rooftops accessible park space, this image explores how existing open spaces might be expanded into multi story parks. 26) Shows how the walkway could become a stand-alone structure and how it might interact with existing ground level open space.
FLUID FORM WALKWAY

This concept was aiming to create a more organic looking walkway that began to fill the in-between spaces separating buildings. Part of this concept was about investigating ways in which these walkway structures may also become wheelchair accessible on a far more conceptual level. This was found to be near impossible without elevators due to the height of the structure and the necessary gradient required for wheelchair access.
Phase Four challenges the previous phases by stripping the design of its key driver (in this case the walkway). What remains of the design project? And how can you achieve a successful outcome through a different design approach? This phase focused on the development of three design typologies and turning newly exposed weaknesses into strengths.
LANEWAY Primarily it is about access and emergency access, but how can it become valued open space without interfering with that function? REFUGE How do you get people up to this space and what reasons do they have for going there? RETROFIT Many buildings need to be strengthened, but can the strengthening serve a secondary purpose? NEW BUILDING What functions can be incorporated into a new building and in what ways can it contribute to a preemptive strategy? LIQUEFACTION PILING The waterfront needs strengthening so it does not slip into the harbour. Also in what ways can it become more boat accessible during emergencies?
**TYPOLOGY ONE** Deals with the idea of a cliff or a need to get to safe high ground. Here it is investigating two types of ‘cliff’: natural high ground and man made high ground. How can you access these areas? And what can they contribute to the everyday experience of the city? **TYPOLOGY TWO** Looks at structures and how landscape architecture can engage with them in a way that exploits their opportunities or strengthens their weaknesses. **TYPOLOGY THREE** Addresses the waterfront by investigating ways to prevent liquefaction damage so that the area can remain usable as a post-disaster evacuation or food drop off point due to boat accessibility.
LANEWAY This design proposes a laneway where the space below ground is used for retail outlets or cafes, promoting a multi-purpose, multi-function design that can still operate as emergency access. REFUGE This design looks at repurposing rooftops as street accessible park space that can be used as refuge areas during an earthquake. RETROFIT Uses stairwells as a reinforcing structure that strengthens the building for earthquakes, yet allows rooftop access for everyday use. NEW BUILDING Here emergency access has become part of the new building where the rooftop is a cafe/refuge area. LIQUEFACTION PILING Liquefaction piling is used as a surface treatment/art installation. WATERS EDGE Creates a more boat accessible waterfront for post-emergency functions.
PHASE FIVE
DEVELOPMENT THROUGH REFLECTION

DIAGRAMMING INFLUENCES

This final design phase was largely about reflecting on my literature review, precedent studies, and my previous design iterations and re-testing them with ideas and concepts that were present in my design. This process led to the discovery that some designs from the early stages of my process that were seemingly irrelevant or out of place carried more weight in the later stages of my thesis. One example being Wayfinding, which had roots in my very first design exploration, but never came to fruition until the last iterations of my preemptive strategy.

Figure 3.58

DIAGRAMMING INFLUENCES The above diagram represents a mind map of all the influences that aided in the direction of my final design. It shows the ideas investigated through my previous design iterations, topics explored through my literature review, and the precedents that informed both my design process and my final design concepts.
SYNTHESISING IDEAS

The above images represent the first steps I took towards developing a final preemptive strategy for the Wellington CBD, as seen in Chapter 6. These concepts illustrate the synthesising of ideas, such as way finding, robust structure, snakes and ladders, and disaster aesthetics to form a strategy that could save lives in the event of a major earthquake.

LANEWAY
This concept uses a type of way finding signage to make it visually obvious to the public that it is intended as an emergency access route out of the CBD.

VERTICAL ACCESS
The vibrant colour red becomes a tool for communication, it indicates to the public that red is associated with some form of disaster function. In this case it is safe, robust access to a rooftop refuge area.

NEW BUILDING
This new building design combines a visually robust and strong structure with the idea of wayfinding signage. The design is meant to build up a disaster aesthetic, a design style that communicates to the public that they live in an earthquake prone city and that this area is safe during an earthquake.
LITERATURE REVIEW
INTRODUCTION

Within the discipline of disaster planning, it has become commonplace to prepare a city for a natural disaster by looking towards both architectural and engineering solutions that resist or deter the natural event. However, developing theories of urban resilience suggest that, rather than trying to prevent a natural disaster from impacting our cities, we should investigate ways in which we can reduce the impact natural hazards have on the health and safety of the public and the infrastructures that influence our everyday lives.

As mentioned in chapter 2, the idea of landscape architecture making a contribution to pre-disaster planning is not necessarily a new idea, however it is yet to be fully recognised for its potential as a preemptive strategy. In the context of disaster planning and mitigation, landscape architecture typically makes a contribution in the form of vast open spaces with the intention of them being used as refuge areas during a natural disaster. However, it is common for these vast open spaces to suffer from a lack of public activation and become like voids in the city, failing to combine emergency functions with quality urban design for day-to-day use.

1 (Cigler, 1988) - 48
This paper explores literature and theories focused on the developing ideas of disaster management and urban resilience, suggesting that there is a place for landscape architecture within this area of pre disaster planning that could potentially save lives in the event of a natural catastrophe, whilst enhancing the urban environment for everyday use. This will be achieved by reviewing literature surrounding Preemptive Design, Bottom-up Design, and Loose Space in order to discover how landscape architecture can successfully combine quality urban design with latent emergency functions to create one coherent pre-disaster design strategy.
There is a shift beginning to occur in disaster management that is looking for new ways to mitigate natural disasters through non-structural means. Rather than preventing floods with big engineering projects, people are starting to ask why not adapt the way we live to the conditions of the flood plain or why build a city in a flood plane at all? This shift in thinking to more resilience-based ideas could potentially open doors for landscape architecture within the realm of pre-disaster planning and urban resilience. This section reviews literature surrounding the shift in disaster planning from structural solutions to more resilient infrastructures, and suggests a design approach that could help facilitate that change.

Hazards can be defined as threats to life, well-being, material goods, and the environment, from the extremes of natural processes or technology. The pre-disaster management and mitigation of these hazards, as Cigler explains, has often been dominated by engineering and structural solutions that are not always the best answer to the problem.

“Dams to prevent floods actually induce urban development in floodplains and stimulate a false sense of security among floodplain occupants. Flood damages may well increase, not in spite of mitigation policies but because of them.”

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2 (Ruchelman, 1988) – Pg 59
3 (Cigler, 1988) – Pg 59
4 (Cigler, 1988) – Pg 48
5 (Cigler, 1988) - Pg 49
This suggests that in order to reduce the effects that natural disasters have on both cities and the infrastructures that affect our day to day lives, we need to not only investigate ways of creating more resilient infrastructure, but to explore new ways of designing that include the consideration of natural disasters into the structure and function of the city. Rather than ignoring a flood plain or active fault line, we should embrace these vulnerabilities as opportunities to re-invent the city in such a way that does not create a sense of false security, but acts as a reminder that we do live in a flood or earthquake prone area.

A concept that is beginning to break ground in the area of landscape architecture and pre-disaster planning is the idea of preemptive design, an idea that identifies the need for multiple levels of redundancy to be built into the planning and design of cities\(^6\). Similarly to Beverly Cigler, Miho Mazereeuw is of the opinion that there is an overwhelming need for preemptive design within the realm of disaster preparation and urban planning. She suggests that designing a city in anticipation of a catastrophic natural event allows latent emergency functions to become woven into the very fabric of a city\(^7\).

“Design becomes an anticipatory and preemptive strategy: as a measure that can embed several systems in the actual layout of a city, from streets to the location of high ground”\(^8\)
This means that a preemptively designed city would support a sub-layer of designed emergency functions, such as safe high ground or multiple clear access routes that work to save lives in the event of a major catastrophe. Preemptive design creates an opportunity for landscape architects to intervene in ways that work with the inevitability of natural disasters, reducing future disturbance. By designing preemptively with natural disasters in mind, it could become possible to create a sublayer of emergency infrastructure that lies dormant during the everyday use of the urban environment, until it shifts into action in times of distress and natural disaster. This infrastructure, when combined with quality urban design, could potentially enhance the day-to-day experience of the city whilst saving lives in the event of a natural catastrophe.
CASE STUDIES

The following two case studies are both theoretical, yet both provide an approach to preemptive design that shows how latent emergency functions could be successfully combined with quality urban design from two very different contexts. The first is the ‘Komunitas Siaga Tsunami’ and the second is ‘New Urban Ground’.
KOMUNITAS SIAGA TSUNAMI

The ‘Komunitas Siaga Tsunami’ is a speculative design concept by Ben Devereau, intended as a preemptive design response for a community village in the Sumatran City of Padang, an area that is prone to earthquakes and significant tsunamis. This project follows the 2011 tsunami that devastated Japan, where it was revealed that even some of the largest engineering projects could be over powered by the forces of nature. The ‘Komunitas Siaga Tsunami’ searches for a more effective disaster mitigation strategy, born out of natural processes, not to deter the force of the wave but to save lives in the event of such a disaster\(^9\).

The aim of this project was to conceive a more effective solution to tsunami mitigation in a low socio economic community that could not afford large engineering solutions. The result of which was the design of a multi-storied community hub, where the building typology is designed to be highly resistant to earthquakes and tsunamis, yet available to the public for daily activities\(^10\).

\(^9\) (Devereau, 2012)
\(^10\) (Devereau, 2012)
Design Strategy

DESIGNING FOR CHANGE

Although the ‘Komunitas Siaga Tsunami’ is not actually built, it still provides a useful strategy for applying resilience through preemptive design. This design explores ways in which the constant threat of natural disaster could be lessened by designing for change as opposed to trying to prevent it. The strategy used here, although hypothetical, is certainly a preemptive approach to design. The existing city of Padang is retrofitted with a latent emergency infrastructure that aims to primarily save lives in the event of an earthquake and accompanying tsunami, and secondly, to lessen the impact it could have on the way people go about their day-to-day lives. This idea of a multi-storied pedestrian network aligns with some of my own ideas and has potential in the future development of my own design.

**RELEVANCE** This design explores a low cost way of living within a landscape prone to natural disasters. It promotes a design method that minimises the effects of natural disasters on people’s health and well being as opposed to defending the city from the event. This allows the city to remain resilient and aware of the threat of natural disasters, leaving them constantly prepared.
NEW URBAN GROUND

‘New Urban Ground’ was part of the Museum of Modern Art’s exhibit ‘Rising Currents’, conceptualised by a team of designers from both the Architecture Research Office (ARO) and dlandstudio. This project was designed as a preemptive response to the imminent threat of climate change and a sea level rise of 6 feet by the year 2100. Rather than seeing this as a catastrophic event where 21% of Manhattan island would become submerged by high tide, ARO and dlandstudio saw this as an opportunity to design with the disaster as opposed to preventing it. The outcome of which was a wetland city that exploits the advantages of both man made and ecological systems, thus creating a new urban model that is retrofitted with the latent capacity to absorb change, whilst enhancing the day-to-day experience of the city.

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11 (Bergdoll, 2010) - Pg 60
12 (Cassell, Drake, & Yarinsky, 2010) - Pg 83
13 (Cassell, Drake, & Yarinsky, 2010) - Pg 83
14 (Cassell, Drake, & Yarinsky, 2010) - Pg 82

Figure 4.5
Design Strategy

INNOVATION

Essentially, this design acknowledges that current disaster mitigation techniques, such as sea walls, are not the only solution to managing the effects of a natural disaster. This design proposes a preemptive strategy where landscape architecture has the capability, not to defend a city from the overpowering forces of nature, but to adapt the way we inhabit it, ultimately reducing the impact disasters have on our infrastructure and our day-to-day lives. ‘New Urban Ground’ sees the threat for imminent disaster as an opportunity to reshape the city with more innovative landscape design solutions before the natural disaster occurs. In doing so has provoked a rethinking of the relationship between ecology and infrastructure and allowed for the reconfiguring of Manhattan’s character to one that is innovative, flexible, and prepared for future disturbance.

RELEVANCE New Urban Ground inspired the idea of reinventing the city in a way that makes it obvious to the people occupying it that they live in an area prone to earthquakes. The colour red would become an indicator of an emergency infrastructure, such as safe access or safe open space, so that people know where to go in the event of an earthquake. Much like new urban ground, Wellington’s vulnerability to earthquakes would become visually evident through design, so that people are aware of the hazard in everyday life and are prepared in times of emergency.
“The best research tool we have is our eyes, to open our eyes and look around us, to begin to understand why things are the way they are and to question them. Observing where we are needed as designers”15

Sand Helsel

If preemptive design presents a strategy for embedding latent emergency functions into the structure of a city, then bottom-up design is the strategy that proposes an alternative approach for creating more intimate, opportunistic, and quality urban design. This section of the literature review explores the bottom-up design strategy as an approach to urban design that will ensure the on-going inhabitation of space during the day-to-day activities of the inner city. This will create quality urban design that can then be combined with latent emergency functions to form an overall preemptive strategy.

Within the discipline of urban design and pre-disaster planning the top-down design strategy is commonplace as it focuses on finding solutions to holistic problems from a large-scale analysis down to a more detailed resolution.

However, Sand Helsel is of the opinion that when we are working at a larger scale we are often distanced from the subject matter16, which can result in spatial designs lacking social and cultural context.

15 (arsitekturUPH, 2011)
16 (Helsel, 2003) – Pg 91
Helsel believes that, as architects and landscape architects, we need to be designing from the bottom-up\textsuperscript{17}. What she means by this is that our design process needs to begin with ground level observations that then work out to larger scale strategies, creating a more intimate connection with the city. This will help create open spaces that serve an emergency function (such as refuge areas) to operate more successfully in the daily activity of the inner city.

Designing from the bottom-up is very much about designing from a first person perspective. It is about making observations and personal readings of the site and applying them to design in such a way that it facilitates the appropriation of space so that people can influence the city that surrounds them. This is an idea shared by Diego Ramirez-Lovering, who suggests that it is the informal and sometimes illegal activities of the public that build character and activity on the street, and that we should encourage an attitude directed at working with, rather than against, these informal systems\textsuperscript{18}.

Helsel and Ramirez-Lovering would agree that the bottom-up approach to design has to begin with ground level observations that can then inform the way we design spatially to give a level of control over the use of the space back to the public. Through a bottom-up approach, it is our role as landscape architects to identify the issues, opportunities, and unique characteristics that people impose onto a site\textsuperscript{19}. It is our role to observe what activities make or define a space and then design to facilitate that activity or observation, promoting the on-going inhabitation of that space.

\textsuperscript{17} (arsitekturUPH, 2011)
\textsuperscript{18} (Ramirez-Lovering, 2008) – Pg 13
\textsuperscript{19} (arsitekturUPH, 2011)
Both Helsel and Ramirez-Lovering write about the bottom-up design strategy in the context of densely populated, low socio-economic status areas, where the illegal occupying of space is often an only source of income (such as street vending, etc.)\textsuperscript{20}. However, both authors describe the strategy as being able to translate to many cities of various economies. So what does this mean for Wellington CBD, an area of high economy? Where are these legal/illegal activities taking place and what is their purpose? What are the activities, both formal and informal, that define the character of the site? And what does a design look like that adopts the bottom-up strategy to facilitate these activities?

As emergency planning and disaster preparation typically occur at the top down scale, it runs the risk of creating spaces void of character and occupation.

“\textit{Top down is an urban design approach from plan that fails to understand the people, the culture and what differentiates one place from another}”\textsuperscript{21}

In light of this, a bottom-up approach to pre-disaster planning has the potential to create spaces abundant with activity and character, whilst facilitating latent emergency functions.

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\textsuperscript{20} (Ramirez-Lovering, 2008) – Pg 10-11
\textsuperscript{21} (arsitekturUPH, 2011)
CASE STUDY

The chosen case study not only represents the bottom-up approach to design, but also shows how it can be used to create a more pedestrian safe, disaster resilient city. This case study is the Happy Active Town (HAT) project in Kobe, Japan.
The HAT (Happy Active Town) Kobe Restoration Housing Complex was designed by Yuji Sasaki following the 1995 earthquake in Kobe, Japan. The design of this project was based around an observation that Sasaki made during the 1995 earthquake, which was that survivors evacuated their dense urban homes and occupied parks and open spaces. He found that city dwellers had developed what he calls ‘life fields’, where people who had knowledge of safe open spaces or fields where they could go in the event of an earthquake were literally saved by that knowledge, hence the quite literal name ‘life fields’.

The aim of this project was to create a new housing development where people could feel safe and secure, whilst simultaneously creating a network of ‘life fields’, strategically placed as to provoke day-to-day habitation, embedding the locations of these safe spaces into the minds of the public.

Figure 4.12
**SURVIVALIST URBANISM**

Yuji Sasaki's approach to design shares similarities with the bottom-up strategy described by Sand Helsel and Diego Ramirez-Lovering, a strategy not typically used in disaster design. However, in this case it was very successful as Sasaki, through a bottom-up design strategy, found a way to physically use landscape architecture to save lives in the event of a major earthquake. What is interesting about The HAT project is that it uses a simple ground up observation to create a metaphorically and symbolically robust design. The idea of creating a cellular 'life field' network across the city is simple yet effective in delivering to the public the knowledge of where earthquake safe spaces are located and providing ample open spaces in a very dense and compacted city. This project presents a unique bottom-up design strategy that promotes a form of 'survivalist urbanism', creating urban spaces for the purpose of preserving human life. This is an idea that could prove fruitful when considering what kind of emergency function landscape architecture could provide.

**RELEVANCE** This project is extremely helpful when it comes to thinking about how to design spaces for the 1:1 experience or from the first person perspective, which is very much what the bottom-up approach to design is all about.
Preemptive design proposes a landscape design approach that looks to embed a latent emergency infrastructure into every aspect of a city in order to save lives in the event of a natural disaster and lesson its impact on the infrastructures that influence our day-to-day lives. However, if open spaces were designed without specific functions in mind, so that occupants could mould and program the site in any way they pleased, would this eliminate the need for a latent infrastructure? Or could the two work to a mutual benefit? If open spaces were designed to be flexible and to accommodate change, could they be used in any way the occupants choose for both the everyday and during emergencies? This idea runs parallel to the concept of ‘Loose Space’, an idea that proposes an alternative method for creating quality open space with the latent capacity to accommodate change. This section reviews the concept of ‘Loose Space’ and investigates its potential as a preemptive design strategy.

Loose space is a theory described by Karen Franck and Quentin Stevens that addresses the way people interact with and change the space that surrounds them. Franck and Stevens portray loose space as urban public space in which people pursue a very rich variety of activities not originally intended for in the design of those locations\textsuperscript{25}. This indicates that loose space should have the capacity to change and adapt to people’s needs and desires, not only in day-to-day use, but also in high pressure and emergency situations.

A basic example of very loose space, as described in the book ‘Public Space’, is simply a large open lawn or field where people bring their own programs and activities to occupy the area\textsuperscript{26}. However, when a site such as this is unoccupied it becomes a void in the city and potentially a very unsuccessful piece of urban design. As landscape architects, it is our role to find a way to fill this space whilst maintaining a level of ‘looseness’.

\textsuperscript{25} (Franck & Stevens, 2006) – Pg 2
\textsuperscript{26} (Carr, Francis, Rivlin, & Stone, 1992) – Pg 243
One issue that arises from this theory is, how to design for loose space? By definition, looseness is created by people’s actions and activities that go beyond the intended use of the public space\(^\text{27}\). As designers, do we try to facilitate these activities through design or do we delegate space for them to occur at the risk of creating a void? The questions remain—how can we design urban public space with intended functions while still allowing for flexibility? And what does this space look like?

The idea of creating flexible public space that can mould to the people's needs for both the everyday and emergency situations proposes an alternative approach for which landscape architecture can begin to contribute to pre-disaster planning. By designing highly flexible or customizable public space that combines quality urban design with the latent capacity to accommodate change, could it become possible to design spatially while still achieving a level of looseness? Although the concept of 'Loose Space' was not originally intended as a pre-disaster strategy, it has potential for creating quality public space whilst saving lives during a disaster as it can adapt to change and mould to the specific functions required by the people occupying the space. This idea is one that could easily be adapted into a preemptive strategy, where flexible loose space could be combined with latent emergency functions to further enhance both emergency functions and everyday experience.

**CASE STUDIES**

In order to better understand how one might go about designing flexible, loose space, two case studies have been chosen that approach flexibility from two very different design approaches. One is The Festival Site at Mount Penang, in Sydney, Australia, and the other is the Oslo Opera House in Norway.
The Mount Penang Festival Precinct was designed by OCULUS landscape architects in 2001 and could be interpreted as an outstanding example of loose space and flexibility. In its own way, the Mount Penang festival site presents a unique approach to the combination of infrastructure and landscape architecture as it employs infrastructure as a strategy to enable the public inhabitation of space. This project aimed to create a festival space that can also facilitate an array of both planned and unplanned activities and as such could be classified as loose space.

This design is all about the flexibility and customisation of the space that surrounds us. Foremost, this design has the hidden capacity to facilitate a large event or festival by supplying space, power, and water, whilst also having the ability to hide these infrastructures in plain sight, creating a space that is freely adaptable to the activity or programme being carried out by the people currently occupying the space.

28 (Jacques, 2004) – Pg 325
29 (Jacques, 2004) – Pg 332
**Design Strategy**

**APPROPRIATION**

Although this precedent is unrelated to pre-disaster design, it still explores ways in which latent infrastructure can become engrained into the very fabric of landscape design in a subtle yet successful manner. What is unique about this design is the way that it utilises infrastructure as a strategy for public occupation. The Mount Penang Festival Site is a great example of loose space as it invites people to lay claim to the space and appropriate, activate, and occupy it however they want.

“Mount Penang is a landscape the significance of which is completed by inviting people to inhabit the infrastructure: obeying it, altering it, defying it and changing it in the process”\(^{30}\).

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**RELEVANCE** The site is designed in such a way that it inspires the idea of designing inner city open spaces that provide people with the means to appropriate everyday open space during emergencies. What else interests me about this project is the idea of making infrastructure valued open space. In regard to the development of my project, this design has inspired me to find new ways of activating spaces, such as laneways, which are primary access ways, yet still require daily activation to become successful urban design.

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30 (Jacques, 2004) – Pg 332
OSLO OPERA HOUSE

The Oslo Opera House in Norway was designed by Snohetta in 2000, and was created for the purpose of becoming a standing monument to Norway and its iconic typographical landscape. This design uses symbolism to communicate a story about the Norwegian landscape and its people.

The Oslo Opera House is comprised of a combination of materiality, slopes, level changes, textures, and view shafts, creating a unique user experience that resembles an interpretation of the natural landscape. Undefined pathways envelop the rooftop and are only distinguishable by a change in texture or slope allowing people to discover their own path over the monument, just as one would do in nature. The idea of flexibility and loose space is seen throughout the whole surface of this design, where the rooftop of this structure is undefined in terms of program, inviting people to engage and interact with the space in any way they see fit.

31 (Davey P., 2008) – Pg 36
32 (Davey P., 2008) – Pg 37
Design Strategy

DIVERSITY

The changes in texture and gradient work to create a variety of spaces varying in size, shape, and materiality that are then programmed by how each individual user chooses to interact with the space. It could be argued that one reason for this design’s success is its ability to use basic geometry to create a diverse range of spaces. Again, this design has little to do with disaster preparation, yet it is a great example of how loose space can be achieved and how one might design with flexibility and diversity in mind. When thinking about pre-disaster design, this could mean that, rather than embedding emergency infrastructures into inner city landscapes, perhaps designs just need to be flexible enough to facilitate a range of emergency functions in times of distress.

Spatial Diversity of Laneway Concept

Cafe

Vegetation

Installation Art

Outdoor Gym

Activities

Below: Two sections illustrating how the opera house roof uses gradients to create diversity of spatial experiences.

RELEVANCE One of the most fascinating aspects of this design is the way it uses such simple and basic design moves (level changes, sloping gradients, various surface treatments) to create a wide range of loose yet diverse spaces. The key word here is ‘diversity’, in relation to loose flexible space. Diversity becomes so important as it not only keeps the design fascinating, but it also provokes a sense of discovery through the site. This idea of diverse loose space will be useful in the development of my own design project as it will aid in the activation of my spaces, whilst also providing a way of creating more interesting and habitable spaces.
The purpose of this literature review was to discover ways in which landscape architecture could make a significant contribution to pre-disaster planning with the aim of saving lives in the event of a natural catastrophe, as well as enhancing the urban environment for everyday use.

When going over the literature it becomes apparent that each approach to design has a clear set of strengths that make them all valuable when considering one overall pre-disaster design strategy. The most effective way to combine latent emergency functions with quality urban open space is to take relevant aspects from each approach and combine them into one unified preemptive strategy. Preemptive design supplies the sub layer of latent emergency infrastructure, bottom-up design provides the strategy for creating quality urban design, and loose space supplies the loose and flexible programming that ties it all together. Whether it be an innovative reconfiguration of an entire city, such as ‘New Urban Ground’, a form of ‘Survivalist Urbanism’ like Sasaki’s ‘Life Fields’, or even the latent capacity to facilitate change like the ‘Mount Penang Festival Site’, landscape architecture certainly has the ability to reduce the impact natural hazards have on the health and safety of the public and the infrastructures that influence our everyday lives.

In conclusion, landscape architecture through a hybrid preemptive strategy could not only combine quality urban design with latent emergency functions, but could also make a significant contribution to pre-disaster planning and mitigation.
SITE ANALYSIS
INTRODUCTION - WELLINGTON CITY

Wellington is the Capital city of New Zealand and is located at the bottom of the North Island. Recent seismic activity over the past few years has brought back into the spotlight a common concern that Wellington is well overdue for a major earthquake that could devastate the city. During the 1855 Wairarapa earthquake the Hutt valley road was blocked due to slippages, fissures opened up in the ground, landslides scarred the Rimutaka Range, and a tsunami in the Wellington harbour managed to flood various buildings on Lambton Quay. In the years since, most of the central business district now occupies land that was once below sea level. Today, this has resulted in a large portion of Wellington’s CBD lying on relatively flat, low lying, reclaimed land that is vulnerable to liquefaction, ground shaking, and tsunami inundation. In the event of a significant earthquake, deficiencies in access ways, open space, and accessible high ground to avoid earthquake related damage are very real threats that could increase the risk of human casualties.

The Wellington Earthquake Risk Assessment Study proposes a scenario which estimates that a magnitude 7.5 earthquake will erupt on the Wellington fault sometime in the next 600 years that will damage much of the city’s infrastructure and potentially claim the lives of many Wellingtonians.

The following analysis focuses on Wellington at the regional scale, identifying the particular opportunities and vulnerabilities that make Wellington uniquely exposed to earthquake related damage. This analysis then focuses on the area of Wellington located between the motorway and the harbour, running the length of Lambton Quay, and the opportunities and vulnerabilities presented by this area. A sample selection is then taken from this CBD site in order to better illustrate the typologies present and the opportunities available at a more intimate and qualitative scale.

1 (McSaveney, 2009)  
2 (Davey & Shephard, 1995) – Pg 8
THE WELLINGTON FAULT
This map illustrates the Wellington Fault and its close proximity to the CBD
LIQUEFACTION POTENTIAL

The above map shows the areas estimated to be most vulnerable to liquefaction. What is interesting is the overlap of Wellington’s CBD with the liquefiable areas.
ACCESS ROUTES
This map outlines Wellington’s main transport access points/routes. A big issue here is that the main access routes in and out of the city converge right on top of the Wellington fault. This may lead to the isolation of the city in the event of a major earthquake.
GROUND SHAKING HAZARD
It is apparent that there is a relationship between vulnerable areas and reclaimed land. This is due to poor soil structure and possibly height above sea level.
This map illustrates Wellington's tsunami evacuation areas. It is worth noting that a large portion of the CBD lies within the High to Medium danger Zones.

**TSUNAMI EVACUATION ZONES**

- High danger
- Medium danger
- Low danger
SLOPE FAILURE

Although the CBD is relatively safe from slope failure, secondary access routes and the main highway out of the city are largely at risk.
BUILDING DENSITY

This map indicates that building density increases in areas that are most vulnerable to liquefaction, ground shaking, and tsunami inundation.

Figure 5.8
PARK SPACE There is a low quantity of park space within the CBD, resulting in a lack of refuge space during a natural disaster. PUBLIC TRANSPORT There are opportunities for a new emergency infrastructure to plug into existing public transport for everyday use and during emergencies (allowing for the movement of people and supplies). PEDESTRIAN FLOWS There is a very strong pedestrian presence along Lambton Quay that has become disjointed from the waterfront. TRAFFIC FLOWS The Arterial Road connecting the CBD to the rest of the city lies very close to the waters edge on liquefiable soil. This road has a dense traffic flow, which separates the Waterfront from the CBD.
EARTHQUAKE PRONE STRUCTURES Within Wellington’s CBD there is a moderate amount of earthquake prone buildings that either need to be replaced or strengthened. There are opportunities for this typology of buildings to contribute more to the city than just reliable, strong structures. Low level rooftops could become a great source of pedestrian accessible open space in a city where space is so valuable and desperately needed.
TSUNAMI INUNDATION Wellington City’s CBD lies on relatively flat, low lying, reclaimed land. The whole area between Lambton Quay and the Wellington harbour was once under water and, in most places, is less than four metres above sea level. In the event of a significant tsunami, a great portion of the CBD will be inundated with limited access to safe high ground and open space for people to evacuate to.
PERMEABILITY TO THE TERRACE

Currently there are only two uncovered and one partially covered access routes to the Terrace from Lambton Quay. They are the Plimmers steps, Woodward St, and the partially covered Farmers Lane. This means that during and after an earthquake there are limited fast pedestrian access routes from Lambton Quay to the Terrace. A lack of permeability could lead to ‘bottlenecks,’ increasing the risk of people getting trampled or trapped on Lambton Quay and being unable to access high ground or safe open space.
Existing building separating Lambton Quay from safe, high ground

The Terrace operates as safe, high ground as it is not reclaimed land.

Potential safe, high ground accessible from the street

Earthquake prone building - potential for earthquake retrofit as safe, high ground

Original Coastline

CLIFF TYPOLOGY

STRUCTURES

RECLAIMED
BRANDON STREET ANALYSIS: This section was taken as a reasonably typical sample of the land located between the Terrace and the Wellington harbor. A few things to note are the height above sea level, where Lambton Quay is between 2-4 metres above the harbour. This indicates that if a tsunami wave (as a result of an earthquake) is higher than 2-4 metres it could certainly reach Lambton Quay and, without access to safe high ground, it is possible that people could be seriously injured or worse. In the above image, the area below the section line is filled with images that are sequentially placed to better understand the qualities and materialities associated with each area, progressing from the Terrace to the Waterfront.
CLIFF TYPOLOGY
SITE ONE: LANEWAY

SITE THREE: RETROFIT EARTHQUAKE PRONE BUILDING

SITE FIVE: LIQUEFACTION PILING

WATERFRONT TYPOLOGY
SITE FIVE: LIQUEFACTION PILING

SITE ONE: LANEWAY The exiting site is part of the Boarders shop on Lambton Quay. This site is perfectly located to provide adequate access between the Terrace and Lambton Quay. There is also an opportunity here for the laneway to plug into existing retail outlets. SITE THREE: RETROFIT This building is an earthquake prone building that either needs to be replaced or strengthened. What other functions could earthquake strengthening provide and could this site still become accessible high ground? SITE FIVE: LIQUEFACTION This space is currently a car park area on the waterfront, which seems to me like a waste of quality space. There are opportunities here that could turn bland liquefaction piling into some kind of attractive park space or art installation.
SITE TWO: ROOFTOP REFUGE

SITE FOUR: NEW BUILDING

SITE SIX: WATERS EDGE

SITE TWO: REFUGE This space is currently a rooftop car park, which could be something far greater. In a city with limited space for quality urban design, perhaps rooftops could be utilized as a new form of urban green space, easily accessible to the street. SITE FOUR: NEW BUILDING This site is a two story building in a city that is beginning to expand vertically. There is potential here for a new building that might incorporate some form of preemptive disaster design. SITE SIX: WATERS EDGE There are opportunities present at this site that might enhance the pedestrian activities of the waterfront, as well as making the waters edge more accessible to boats.
The purpose of this design intervention is to demonstrate the potential of landscape architecture within the field of disaster planning as a pre-emptive strategy that could save lives during an earthquake, whilst also enhancing the urban environment for daily occupation. The Wellington CBD area was chosen as a site due to a number of contributing factors, outlined in Chapter 5, that have identified the area as extremely vulnerable to earthquake related damage and, therefore, as a site with ample opportunity for design intervention. The chosen sample area cuts through three very distinct typologies that are typical of the larger CBD site. Each typology presents its own unique set of opportunities and challenges that have provoked certain design responses that could then be adapted and applied to the rest of the CBD. The aim of this intervention is to propose a design solution that responds to the site’s unique typological issues, saves lives in the event of a major earthquake, and successfully combines latent emergency functions with quality urban design.
This chapter has been divided into two parts. Part one illustrates ways in which landscape architecture can begin to contribute to pre-disaster planning as a preemptive design strategy. This preemptive strategy identifies three key site typologies located between the Terrace and Wellington harbour, and exploits their unique weaknesses as opportunities for design intervention. This section then proposes ideas for further development, suggesting that, although this is a final design strategy, there is still refinement required at a spatial scale.

Part two of this design chapter takes a design proposed in part one and resolves it down to a more detailed scale as an indicator of how the whole preemptive strategy could be further refined, both spatially and more intimately. This chapter then concludes by generating data with the purpose of supporting claims that landscape architecture could make a significant contribution to pre-disaster planning.
FINAL DESIGN
PART ONE
INTRODUCTION
The pre-emptive strategy developed in this chapter is informed by the site's particular vulnerabilities and is comprised of a hybridization of theories on preemptive design, loose space, and bottom-up design, as outlined in Chapter 4. The biggest challenge faced by this strategy was finding a way to combine a sublayer of emergency functions with quality everyday open space to create designs that have the latent capacity to absorb and adapt to change, yet can still enhance the quality of day-to-day life within the inner city. With this in mind, this hybrid pre-emptive strategy can be broken down into three key design considerations: emergency use, everyday use, and communication.

EMERGENCY USE
This aspect of the pre-emptive strategy was explored through the idea of ‘survivalist urbanism’ (discussed in Chapter 4), which focused on the preservation of human life during emergencies. This addressed issues of poor pedestrian access out of hazardous areas and a lack of accessible, safe open space within the CBD. One design response to these potential problems was to introduce four lifeline networks that ran from the Waterfront to the Terrace, connecting the various elevated open spaces to safe access routes out of the immediate CBD area. These lifelines would operate as pedestrian arteries allowing quick and frequent access to safe high ground, whilst making the CBD more permeable to pedestrian activity during both emergencies and everyday life.

EVERYDAY USE
A major challenge with designing an emergency infrastructure was how the design would function and operate in day-to-day life. Spaces designed for emergency access cannot be cluttered with programs that will affect its emergency function. However, access ways without programs fail to become active spaces during the everyday. With the preemptive strategy in mind, open spaces were designed with both diversity and the intention of promoting spatial appropriation, giving control of how the spaces are activated back to the people occupying the site.

COMMUNICATION
This third design consideration was in response to the potential issue of how people would know which spaces were designed for an emergency function and how they would know what that emergency function is. This challenge was met by designing these spaces in such a way that an ‘Earthquake Aesthetic’ was created that would not only remind the public that they live in an earthquake prone city, but would visually communicate which spaces are safe during an emergency. This was achieved through the integration of a wayfinding and information distribution systems, and through the development of visually robust, strong, and innovative designs.
Above is my final presentation board illustrating the proposed preemptive strategy for Wellington CBD. This strategy will be examined in further detail through the remainder of this chapter.
Typology one is classified as the cliff typology. It is an area that proposes a very definitive issue, that access to safe high ground is very poor and under developed. Laneways to high ground are reasonably iconic within the Lambton area, however they are not easily identified and are often internal. The design responses for this typology are primarily focussed on traversing the gap from the pedestrian footpath to elevated safe open space and, as such, take the form of a laneway and a rooftop refuge area. In this case the ‘cliff’ refers to both the land mass between the Terrace and Lambton Quay and the verticality of the cliff like building facade, where both must be climbed in order to reach safe high ground.
LANEWAY The design of this Laneway is focused on creating a successful emergency access route out of the CBD, whilst providing habitable, multi-purpose open space for everyday use.
Left:
A view from the top of the Lane-way looks down towards Lambton Quay, crossing thresholds of open space outside store frontages.

Left:
Underneath the Laneway lie four modular shops, each occupied by a different program. These programs could range from retail and coffee shops, to bookstores and information centres.

Left:
A view of the lane-way from Lambton Quay. This image shows how the design would fit into the surrounding context, whilst standing out as an emergency access route.
FUNCTION DIAGRAMS

LANEWAY DURING EVERYDAY USE

This diagram illustrates the layers of activity that occur at the site, both above and below ground level on a daily basis.

LANEWAY DURING EARTHQUAKE

This diagram illustrates how the laneway would be used during an emergency by pedestrians to escape the more hazardous CBD area.
**DESIGN DEVELOPMENT**

**MEMORIAL LANEWAY**

Above: A concept where the rooftop of the laneway could be treated as a pre-earthquake memorial, where lights on the ground display words or meanings.

**OPEN PLAN APPROPRIATION**

Left: This concept proposes a design where the shops appropriate the rooftops during the day, blurring the boundaries between interior and exterior space.

**ECOLOGICAL DIVERSITY**

Above: Looks at the open spaces generated by the form of the laneway and proposes different spatial experiences on each level through ecological diversity.

**VEGETATION**

Below: An exploration of a fully vegetated laneway that could provide a new inner city experience, whilst restoring some native wildlife to the area.
This rooftop park looks at creating more urban green space within the inner city, whilst providing the public with a temporary safe refuge area in times of emergency. This can only be achieved through frequent and obvious access from the street, however there would also be internal access, such as elevators, for everyday access. The red cantilevered skirts are in place to protect site users from any falling glass, while the spaces outlined in red are marked as safe refuge areas, exploring the idea of a ‘survivalist urbanism’.

Figure 6.1.15
ROOFTOP REFUGE

ACCESS TO THE STREET

REFUGE SECTION/ELEVATION
FUNCTION DIAGRAMS

ROOFTOP REFUGE DURING EVERYDAY USE

This diagram shows how this rooftop park might be used in day-to-day life. It also shows its various access points.

Figure 6.1.19

ROOFTOP REFUGE DURING EARTHQUAKE

This diagram shows how the space would be used as a temporary refuge area, both during and immediately after the earthquake.

Figure 6.1.20
DESIGN DEVELOPMENT

Right:
This Design, looks at the idea of loose flexible space by providing various sized open spaces that could facilitate a variety of unspecified programs.

OPEN FIELDS

Left:
This concept proposes two open fields rather than three triangular spaces as they may be more appropriate for a wider mix of recreational activities.

COURTYARD

Right:
This design concept proposes the development of a courtyard area that may be used as loose space, catering to a range of formal and informal activities.

ELEVATED WALKWAY

Left:
This design looks at segregating the walkway foot traffic in an attempt to create an open plan area where activities are not controlled by pedestrian paths.
Typology two is defined as the structures typology. This typology addresses the issue of earthquake prone buildings and the potential threat they pose to the public during a major earthquake. This typology is faced with the challenge of where an earthquake prone building either needs to be replaced with a new building or retrofitted and strengthened to withstand a significant earthquake. In response to this the design interventions explore how an earthquake strengthening structure could contribute to the everyday function of the city and how a new building might consider pedestrian activity for both emergencies and everyday use.
This design was about finding a way to not only strengthen an earthquake prone building (EQP), but also to find a way to turn it into habitable open space. This was done by using access as structure. Creating a mesh of stairs that provide pedestrian access to a lightweight rooftop park, whilst simultaneously operating as an earthquake strengthening structure.
Left:
A view of the EQP building and ground level streetscape from the intersection of Brandon and Featherston St. The green wall would work to shelter the stairs whilst hiding some of the less aesthetically pleasing infrastructure.

Figure 6.1.28

Left:
A perspective view of the exterior staircases leading to the top of the building.

Figure 6.1.29
FUNCTION DIAGRAMS

RETROFIT BUILDING DURING EVERYDAY USE

This diagram shows the retrofitted earthquake prone building and how it could be occupied during everyday life.

Figure 6.1.30

RETROFIT BUILDING DURING EARTHQUAKE

This image illustrates in red ‘access as structure’. It shows the infrastructure in place that strengthens the building whilst providing roof access.

Figure 6.1.31
DESIGN DEVELOPMENT

Right:
A design of a lightweight rooftop garden with extra reinforcing at the base of the structure. This would aid in preventing the building from collapsing out into the street.

REINFORCED WALKWAY PATHS

Left:
This concept looks at creating more seating at street level to provoke an increase in the habitation of that space. The rooftop also has designated walkway areas to restrict the amount of people that can occupy the space at any one time, limiting the weight on the structure.

LIGHTWEIGHT GARDEN

Left:
This concept looks at using the rooftop as some kind of attraction. In this case it is to showcase both native and exotic plantations, and ecologies such as a butterfly enclosure, enhancing the everyday use of the space.

RIGHT:
A design that utilises the rooftop as both an exercise area and children’s playground through the generation of simple forms that could facilitate a range of activities.

LIGHTWEIGHT PLAY GROUND

ECOLOGICAL ENCLOSURE

Left:
This concept looks at creating more seating at street level to provoke an increase in the habitation of that space. The rooftop also has designated walkway areas to restrict the amount of people that can occupy the space at any one time, limiting the weight on the structure.

ECOLOGICAL ENCLOSURE

Above:
A design that utilises the rooftop as both an exercise area and children’s playground through the generation of simple forms that could facilitate a range of activities.
This idea runs on the assumption that there will indeed be new buildings constructed within the CBD, and proposes that some of them could consider new ways to prepare the city for a natural disaster. This would include the design of a building with elevated open space accessible to the public as a safe refuge area. This particular design looks at how that open space could also flourish during the day-to-day activity of the city.
Left: A view of the new building from the Brandon and Featherston St intersection looking East. It suggests how a new building could be accessible to the street and how it could be identified as an emergency refuge area.

Figure 6.1.38

Left: A view looking West down the pedestrian access to the street. The green wall protects the staircase from broken glass during an earthquake, yet may provide filtered light into the interior of the building.

Figure 6.1.39
FUNCTION DIAGRAMS

NEW BUILDING DURING EVERYDAY USE

This Diagram shows the new building concept and how it could be used on a daily basis. Here its primary function is a rooftop cafe, yet at night time it could become a rooftop bar.

NEW BUILDING DURING EARTHQUAKE

This image shows the new building functioning during an emergency. The rooftop operates as a safe, high ground refuge area, while the red signage operates as visual wayfinding in an emergency.
DESIGN DEVELOPMENT

Right: This concept looks to create the largest refuge area possible without ruining the space for daily activation. It does this by removing a large portion of the vegetation in place of a courtyard area.

GREEN WALL/WINDOWS/WOODEN PARK

Left: This concept tries to make the inside of the building more habitable by adding more windows. It also tries to create a much more relaxed rooftop park that becomes less exposed than other concepts.

MORE WINDOWS/ POCKET PARK

Right: This concept is very similar to my original design, but it tries to make the plant boxes less intrusive, as well as introducing more seating areas.

POCKET PARK CAFE

Left: This design has made big changes to the building facade where it is looking to create a contrast between glass and concrete. The rooftop area is investigating structural replacements of trees, using wooden slats to create shelter and spatial diversity.
Typology three is characterised as the waterfront typology. This typology, as suggested in the name, deals with issues associated with the water’s edge, such as liquefiable soils and aquatic access. The challenge of this area was to find new and innovative ways to infuse structural solutions with landscape architecture, creating more resilient and desirable waterfront spaces. The identification of these challenges led to two specific design responses. The first was to create an exciting way to use liquefaction piling (see appendix 1) as not only a structure, but a design element to enhance the everyday use of the space. The second was to create a more boat accessible water’s edge, able to operate as a means of evacuation or a supplies drop off point post-disaster.
LIQUEFACTION PILING SECTION

LIQUEFACTION PLAN

LIQUEFACTION PILING This design has two main objectives. One is to strengthen the waterfront area so that land does not slip into the harbour and the second is to create an instantaneous tsunami warning system. The importance of this design is to maintain the structural integrity of the waterfront area so that it can be accessed by boat for food and water supplies to the CBD or, more importantly, evacuation post disaster.
Above is a view of the liquefaction piles extruded above ground level to form bell towers and other sculptural elements. When an earthquake occurs the bells shake, indicating that a tsunami is possible and warning people to evacuate to high ground. This system is inspired by the ‘Komunitas Siaga Tsunami’.

ACCESS FROM THE WATERS EDGE

Above is a view of the emergency access at the waterfront. Also visible is the grid of liquefaction piling and park area.
FUNCTION DIAGRAMS

LIQUEFACTION PILING DURING EVERYDAY USE

This image shows how this space could operate as thriving park space during everyday activities.

LIQUEFACTION DURING EARTHQUAKE

This diagram illustrates how people would evacuate the site in the event of an earthquake.
DESIGN DEVELOPMENT

Right:
This concept strips the previous design right back to its structural elements, functioning purely as a liquefaction strengthened area accessible by vehicles.

PEDESTRIAN SPINE

Left:
This design is, again, the bare minimum of the previous design, focusing on the space as a pedestrian only area. This concept promotes the idea of loose space and encourages people to activate it, in any way they see fit. This could range from weekend markets to events at the local bars and restaurants.

TSUNAMI BELLS

Right:
This design proposes an increased number of bell towers of various sizes to add a vertical element to the space.

VERTICAL LIQUEFACTION PILING

Left:
This design looks at covering the site with liquefaction piling below and above ground level so that they may operate both functionally and as a piece of sculptural art.
WATERS EDGE This design is primarily an improved retaining wall that will help prevent this fragile piece of land from slipping into the harbour. The main objective of this design is to ensure that this area is still operational post disaster so that it is accessible by boat and stable enough to remove people from the CBD, or to supply inhabitants with food and water until a time that they can be safely removed from the CBD.
Above is a visual representation of the waters edge design in front of the Foxglove, a waterfront bar. The purpose of this is to operate as both a retaining wall and an area where people can begin to engage with the harbour.

Above is a perspective of the boat accessible area. This design would allow a boat carrying supplies or people to come further inland than is currently possible, to a sheltered, easily accessible area.
FUNCTION DIAGRAMS

WATERS EDGE DURING EVERYDAY USE

This image shows how this waters edge area could be inhabited for everyday use.

Figure 6.1.61

WATERS EDGE AFTER EARTHQUAKE

This diagram illustrates how people could evacuate the CBD via boat post-disaster, due to the stabilization of this highly liquefiable area.

Figure 6.1.62
DESIGN DEVELOPMENT

Right:
This concept focuses on the retaining structure and how different combinations and spatial configurations may create more interesting spaces.

DIVING PLATFORMS

Left:
This design considers a different way of engaging boats. Rather than just making a docking area it, considers the possibility of creating a ramp to launch small boats.

ENCLOSED SWIMMING AREA

Right:
This concept looks at creating a solid retaining structure that can be used in a playful nature for engaging in swimming activities, such as diving, etc.

BOAT RAMP/ VEGETATION

Left:
This design looks at creating a solid retaining structure that can be used in a playful nature for engaging in swimming activities, such as diving, etc.

Creating Space

Right:
This concept focuses on the retaining structure and how different combinations and spatial configurations may create more interesting spaces.

Figure 6.1.63

Figure 6.1.64

Figure 6.1.65

Figure 6.1.66
Wayfinding is an essential component in developing a pre-emptive strategy and, as such, becomes an extra layer of design applied over all three typologies, linking them together as one larger emergency network. The purpose of this wayfinding system is to make safe spaces easily identifiable during an emergency and to embed emergency information into the minds of the public during their day-to-day occupation of the urban environment. This will ensure that people know where the safe places are and what they should do in the event of an emergency, similarly to Yuji Sasaki’s ‘Life Fields’ that were discussed in Chapter 4. David Gibson explains that wayfinding is also a great way to simplify people’s perception of place and that it can “breathe life into an otherwise purely utilitarian designs.”

1. (Gibson, 2009) - Pg 93
Figure 6.1.67

KEY

- Emergency Street Lighting
- Emergency Information Kiosk
- Emergency Access Route
- ‘Walk The Line’ pamphlet distribution point.
- Bus Stop Information Stand
- Tactile Access Maps
Bus stops are often a place of waiting and contemplation, where information is readily absorbed. Emergency information regarding what to do and where to go during an earthquake could be on permanent display at bus stops, allowing it to be absorbed and digested by the public.

**EMERGENCY ACCESS**

What is the point of creating an elevated open space network that provides both refuge areas and much needed green space, if no one knows how to find or access these spaces during the everyday or an emergency? This idea suggests a ‘Tapis Rouge’ of sorts that guides a user both visually and physically towards a space. The colour red will be used to identify spaces with an emergency function, and will also bind the spaces together as one larger emergency network.
EMERGENCY STREET LIGHT

If a significant earthquake were to occur, it is possible that the CBD could have a massive power outage. If this were to happen at night time the CBD could become extremely dark, making safe areas very hard to find. This idea proposes that street lights be retrofitted with a solar powered emergency light that flicks on during power outages.

Right:
These information hubs are essentially the typical poster kiosks you see around Wellington. However, these hubs are split down the middle, where one half is dedicated to a permanent display of emergency information and the other half is left blank for everyday posters.
This design looks at the non-slip tread at pedestrian crossings, investigating their form, function, and potential for wayfinding. Could the generic copy paste tread become a tactile map illustrating the nearest refuge area and accompanying escape route, whilst still performing its non-slip function?
'Walk the line' is a tourist attraction that educates visitors to Wellington about our unique relationship between the land and sea. Tourists will walk along Wellington's proposed life line systems, experiencing our unique and diverse inner city open space network, whilst becoming familiar with emergency escape routes and refuge areas. This will provide tourists and visitors to Wellington with an invaluable understanding and knowledge of our city, which, in the event of an earthquake, could save their lives.
Due to access out of the CBD area being one of the key issues identified throughout the duration of this thesis, part two of this design chapter recognises the laneway concept as the most important intervention of the preemptive strategy and, as such, it has been chosen to be resolved down to a more detailed scale. This design serves as a case study, giving an indication of how the other design components in the preemptive strategy could be further developed.

The following work begins with a brief analysis of the site and the Wellington context, before exploring various concept developments based on ideas presented by previous literature and precedent studies. It then explores a final concept and attempts to validate claims that landscape architecture can make a significant contribution to pre-disaster planning in the context of Wellington’s inner city.
SITE PHOTOS

VIEWS FROM LAMBTON QUAY

VIEW FROM THE TERRACE

PROPOSED LANEWAY SITE

Figure 6.2.1
INNER-CITY LANEWAYS The above laneways vary across the city due to a variety of influences, such as function, access, and surrounding context. A recurring element throughout these laneways is the strong presence of art, which is reflective of the Wellington culture and forms a very definitive character iconic to each site. This iconic character is something that needs to be maintained and enhanced. However, the Lambton Quay area, as seen in Chews Lane, requires a much more habitable adaptation of this character to one that is cleaner and more legal.
LAMTON TO TERRACE LANEWAYS

LAMTON TO THE TERRACE These laneways provide three different approaches to connecting Lambton Quay to the Terrace. Farmers lane is purely access, with no other function and limited space for appropriation. Woodward street is far more plugged into its surrounding context, with a focus on open space and creating its own unique aesthetic that still very much reflects Wellington’s culture. The Plimmers steps again seem to focus on access, yet they provide small pockets of open space that seem to be primarily used by workers occupying surrounding buildings. Currently these access routes, particularly ‘Farmers Lane’, are all somewhat under-developed as they are not easily identifiable and are tucked away at the base of existing buildings rather than exploiting opportunities to become thriving open space with the latent capacity for emergency access.
**LANEWAY CONCEPT WITH A FOCUS ON OPEN SPACE**

**LANEWAY CONCEPT WITH A BALANCED FOCUS ON ACCESS AND OPEN SPACE**

**LANEWAY CONCEPT WITH A FOCUS ON ACCESS**
Left:
This laneway option focuses on reducing the presence of access for day-to-day activities, allowing for an increase in open space spanning the length of the laneway. A two metre access width allows for 3 people to move through the space at one time, which could significantly restrict the amount of people able to use the access during an emergency.

Right:
This second option looks at balancing access routes with an equal amount of open space. In doing so it will provide space for day-to-day activities, whilst allowing significant space for emergency access.

Left:
This consideration views access as the dominant feature of the laneway and, therefore, deserves priority over open space. This could potentially become problematic in the activation of the laneway for the day-to-day use of the space.
DRAINAGE

Right:
This iteration looks at using vegetation to filter drainage running from the Terrace down the laneway to Lambton Quay. This concept would be impractical as far more vegetation would be needed to filter the run off.

DEBRIS PROTECTION

Right:
This concept considers a form of shielding or protective cover from falling debris, such as broken glass. Although the idea has identified a potential problem, there could become issues with the form due to natural light, strength, and poor aesthetic.
This concept attempts to blur the boundaries between interior and landscape. When does a landscape become an interior and when does architecture become a landscape?

This design looks at the resilience attribute ‘Modularity’ in conjunction with open space appropriation. It proposes open space modules that could be customised to fit its surrounding context or a program forced upon it.
DEVELOPING A LAMBTON QUAY AESTHETIC

Right:
This idea is directly influenced by Wellington’s existing CBD laneways and their very clean, formal aesthetic. It also is beginning to address structural integrity and materiality.

TRANSFORMING LANDSCAPE

Right:
This concept is about embracing diversity and ephemerality. This design creates a different experience for each modular terrace. However, what is truly interesting about this design is its ability to both open up and close, creating an open plan design that can lock up at night and appropriate space during the day.

Sliding walls allow shops to open up and appropriate the laneway for daily use.
FORMAL LANEWAY

Right:
This Laneway is about creating very loose space that maintains the appearance of the very formal CBD aesthetic. It prioritises access over the programming of open space.

DEVELOPING A WELLINGTON AESTHETIC

Right:
This laneway iteration is very much about programming the laneway in such a way that is culturally in tune with the Wellington laneway aesthetic. It is about designing a sequence of spaces that would appeal to Wellingtonians, allowing people to influence the design that surrounds them.
DEVELOPING AN EARTHQUAKE MOTIF

Right: This concept is about using the idea of an approaching earthquake as a design motif, operating as a constant reminder to the public that they live in an earthquake prone environment.

WAYFINDING LIGHTING

Right: This design iteration is beginning to consider lighting and how it might be used as alternative wayfinding signage during the night.
The Terrace

More relaxed recreation space

More formal retail/business area

Wellingtonians street art work ‘leaving their mark’ on the city.

Emergency access and wayfinding lighting

Plugs into surrounding context

Figure 6.2.23

Figure 6.2.24

Materiality

Grafetti
Wooden Floor
Rough Concrete Walls
Window Glazing
Hard Wood Seating
Non Slip, Painted Steel
Sandblasted Concrete
Red LED Lighting
Sandblasted Concrete Tiles

This final laneway concept is a convergence of many of the previous iterations that each made a significant contribution to both emergency function and daily occupation. The design itself is very loose promoting spatial appropriation, and the aesthetic attempts to combine Wellingtonian culture with a clean CBD finish. The laneway also plugs into existing shops and encourages the laneway walls to be painted in whichever way the people please with an annual ‘Paint The Laneway’ event.

KEY WORDS Preemptive Design, Loose Space, Bottom-up, Flexibility, Emergency Access, Wellingtonian Culture, CBD Aesthetic, Open Plan, Legal/Illegal Appropriation of space
Figure 6.2.25

EMERGENCY WAY FINDING SIGNAGE

EMERGENCY ACCESS

Open Space is intentionally left un-programed and loose. This will allow the public and shop owners to appropriate the space to real needs.

ECONOMIC VIABILITY

Art Gallery

Cafe

Modular rooms that could be tailored to suit a variety of programs

Retail Outlet

Structural Columns

Book Store

Possible Storage area or space for emergency supplies

Figure 6.2.25
DESIGN PROGRAMMING AND VALUES

POTENTIAL PROGRAMMING: The above images are representations of occupational suggestions and are not limited to this list of programs. In fact, the potential of this design could be far greater than outlined above, but, as a designer it is near impossible to design for all the possible programs that people may carry out in a space. It is our role as landscape architects not to define the program of a space, but to design in such a way that facilitates the ongoing appropriation of a space.
LANEWAY PLAN
LANEWAY PLAN What is important to note here is that the hierarchy of this design is given neither to access nor open space. Rather, they overlap in what could be described as a mutually beneficial relationship. The access way remains uncluttered and clear in case of an emergency, whilst the open space is fed with a constant stream of pedestrian activity.
LANEWAY SECTION

This section identifies not only the cliff like nature of the laneway and the climb that must be made from Lambton Quay to reach the Terrace during emergencies, but also the transgression of space from the Terrace, (where the laneway is treated more like a playful recreation area), to Lambton Quay, where there is a slight aesthetic shift to a more formal and shopping orientated use of space. This was done to fit more tightly with the surrounding context and to further promote the ongoing inhabitation of space for day-to-day use.
LANEWAY CROSS SECTION

This cross section cuts through the layers of activity present on the laneway, beginning to suggest potential programs and uses that go beyond the intended use of the space.
On top of the laneway spaces are in a constant state of flux where people perform their own activities in spaces of their choosing, only limited by the size of the space and the extent of their imaginations.

Beneath the surface of the laneway is a hive of activity that contributes economic viability to the overall design and more opportunities for engagement by the public.
LAMBTON QUAY VIEW
THE LANEWAY PENETRATES THE LAMBTON QUAY FACADE CONNECTING IT TO THE TERRACE

LAMBTON QUAY The above view shows the laneway plugged into its surrounding Lambton Quay context. The red ‘tapis rouge’ signifies emergency access, whilst the laneway itself begins to make a statement about developing an earthquake aesthetic - strong, bold, and iconic.
OPEN PLAN COFFEE SHOP
FORMAL APPROPRIATION PROMOTES INTERACTION BETWEEN ACCESS AND OPEN SPACE

COFFEE SHOP This image is a suggestion of a potential program that might occupy one of the interior terraces. It also shows how such programs, in this case, a cafe/coffee shop, might begin to occupy the exterior space of the laneway on a daily basis, tearing down the boundaries between interior and landscape.
ANNUAL PAINTING OF THE LANES
ONE DAY A YEAR WELLINGTONIANS ARE ENCOURAGED TO FORMALY LEAVE THEIR MARK ON THE LANEWAY

THE ANNUAL PAINTING OF THE LANES This image is about promoting the legal and sometimes illegal activities that activate, define, and shape the character of a space. In Wellington, street vending and other such activities are more or less non-existant. However, street art and graffiti are on every corner and are actively playing a role in defining the character of spaces around Wellington. This idea celebrates this form of art whilst allowing people to shape the space that surrounds them by painting a section of the laneway or simply leaving there mark during the annual ‘Paint The Lanes’ event.
PARKS AND RECREATION
THE LOOSE PROGRAMMING OF THE LANEWAY ALLOWS FOR A VARIETY OF ACTIVITIES

PARKS AND RECREATION This image refers to the lack of both park and recreation spaces within the Wellington CBD and shows how the laneway provides a stage for the activities that shape these spaces to take place. The Terrace end of the laneway is described as being less formal and more about facilitating activities, which is what the space is intended to do through the provision of loose, flexible, and adaptable open space.
LANEWAY AS EMERGENCY ACCESS
The overall development of this preemptive strategy has focused on balancing emergency function with everyday use for the benefit of both the design and the safety of the public on the larger CBD scale. In light of this, the design concepts presented in part one of this design chapter are yet to resolve issues surrounding spatial implications of the 1:1 scale. Therefore, the design of this laneway should be seen as a case study for how the other design components of the previously outlined preemptive strategy would be refined down to a more intimate spatial scale, further exploring the opportunities presented by the site and its surrounding context.

PROPOSED LANEWAY SITE

Figure 6.2.37
This section of my design process aims to validate the functional claims of my laneway design by generating data based on my own physical abilities and limitations. It proposes two scenarios that are both used to work out the amount of people that could be evacuated from the CBD area over a 5 minute period via my laneway design. Scenario one looks at this evacuation occurring at my average running speed of 3.5 metres per second and scenario two looks at this evacuation period occurring at my average walking speed of 1.5 metres per second. The results of these two scenarios are then used to work out the mean number of people that may be evacuated from Lambton Quay and potentially saved over a 5 minute period during an emergency.

Due to this data deriving from my own physical abilities there are many important variables that have not been accounted for in these figures. For instance, it does not account for the effects of fatigue or adrenaline provoked by an emergency situation, fitness, age, various physical ability, disabilities, and other influences that may effect the final results. However, the data generated by this experiment do provide a general idea of the number of lives that could be saved in an emergency and, as such, it is a useful tool for exploring the functional capabilities of this design.
This data was generated through my own observations and findings and, as such, is loosely defined by my own physical capabilities. This data does not account for variables such as fatigue and adrenaline affecting performance.

The amount of people that can move up the laneway is restricted by the width of the access. This means at its thinnest point (3m), 5 - 6 people can move through the width of the space at any one time.

The above transect represents the access route laid out as one straight section. It is almost 100 metres in length, comprised of both flat landings and 88 stairs.
SCENARIO ONE
This scenario attempts to identify the number of people that could use the laneway to evacuate the Lambton Quay area over a 5 minute period during an emergency. The results of this scenario are generated based on the premise that people could move through the site at my average running speed of 3.5 metres per second (mps).

STAIRS
The laneway is comprised of 8 sets of 11-step staircases, reaching a maximum height of 17.6 metres.

My average stair climbing speed whilst running is 4 steps per second (4 sps).

(\text{Distance: 88 Stairs}) / (\text{Speed: 4 sps}) = \text{Time: 22 seconds} to climb 88 stairs at running speed.

FLAT LANDINGS
The laneway access route measures almost 100 metres in length. Without the stairs (300 mm runs x 11 stairs x 8 staircases = 26.4 m) it has a total flat run of 73.6 m, rounded up to 74 metres.

My average running speed is 3.5 mps.

(\text{Distance: 74 m}) / (\text{Speed: 3.5 mps}) = \text{Time: 21.1 seconds} to run the flat landings of the laneway.

STAIRS + LANDINGS = TIME TO RUN UP LANEWAY
\text{SO}
AN AVERAGE PERSON COULD RUN UP THE LANEWAY IN: 43.1 seconds

PEOPLE EVACUATED OVER 5 MINUTE PERIOD
Due to the access width of 3 metres, 5 people could potentially get from Lambton Quay to the Terrace via the Laneway in 43.1 seconds. After this time people would continually proceed up the laneway at 3.5 mps with a gap of 1.8 metres due to the surface area of a running person.

\text{TIME = 5 mins = 300 seconds}
300 secs - 43.1 secs (length in time for first person to reach top of laneway) = 256.9 secs of people being saved.

(\text{Time: 256.9 sec}) x (\text{Speed: 3.5 mps}) = \text{Distance of first person travelled past laneway: 899 m.}

899 m / (\text{surface area of a running person: 1.8 m}) = 499 people. (499 people) - (\text{Space between people: 1.8 m}) = 499m / 2 (as there will only be a person every second 1.8 m) = 249 people saved. This then needs to be multiplied by 5 due to the 5 person width of the laneway, so:

1,245 PEOPLE SAVED OVER 5 MINUTES

SCENARIO TWO
This scenario looks to identify how many people could evacuate the CBD over a 5 minute period given that they can only move as fast as the slowest person. In this scenario the slowest person is represented by my average walking speed of 1.5 mps.

STAIRS
The laneway is comprised of 8 sets of 11-step staircases, reaching a maximum height of 17.6 metres.

My average stair climbing speed whilst walking is 2 steps per second (2 sps).

(\text{Distance: 88 Stairs}) / (\text{Speed: 2 sps}) = \text{Time: 44 seconds} to climb 88 stairs at walking speed.

FLAT LANDINGS
The laneway access route measures almost 100 metres in length. Without the stairs (300 mm runs x 11 stairs x 8 staircases = 26.4 m) it has a total flat run of 73.6 m, rounded up to 74 metres.

My average walking speed is 1.5 mps.

(\text{Distance: 74 m}) / (\text{Speed: 1.5 mps}) = \text{Time: 49.3 seconds} to walk the flat landings of the laneway.

STAIRS + LANDINGS = TIME TO WALK LANEWAY
\text{SO}
AN AVERAGE PERSON COULD WALK THE LANEWAY IN: 93.3 seconds (1.33 minutes)

PEOPLE EVACUATED OVER 5 MINUTE PERIOD
Due to the access width of 3 metres, 5 people could potentially get from Lambton Quay to the Terrace via the Laneway in 43.1 seconds. After this time people would continually proceed up the laneway at 1.5 mps with a gap of 1 metre due to the surface area of a walking person.

\text{TIME = 5 mins = 300 seconds}
300 secs - 93.3 secs (length in time for first person to reach top of laneway) = 206.7 secs of people being saved.

(\text{Time: 206.7 sec}) x (\text{Speed: 1.5 mps}) = \text{Distance of first person travelled past laneway: 310 m.}

310m / (\text{Surface area of a walking person: 1 metre}) = 310. (310 people) - (\text{Space between people: 1 metre}) = 310m / 2 (as there will only be a person every second metre) = 155 people saved. This then needs to be multiplied by 5 due to the 5 person width of the laneway, so:

775 PEOPLE SAVED OVER 5 MINUTES
SUMMARY OF FINDINGS

The data generated in this section proposes scenarios that represent the optimum operating capacity of the laneway as it does not account for age, fitness, physical disabilities, fatigue, adrenaline, and other variables that could affect the outcome. The aim of this data is to conceptualise the possible impact of the laneway and to prove that this design would benefit the CBD area and potentially save lives in the event of a major earthquake along the Wellington fault.

The current problem with the CBD area (as outlined in Chapter 5) is that there is a lack of access to the terrace, which would create bottlenecks during emergencies and leave people trapped on Lambton Quay or potentially harmed trying to escape the area.

The proposed solution of creating more laneway connections from Lambton Quay to the Terrace would distribute the amount of people using each laneway more evenly, relieving the pedestrian pressure being built up in the CBD during emergencies.

STATISTICS NZ SHOWS THAT IN 2006, 4776 PEOPLE LIVED IN THE LAMBTON AREA, YET NO INFORMATION IS GIVEN TO THE AMOUNT OF PEOPLE THAT OCCUPY THE CBD DURING THE DAY. IT CAN BE ASSUMED THAT THE NUMBER WOULD BE SIGNIFICANTLY GREATER.

AVERAGE AMOUNT OF PEOPLE SAVED OVER A 5 MINUTE PERIOD TRAVERSING THE LANEWAY AT VARYING SPEEDS

\[ \frac{(1,245 + 755)}{2} = \text{mean} = 1010 \]

1. (Statistics New Zealand, 2006)
7 DESIGN DISCUSSION
The aim of this design is to demonstrate the potential of landscape architecture to play a major role within the field of disaster planning and mitigation, as a preemptive strategy that could save lives in the event of a major earthquake.

Throughout the development and design of this preemptive strategy this design led research project has made a number of discoveries, both specific to Wellington and to the overall idea of landscape architecture, making a major contribution to pre-disaster planning. This design:

- Has identified major issues of access within Wellington’s inner city. It suggests where the latencies are and where there are possibilities for embedding a different type of access into the existing structure of the city.
- Develops a hybrid multifunctional laneway that balances both the latent capacity to absorb and adapt to change with the ability to facilitate a wide range of activities that promote the ongoing habitation of space on a daily basis.
- Examines the possibilities of the existing CBD infrastructure through a typological study, exploring it as a starting point for developing a new way of inhabiting the city, using infrastructure as a means to occupy space.
- Finally, this design has developed a preemptive strategy for the Wellington CBD area that works to save lives in the event of a major earthquake all the while enhancing the urban environment for day-to-day occupation.
EMERGENCY FUNCTION VERSUS EVERYDAY USE

The most significant finding was the one major design consideration that absolutely controlled the success of the project. This was the mutually beneficial relationship between emergency function and everyday use. It was found that in designing a preemptive strategy for the Wellington CBD the most significant design challenge was solving the conundrum of how to design a sub-layer of latent emergency functions into existing open spaces and access ways without creating bland inactive spaces for everyday use. This led to the realisation that latent emergency functions need to have a balance with quality urban design in order to achieve a successful preemptive strategy. Quality everyday design ensures activation by the public on a day-to-day basis, ingraining the knowledge of where safe spaces are located into the minds of the users so that this knowledge could potentially save their lives during an emergency.

HYBRID PREEMPTIVE STRATEGY

This challenge was met and overcome by creating a hybrid preemptive strategy that adopted urban design techniques and theories, such as the bottom-up approach to design and the idea of loose, flexible space, and applied them to the design of this emergency infrastructure. Open spaces were designed for diversity, appropriation, and flexibility, provoking people to occupy and activate a space in a way that suits their needs. All the while emergency spaces were designed with latency, an earthquake aesthetic and the idea of survivalist urbanism, allowing these spaces to facilitate emergency functions whilst being visually obvious in communicating their function to the public.
FURTHER RESEARCH

Given the chance to alter or expand on this design research, there are many opportunities that either could not be investigated inside the time frames of this thesis or could not be explored within the current scope of the research.

To further develop this preemptive strategy by filling gaps in the research, a focal area would be the development of the elevated open space network, exploring what each space could offer during an emergency and investigating to a greater detail their opportunities for everyday use. As the design outlined in Chapter 6 focuses predominantly on access and the time immediately after the natural disaster, future design concepts may also look to further investigate a preemptive strategy that focuses on open space and a longer period of time post disaster. This exploration might consider the role of open space over 1 hour, 1 day, 1 week, 1 month, or even longer after the event. This would present new opportunities for design intervention whilst allowing open space to play a more active role within Wellington’s inner city.

The next step for expanding Wellington’s preemptive strategy would be to address access on the larger Wellington city scale. As evident in figure 5.4 (Access Routes) all access routes out of the city are in some way susceptible to earthquake related damage, such as slope failure or liquefaction. This could result in the isolation of Wellington for a significant amount of time, presenting a whole new set of issues and implications situated around the gathering of food, water, and other provisions.
A ROLE FOR LANDSCAPE ARCHITECTURE
Through design, this research has tested various concepts and iterations that centre around the premise that landscape architecture is a viable medium for disaster preparation. The outcome of this project illustrates the significant contribution that could be made to the landscape architecture discipline as it opens up whole new areas of design opportunities within the realm of disaster planning and preparation.

By looking towards resilience based initiatives there is a niche developing in the pre-disaster planning of cities that focuses on the safety and well being of the public during and after natural disasters. This is where landscape architecture can begin to make significant contributions to the disaster preparedness of cities through the generation of ideas such as preemptive strategies and emergency infrastructures.
In Conclusion, this research has explored various opportunities and approaches to developing a preemptive strategy for the Wellington CBD that combine quality urban design techniques with latent emergency functions. This created an emergency infrastructure that could save lives in the event of a significant earthquake along the Wellington fault, whilst enhancing the inner city for everyday use. The ideas presented by this innovative, preemptive strategy may provide insight into how other disaster prone cities in New Zealand and around the world may become more resilient to natural hazards, whilst indicating that there is a role for landscape architecture within the discipline of disaster planning.

This thesis has explored a landscape architectural approach to pre-disaster planning and has attempted to develop a preemptive strategy to mitigate the effects of the impending seismic hazard that threatens the heart of Wellington City. This research has identified major issues within the city in terms of resilience and access, and has taken steps towards finding solutions to these serious problems, focusing predominantly on pedestrian access ways and open space and their potential as lifelines during a major earthquake. These lifelines would have the latent capacity to absorb and adapt to change, saving numerous lives in the event of a major earthquake, while providing quality, people oriented public space for everyday occupation. Through combining quality urban design with latent emergency functions, this preemptive strategy allows landscape architecture to make a significant contribution to the pre-disaster planning of the Wellington CBD, whilst enhancing the city for day-to-day use, indicating a place for landscape architecture within the pre-disaster planning of cities.
The design suggestions and proposed solutions within this thesis are by no means an absolute solution for Wellington City's vulnerability to earthquakes, nor are they examples of the full extent of landscape architectures potential to contribute to pre-disaster planning. However, they are examples of how landscape architecture can make significant contributions to the field of pre-disaster planning, an area usually reserved for architectural and engineering solutions.

The preemptive design strategy generated through the duration of this thesis is designed specifically for the Wellington CBD and, as such, a focus is placed on access ways and open space as they are vulnerabilities specific to the site. However, this strategy proposes creative resilience based ideas that are the perfect starting point to be developed and adapted as required by any location, becoming applicable to other disaster prone cities in New Zealand and, potentially, around the world. Overall, this thesis has tested and explored creative new solutions in regards to urban resilience and has indicated that, not only can landscape architecture make a significant contribution to pre-disaster planning, but that spaces designed for an emergency function can still enlighten our day-to-day experience of the city.
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