

RESILIENCE IN BETWEEN

CHRISTCHURCH EARTHQUAKE 2011

On the 22nd of February 2011, a 6.3 magnitude quake with its epicenter in Lyttleton struck Christchurch, New Zealand. It was the second major earthquake since the 2010 Canterbury Earthquake. The earthquake caused extensive damage to buildings, sewerage, road and landscape across Christchurch. A total of 185 people from 16 countries were killed. Since the February earthquake, the residents of Christchurch have experienced more than 13,000 aftershocks and quakes. The loss of lives, the damage of buildings and infrastructure of the city reminded people that our cities are highly vulnerable to natural disasters. Given the fact that Christchurch is earthquake prone, the rebuild of Christchurch should aim to provide an appropriate environment for surviving future earthquakes.

AREA OF STUDY: CHRISTCHURCH CBD



Figure 1. Christchurch CBD

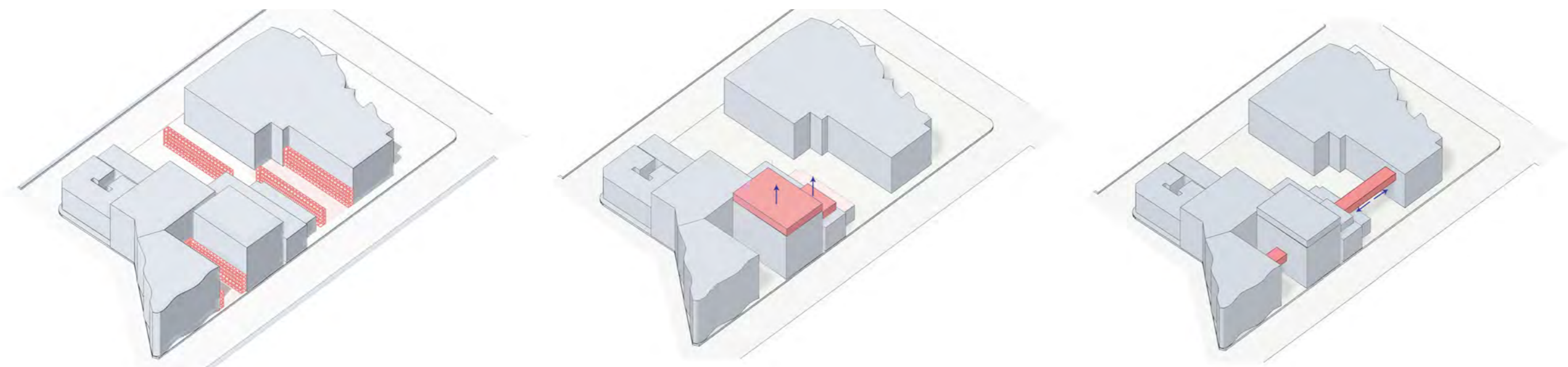
ASSESSING URBAN RESILIENCE

To understand how the earthquake affect Christchurch CBD's urban resilience and how the relationship between open space and building footprint affect its urban resilience, a comparative analysis was carried out between four scenarios that represent Christchurch CBD's built environment before and after the earthquake. The four scenarios are 1) the built environment before the 2011 earthquake; 2) the built environment after the earthquake, when all buildings targeted for demolition were 3) the current built environment 4) the Blueprint for the CBD extracted from the Central City Recovery Plan. The analysis adopted the hypothesis in ecological resilience which suggests that heterogeneity of the landscape is linked with its resilience capacity that a more diverse and heterogeneous urban landscape is more resilient to adapt to changes.

The result of the comparative analysis shows that open spaces are essential to urban resilience. When the diversity of open spaces increases, the total diversity of the built environment increases (Figure 9). In contrast, compact built environment (Scenario 4) reduce the benefit of open spaces, make the built environment overly simplified and rigid, and impact on the city's resilience capacity to adapt changes.

The analysis shows that the built environment needs a certain degree of looseness to enhance its urban resilience. However, when an event like an earthquake results in the urgent recovery of an urban fabric, the development of a compact built environment with large mix-use buildings is often considered as a solution to attract business back into the city quickly. So, the question is **how architects and designers can improve the quality of the open spaces left in between buildings in the CBD of Christchurch while increasing the diversity of their functions?**

CONCEPT AND PROGRAMME



Scaffolding Structure

Scaffolding structure is used to store water and food and provide shelters during disasters. Using light and temporary structure give the sites the flexibility to adapt and change over time. It is also inexpensive and easy to build.

Figure 10. Concept

The design proposal does not seek a resilient solution for the future Christchurch, instead its aim is to explore possible ways to utilise current vacant lots in Christchurch to benefit local community and provide people appreciate spaces to interact and to adapt in the times of earthquake. The design explores resilience concepts like diversity and heterogeneity, looseness, adaptivity and modularity. Here diversity and heterogeneity refer to the variety of functions and activities; looseness and adaptivity refer to the flexibility for individuals to the adapt the space for future demands or earthquake.

The design proposes to designate current vacant lots in Christchurch CBD as emergency shelter in the times of earthquake. However, earthquake is not an everyday event, the design will also demonstrate how the spaces can cater a wide of activities that benefit local community. The vacant lots will contain café, playground, community garden and accommodation constructed with scaffolding system, and these can continue to provide necessary food and shelters in the event of earthquake.

Figure 2. The massive demolition after the earthquake resulted in rapid population loss in Christchurch CBD

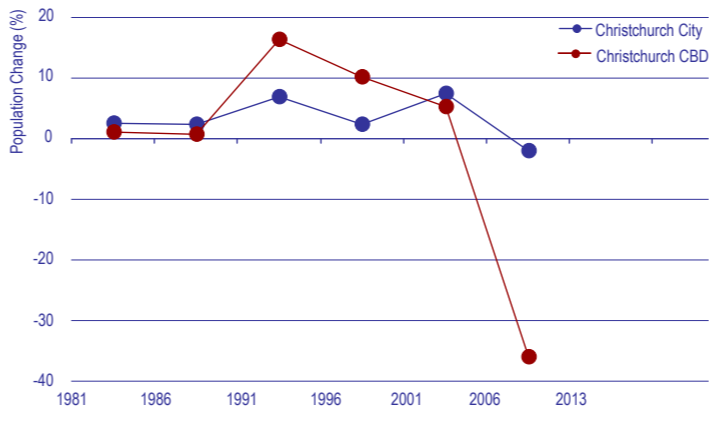


Figure 3. Christchurch CBD's built environment before the Christchurch earthquake 2011.

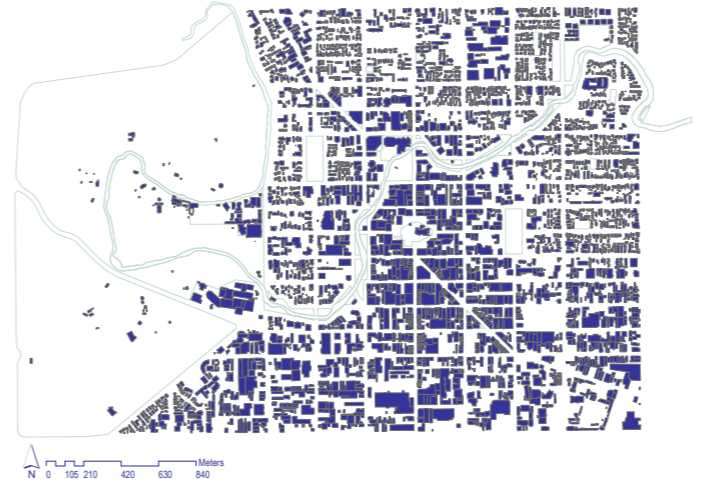


Figure 4. By February 2015, approximately a quarter of the buildings in the Christchurch CBD had been demolished. The built environment has been changed substantially.



Figure 5. Many vacant sites where construction is restricted are currently occupied as carparks

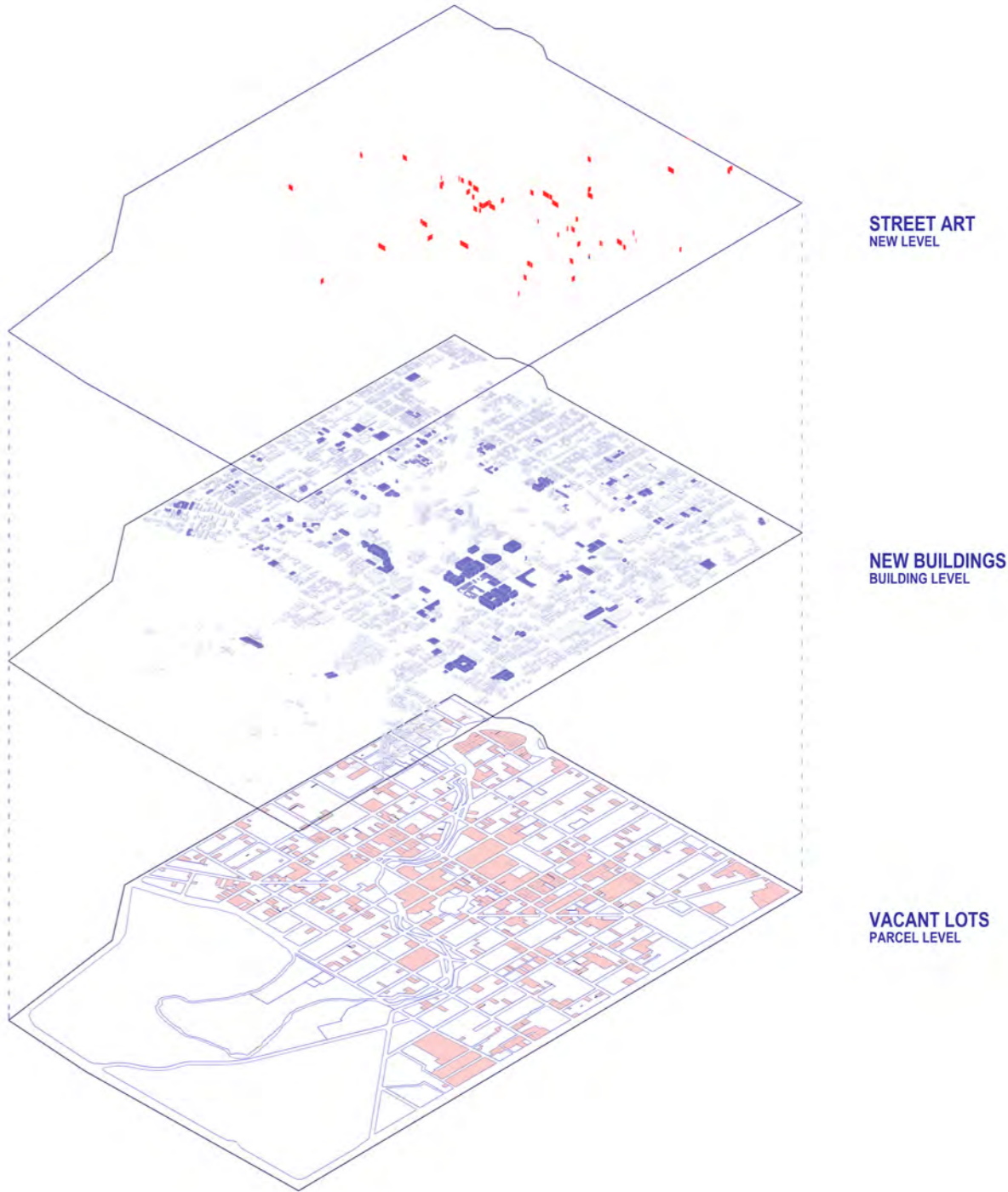
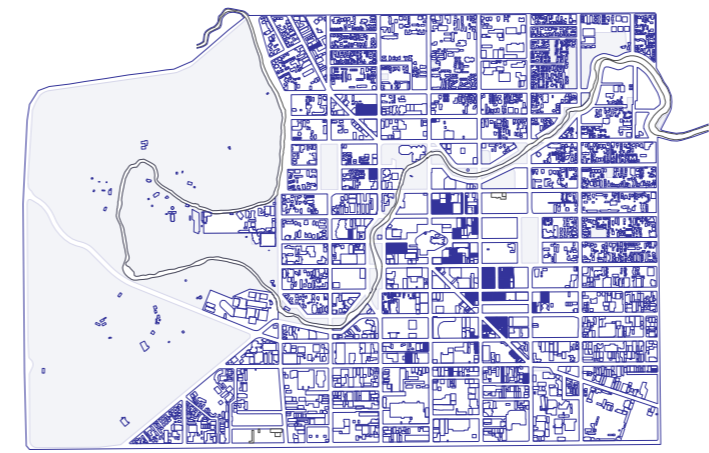


Figure 6. Emergent elements in Christchurch CBD after the earthquake

The area of study or the site for the design project is the Christchurch CBD (Figure 1). The CBD has been chosen because it has been the cultural, economic and political center of Christchurch and a meaningful place for all Christchurch residents. It is one of the areas worst affected by the 2011 earthquake. After the earthquake, the area had been evacuated and red-zoned for safety reasons, followed by massive demolition. By February 2015, approximately a quarter of the buildings in the Christchurch CBD had been demolished. The evacuation and massive demolition resulted in rapid population loss (Figure 2) and significant change in the built environment of Christchurch CBD (Figure 3). The CBD has become one of the major projects for the reorganization of Christchurch Seven years after the earthquake, new building complexes have been constructed. However, many sites where construction is restricted are currently occupied as carparks (Figure 5).

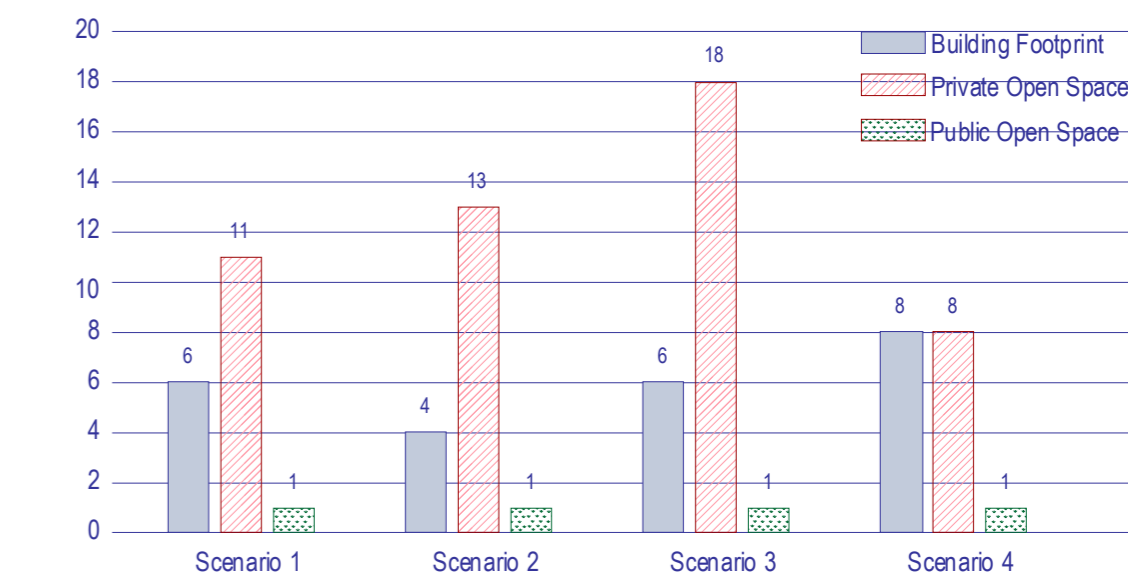


Figure 8. Clusters for scenario 1-4. BF in blue, private OS in red, and public OS in green. Scenario 3 has the richest built environment with 27 clusters in total.

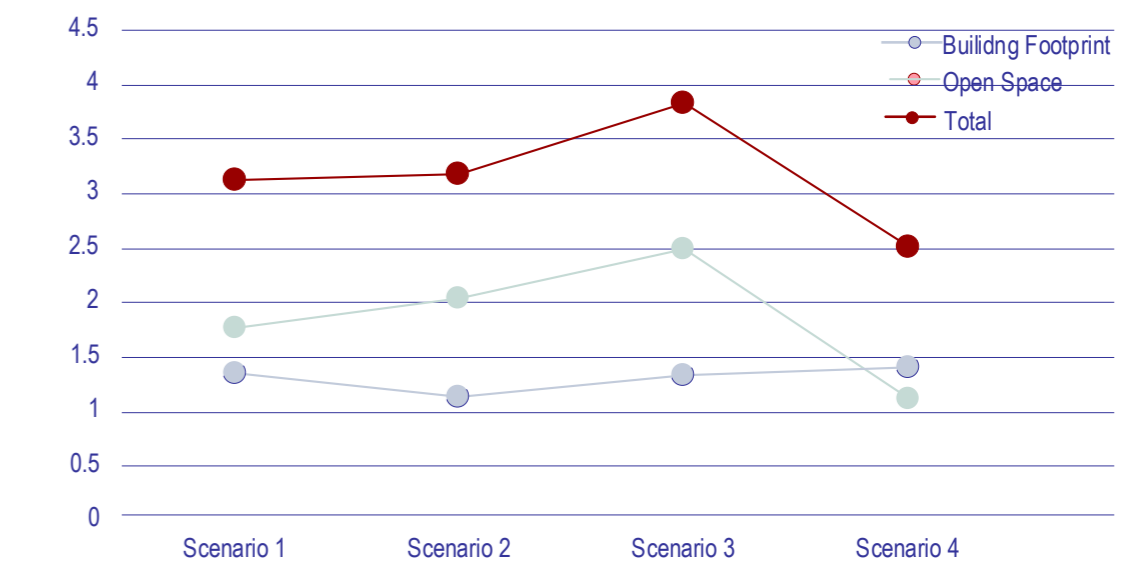


Figure 9. Diversity index for scenario 1-4. BF in blue, private OS in green, and the total diversity in dark red. The value of public OS was 0, so these are omitted.

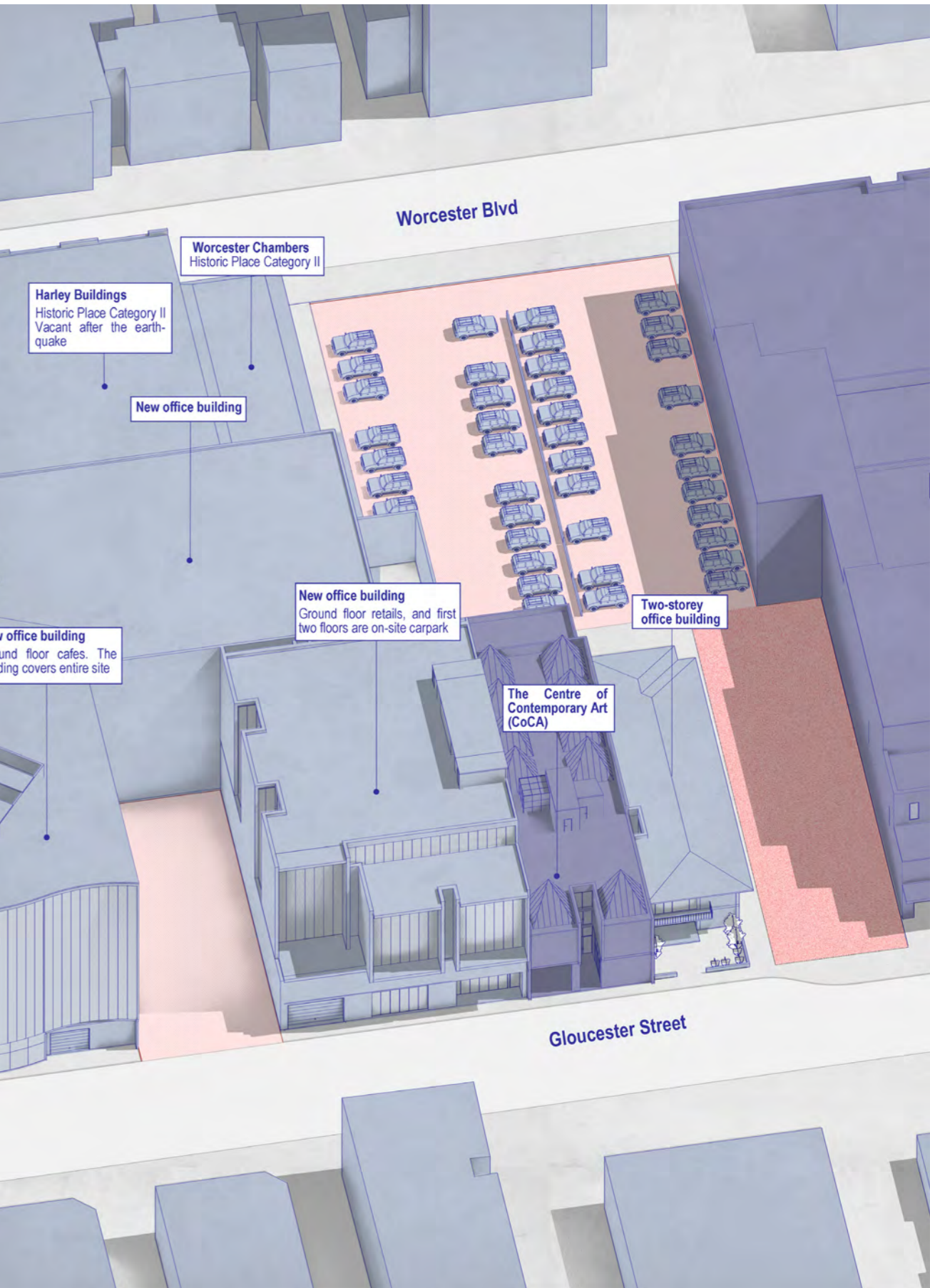
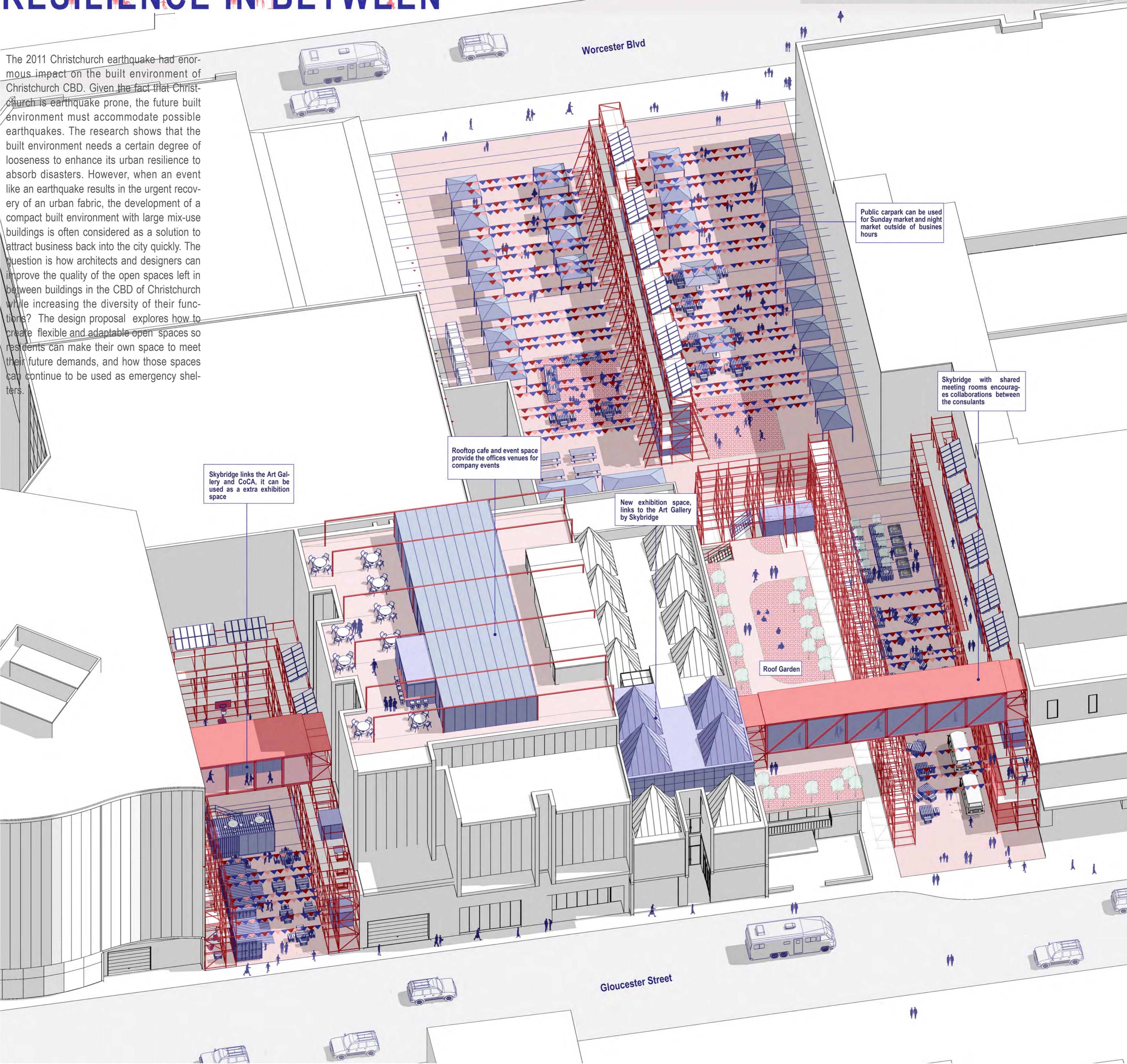


Figure 11. Existing Site

RESILIENCE IN BETWEEN

The 2011 Christchurch earthquake had enormous impact on the built environment of Christchurch CBD. Given the fact that Christchurch is earthquake prone, the future built environment must accommodate possible earthquakes. The research shows that the built environment needs a certain degree of looseness to enhance its urban resilience to absorb disasters. However, when an event like an earthquake results in the urgent recovery of an urban fabric, the development of a compact built environment with large mix-use buildings is often considered as a solution to attract business back into the city quickly. The question is how architects and designers can improve the quality of the open spaces left in between buildings in the CBD of Christchurch while increasing the diversity of their functions? The design proposal explores how to create flexible and adaptable open spaces so residents can make their own space to meet their future demands, and how those spaces can continue to be used as emergency shelters.



ACCOMMODATION

