Proposed industrial land rezoning

Cost Benefit Analysis

Wednesday 20 July, 2022

SENSE PARTNERS
DATA LOGIC ACTION

Context

Sense Partners has been engaged to conduct a cost-benefit analysis (CBA) of a proposed plan change. This proposed plan change consists of changing inner-city land from industrial general (IG) zoning to mixed use (MU) zoning.

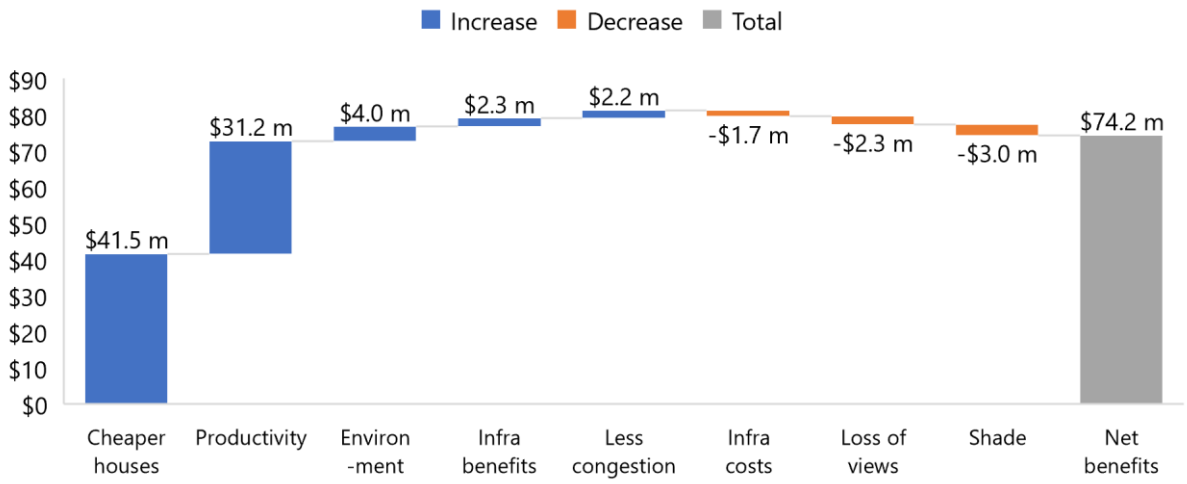
This report outlines the two proposed options, estimates the likely outcome of each option, and then compares these outcomes to infer the total net costs and benefits of the proposed changes.

Key points

Enabling medium density housing south of the city returns benefits that exceed costs

- Our central assessment suggests enabling medium density across a broad area south of Christchurch,[1] would enable 3,910 extra dwellings and return net benefits of $74.2 million dollars (see Figure 1) with a benefit-cost ratio of 11.65.
- Small but persistent returns to productivity improvements generate material benefits over time with smaller benefits to the environment, congestion, and infrastructure.
- Increasing housing supply lowers house prices, a little. More people can transact in the housing market at prices below their willingness to pay for a home. These extra transactions deliver benefits.
- But sales that would occur – regardless of the increase in housing supply – do not add benefits. This is because these sales are simply transfers between buyers and sellers of houses and net to zero. This is standard practice in CBA analysis.

Figure 1: Our analysis shows clear benefits from enabling medium density housing



Current land and house price trends suggest medium density will take time to develop

- We augment a simple development model with land and house prices trends and find the timing of likely medium density (4-6 stories) is likely to be 10-15 years away.
- Take up rates are also expected to be slow initially since other build types – including 1-3 storey townhouses – will return higher yields.
- Our base case suggests 3,910 additional dwellings in the study area – about one-third of the magnitude of extra dwellings suggested by the Medium Density Residential Standards Cost Benefit Analysis – in 15 years' time.
- This time to development reduces the present value of both benefits and costs to the zoning change.

[1] In this report, we define medium density as 4-6 storey dwellings.

- Using the 6 percent real interest rate recommended by New Zealand Treasury to discount future costs and benefits implies $1 million in 15 years is equivalent to a little about $417,265 in 2022.

Alternative policies and choices by non-market providers could increase pace of change

- It is perhaps not that surprising that the zone is unlikely to realise this form of housing for some years – the 4-6 storey format is not well catered for, not just within the zone but right across the city.
- It is not about commercial feasibility. While some types of the 4-6 storey format may not be commercial feasible today, we expect changes in land and construction costs to make the format feasible soon.
- But other build types – including 1-3 storey townhouses – are likely to continue to provide higher returns based on current trends in land and construction costs.
- Policy options to promote medium density could include mixed typologies where townhouses might cross-subsidise some apartments, if diversity of build type is important to council.
- Non-market providers, such as Kainga Ora, might be willing to take on short-term risk for longer-term rewards, could play a role in reducing risk for developers who may be unwilling to be the first to move to a new build typology.

Some outcomes are difficult to quantify but are encompassed by offsetting gains

- Some costs, that we leave unquantified, relate to the opportunity cost of using sites for residual housing purposes instead of industrial uses.
- Land price differentials show a more efficient land use is housing not industrial uses that are effectively receiving an implicit subsidy by not facing true rents.
- That subsidy helps provide more jobs in the study area. But unemployment is low, and it is likely that these jobs and businesses – including for example the significant areas of industrial land at Woolston and Middleton – will move to other locations in the city. This creates change for individual workers, Aggregate employment impacts are small.
- Increased commute time for these workers will be small relative to the commuting savings from allowing more residents to locate close to jobs in the city centre.

Outcomes are uncertain, so we consider a low and high case that also show net benefits

- There are many uncertainties when assessing future development over such a long period. Key uncertainties include the uptake rate, timing of development and cost of providing infrastructure.
- Table 1 shows a low, base and high case for the preferred policy option 2 and a less ambitious option 3 that retains some land for industrial purposes within the study area, return high net positive benefit-cost ratios.
- Our preferred based case returns net benefits of $74 million. Benefits tend to scale such that if fewer houses are realised, both benefits and costs decline, and the project remains a net positive proposition.

Table 1: Our analysis suggests material benefits from zoning changes

	Option 2			Option 3		
	Low	Base	High	Low	Base	High
Policy Impacts						
Extra people	2,976	4,887	4,887	992	1,629	1,629
Extra dwellings	2,380	3,910	3,910	794	1304	1304
House prices	-$15,484	-$25,438	-$25,438	-$5,166	-$8,484	-$8,484
Quantified Benefits						
Cheaper houses	$15,377,019	$41,502,259	$55,539,385	$1,711,539	$4,616,260	$6,177,597
Infra benefits	$1,382,235	$2,270,815	$2,879,059	$460,745	$756,938	$959,259
Less congestion	$1,344,388	$2,195,121	$2,812,461	$444,290	$728,964	$934,926
Environment	$2,455,113	$4,033,165	$5,165,144	$819,468	$1,344,388	$1,722,568
Productivity	$19,027,125	$31,172,693	$39,925,165	$6,315,498	$10,391,446	$13,307,962
Total benefits	$39,585,880	$81,174,052	$106,321,214	$9,751,540	$17,837,997	$23,102,312
Quantified Costs						
Infra costs	$1,005,411	$1,652,100	$2,093,977	$335,686	$551,249	$697,992
Loss of sun	$1,224,265	$3,016,234	$5,099,827	$408,088	$1,005,411	$1,699,515
Loss of views	$934,654	$2,300,434	$3,889,547	$311,003	$766,811	$1,296,089
Total	$3,164,331	$6,968,769	$11,083,351	$1,054,777	$2,323,471	$3,693,596
Summary						
Net benefits	$36,421,549	$74,205,284	$95,237,863	$8,696,763	$15,514,526	$19,408,715
Benefit-Cost ratio	12.51	11.65	9.59	9.25	7.68	6.25

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1. Overview

1.1. Context

Objectives of the proposed plan change

Objective 2 of the National Policy Statement on Urban Development (NPS-UD) requires councils to support competitive land markets:

> "Objective 2: Planning decisions improve housing affordability by supporting competitive land and development markets."

And Objective 3a makes clear that district plans need to: "enable more people to live in, and more businesses and community services to be located in, areas of an urban environment… near a centre zone or other area with many employment opportunities".

Intensification of land use in and around commercial centres can help achieve these objectives. To this end, Christchurch City Council is assessing the current use of IG zoning in the vicinity south of the central city.

Where IG land is required to meet industrial demand, it can be exempted from intensification as a qualifying matter under the NPS-UD. An assessment of industrial land sufficiency in Christchurch has found that the supply of industrial land is sufficient to meet demand. There is in fact a significant surplus of industrial land within Christchurch (see Table 2). In addition, the only location specific demand for industrial land is at the port in Lyttleton.[2]

Table 2: There is ample industrial land to meet future demand
Industrial land sufficiency estimates

Christchurch City	Short term (3 years)	Medium Term (10 years)	Long Term (30 years)
Demand (ha)	18.4	35.7	119.2
Supply (ha)	499.8	601.5	601.5
Sufficiency (ha)	481.4	565.8	482.5

Source: Dyason (2022)

This means that much of the surplus IG land in Christchurch should consider whether to rezone the area to enable a higher density of residential activity.

[2] See Dyason 2022.

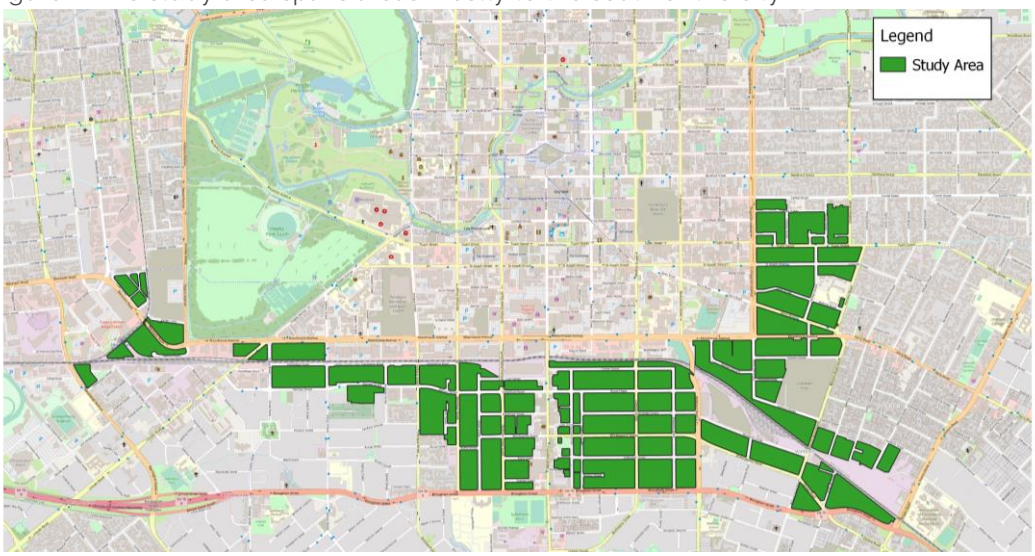
2. Scope

2.1. Study area

We focus on the suburbs covered by the industrial zoning

The study area covers the industrial zoning concentrated to the immediate south, and south-east of the city centre. The area extends south to Brougham Street, west to Whiteleigh Avenue, east to Ensors Road, and north to Cashel Street. Figure 2 below shows the study area, including the existing CMU zone at Addington.

Figure 2: The study area spans areas mostly to the south of the city



Source: Openstreetmap, Christchurch NZ

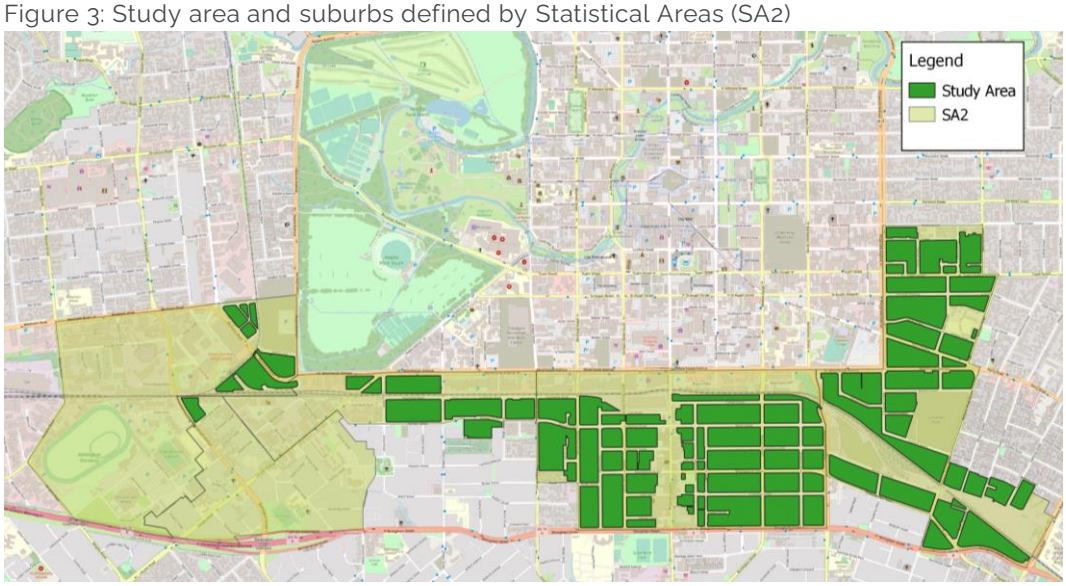
We use Statistics New Zealand's definition of suburbs – specifically Statistical Area 2 (SA2) – to show the characteristics of the study area. The study area has been aligned with five Statistics New Zealand suburbs areas or SA2s. These are listed in Table 3 below and depicted in Figure 3 overleaf.

Table 3: Study area and statistical areas (SA2) – SA2 References

Area	SA2 reference	Population (2021)	Workers (2021)
Lancaster Park	328800	280	4,000
Sydenham Central	328100	400	7,400
Addington North	326400	10	4,850
Addington West	326100	2,700	1,100
Tower Junction	325500	230	6,900

Source: Statistics New Zealand, Census data and Business demography data

Figure 3: Study area and suburbs defined by Statistical Areas (SA2)



Source: OpenStreetMap, Christchurch NZ, Statistics New Zealand

2.2. Options

Option 1: status quo

The first option is to retain the current industrial general (IG) zoning unaltered. This is the base case to which the alternatives will be compared to assess costs and benefits. There are many activities permitted in this zone which are also permitted activities in the Option 2 and Option 3 zoning. Table 4 below summarises the activities which are permitted in IG and are not permitted in option 2 –mixed use.

There are site-specific permitted activities which do not apply to IG zones more broadly. It is assumed that these site-specific settings will remain unaltered regardless of broader zoning. As such these are excluded from the analysis.

Table 4: Summary of permitted activities – Industrial General

Permitted activities	Specifics
Industrial activity	Includes manufacture, assembly, and repair. Excludes mining/quarrying, aggregates processing, and heavy industrial activity. The latter is anything likely to generate air emissions.
Community corrections facility	N/A
Ancillary activities	Some ancillary commercial and food and beverage outlets etc

Source: Christchurch City Council, Operative District Plan

Option 2: A full rezoning

The second option is to rezone the entire study area to mixed use (MUZ), enabling housing in across the entire study area. This is essentially the Commercial Mixed-Use Zoning in the operative district plan, with some proposed changes[3]. The permitted activities associated with MUZ are summarised in **Error! Reference source not found.** below. The MUZ zone is intended to allow a more permissive use of land. This includes retaining the option for industrial uses and introducing the option for residential activity.

The current CMU zoning includes allowances for industrial activities in specific locations. These are the CMU zone on Blenheim Road and Main South Road. It also includes allowances for residential activity in specific locations. These are the CMU zones in Addington, Mandeville Street, and New Brighton.

The current allowances for residential activity in the CMU zones are subject to several spatial and built form requirements. The plan change proposes to amend these to, unlike the operative plan, allow housing-only schemes.:

- permit (without resource consent) up to three units above another permitted activity only;
- enable (via a consent process), comprehensively designed residential development throughout the mixed-use zone.

Option 3: A partial rezoning

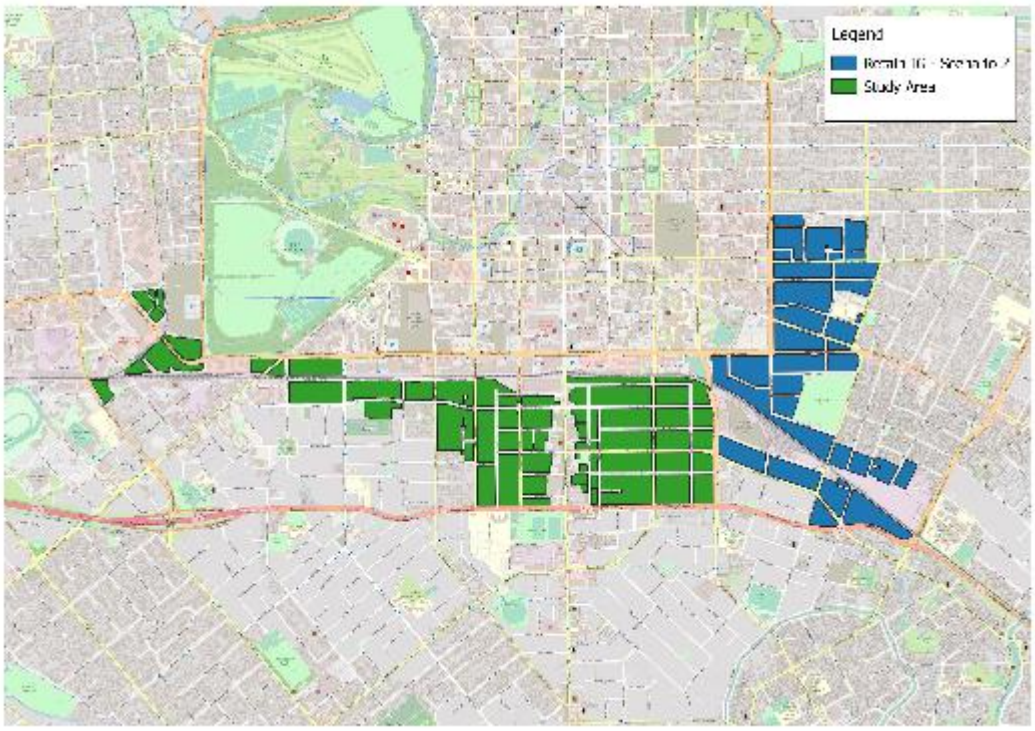
The third option is a hybrid of the first two options. This involves retaining the IG zoning in some areas and rezoning the rest to MUZ. There are two proposed areas for IG retention, with the intention only one is selected in the final option. These are shown in Figure 4 below.

- Scenario 1: retention of IG between Waltham Road and Hawdon Street.
- Scenario 2: retention of IG between Waltham Road and Ensors Road.

This option would retain the possibility for the allowance of residential activity in specified locations as in option 2. The exception may be allowing residential around Lancaster Park, which would remain IG under scenario 2.

[33] Council is proposing to change the name of the Zone from Commercial Mixed Use Zone to Mixed Use Zone to align with the standardized zone names in the National Planning Standards.

Figure 4: Partial IG retention options



Source: OpenStreetMap, Christchurch NZ

3. Options assessment

3.1. Summary

We assess benefits and costs relative to option one

We assess three core benefits and one primary cost for each of option 2 and 3. These benefits and costs are estimated relative to option 1, which is used as the base case or status quo.

There are other benefits and costs that could be associated with urban development. However, these are not assessed as they are considered either marginal or difficult to measure reliably.

Table 5: We restrict our analysis to core costs and benefits only

Qualitative assessment of key benefits and costs

Option	Benefit/cost	Relative magnitude
Option 2 (Full rezoning)	Benefit: housing supply increase	High
	Benefit: agglomeration benefits	High
	Benefit: reduced transport cost	High
	Cost: Infrastructure costs	Medium
Option 3 (Hybrid)	Benefit: housing supply increase	Medium
	Benefit: agglomeration benefits	Medium
	Benefit: reduced transport cost	Medium
	Cost: Infrastructure costs	Low

Source: Sense Partners

We use adjacent suburbs and the city centre as comparators

To understand the impact of the proposed changes, we compare the study area to other parts of Christchurch. We select two areas for comparison.

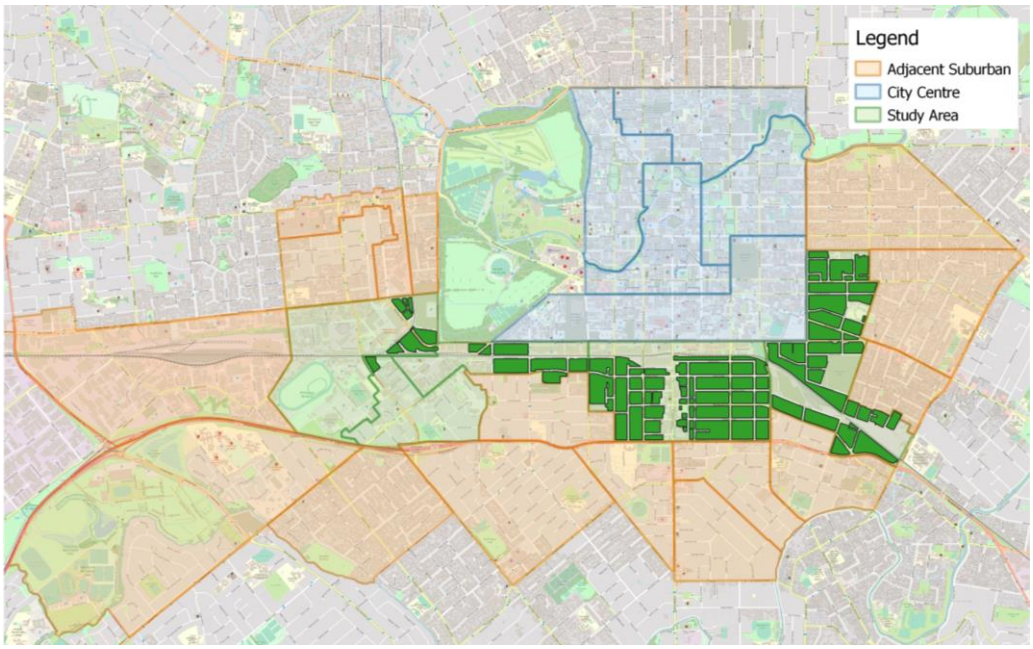
The first is made up of the city centre, excluding Hagley Park. This is a unique urban form in Christchurch, as it is higher density and the economy is oriented towards commercial, retail, and hospitality. This urban form is like the type of residential activity that will be enabled under the proposed changes. This makes it a good comparator from a population perspective.

The second is an aggregation of SA2s surrounding the study area. These are primarily lower density residential areas, with concentrations of commercial, retail, and hospitality, as well as some industrial areas (see Figure 5 and Table 6. The proposed changes do not allow further retail or commercial activity outside of the Sydenham commercial centre. If rezoned, the economy of the study area may more closely resemble the pattern found in these suburbs, making it a good comparator from an economy perspective.

By considering these two areas, we may get a sense of how the study area may evolve if the rezoning is implemented.

Figure 5: We compare the study area to the city centre and suburbs

Selected areas, SA2



Source: Statistics New Zealand

Table 6: Population by suburb, comparator areas by SA2

Name	SA2 reference	Population (2021)
City Centre		
Christchurch Central-South	327100	870
Christchurch Central	326600	130
Christchurch Central-East	327000	2,940
Christchurch Central-West	325700	1,180
Christchurch Central-North	325200	2,920
Adjacent Suburban		
Phillipstown	328900	4,320
Linwood west	327900	5,360
Charleston (Christchurch City)	329600	1,530
Waltham	329900	2,050
Sydenham North	329400	2,180
Sydenham West	328700	1,330
Sydenham South	329700	2,840
Addington East	327400	3,130
Spreydon North	327600	4,000
Spreydon West	326900	3,180
Hillmorton	325000	2,930
Middleton	323500	210
Riccarton South	324400	3,850
Riccarton Central	324200	70
Riccarton East	325200	1,250

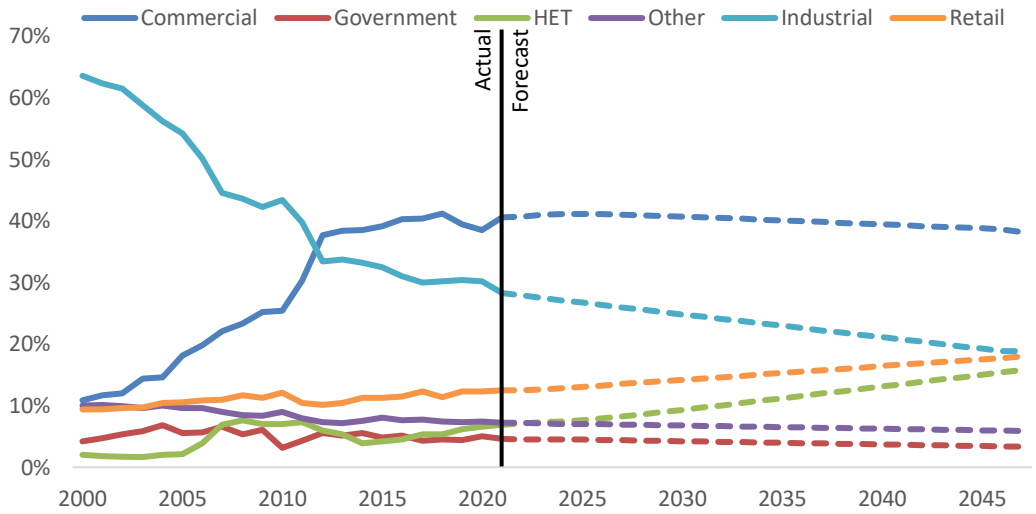
Source: Statistics New Zealand

3.2. Option one: Status Quo

Industrial zoning will restrain growth in the commercial sector

Under option 1, land use will be primarily restricted to industrial activity and ancillary activities. To understand how land use may change over time within these constraints, we use an economic model to project future demand based on recent historic data. Figure 6 shows a sharp decline in the share of industrial jobs in the study area between 2000 and 2010.

Figure 6: Expect demand for industrial land to continue to decline



Source: Sense Partners

Statistics New Zealand data indicates there were 10,818 industrial jobs in the study are in 2000. This had fallen to 8,494 jobs by 2010. Falling job numbers only partially explains the shift in shares. Importantly, commercial jobs increase from 1,849 in 2000 to 4,981 by 2010.

This reduction in the share of industrial jobs reflects the fact that the study area is a more valuable location for commercial sector jobs than for industrial jobs. Since the 2010 earthquakes, the share of jobs in the commercial sector has stabilised.

Existing IG zoning largely restricts commercial activity to those activities which are ancillary to a main site use of industrial activity. For example, a manufacturing facility (primary activity) with additional office space to support (ancillary activity) the work taking place on the factory floor. This may also include a retail shop that sells what is produced or processed on site.

Because of this constraint, commercial jobs can only grow if there are industrial jobs to which they are ancillary. Otherwise, current land use regulations imply that activity cannot take place. As a result, we have had to adapt the model to account for this constraint.

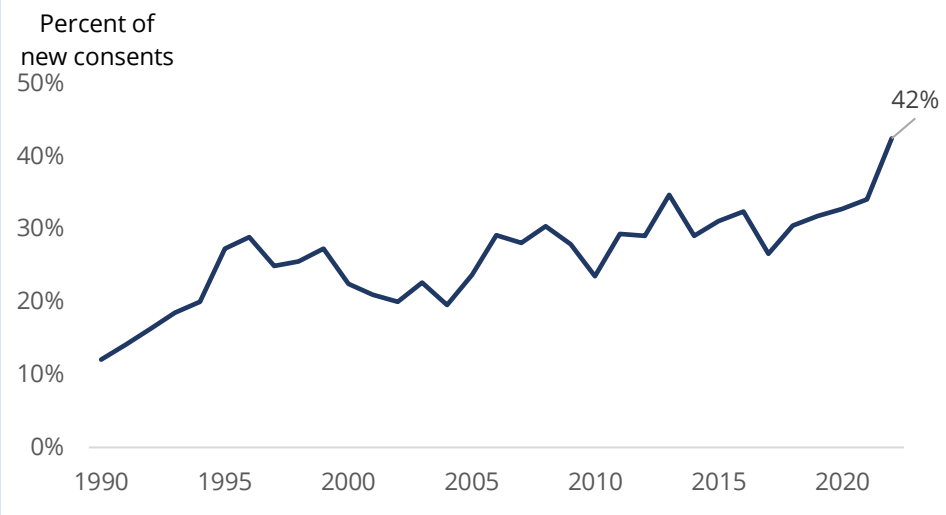
This means that the share of commercial employment is likely to remain around the levels it has maintained since 2011. As the population in surrounding areas grows, this is likely to lead to spill over demand for retail and Health, Education and Training employment. Growth in these sectors will take place along the existing commercial corridor along Colombo Street.

Box A: The shift towards logistics and warehousing

The trend to e-commerce is increasing demand for logistics and warehousing. COVID-19 and the persistent ability for many to work from home, has further boosted the trend towards distributing goods and services through e-commerce channels.

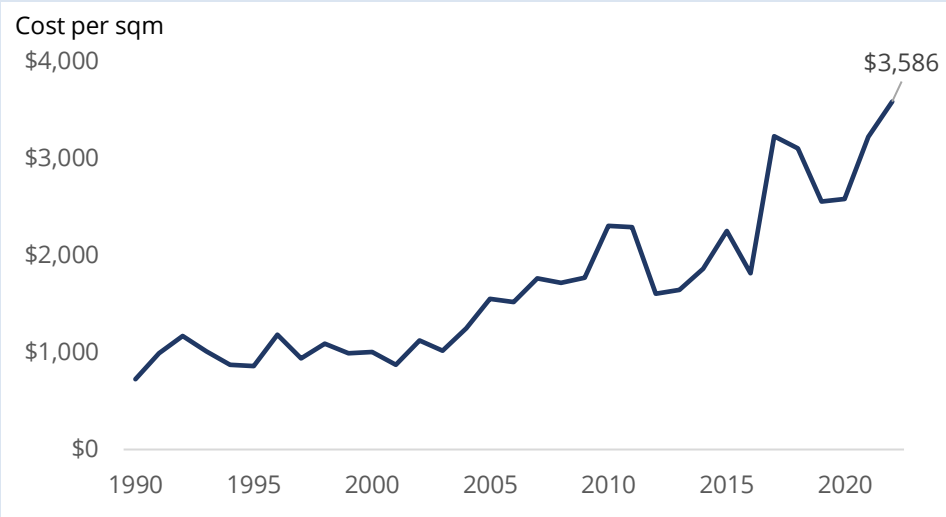
This unanticipated demand for logistics and warehousing, increases demand for industrial land to support these new demands. Figure 7 shows new consents for storage buildings as a share of non-residential buildings, spiked higher in the year to April 2022. New warehouses are increasingly sophisticated. Figure 8 shows spend per square metre is increasing.

Figure 7 Storage buildings are an increasing fraction of commercial buildings
Storage buildings (number) as fraction of new, non-residential consents, New Zealand



Source: Statistics New Zealand

Figure 8 Warehouses are increasingly sophisticated adding to build costs
Storage buildings, cost per square metre of new builds, New Zealand



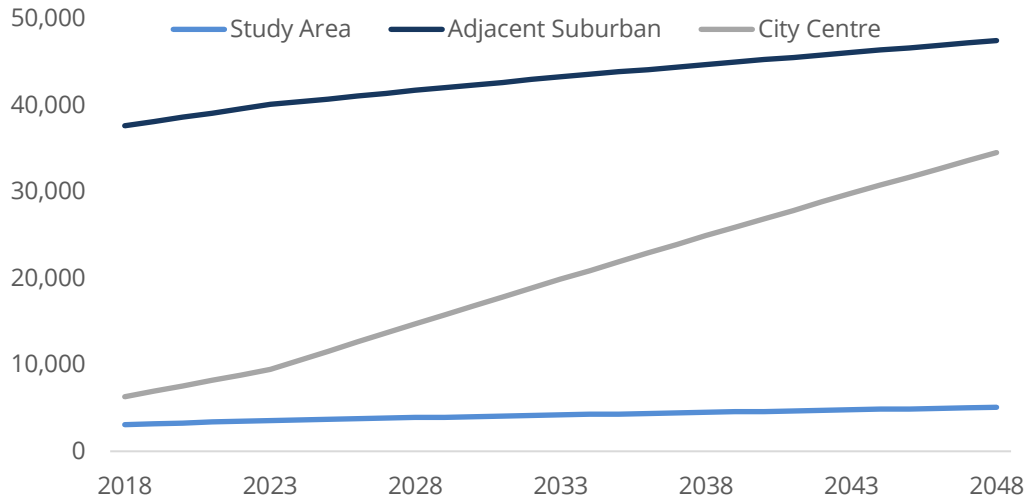
Source: Statistics New Zealand

Existing projections show little population growth in the study area

Without zoning change, expect little population growth and the population of the study area under option 1 will remain low. Any retail business looking to relocate to the study area will need to contend with a low local customer base, the cyclical nature of a workday customer base, and the need to attract people in from elsewhere on weekends.

Figure 9 below shows Statistics New Zealand's high population projections out to 2048, that use the 2018 census as input data. The study area has an estimated population of 3,380 people in 2021 and is projected to grow at an average annual rate of 1.7% - a higher rate than the adjacent suburbs. The city centre is expected to grow rapidly, at an average annual rate of 5.8%, from an estimated 8,206 people in 2021 to over 34,000 people by 2048.

Figure 9: Study Area Population Projections embed some additional population growth
Statistics New Zealand population projections, high, 2018-base



Source: Statistics New Zealand

3.3. Option two

Land use in the study zone will shift to residential

Table 7 below shows estimates of land values in the study zone by land use. Industrial land, at $467.10/m^2, is the least valuable land in the area. This indicates that industrial uses are less valuable than alternative uses in this location. Because the land is restricted to these uses, buyers are less willing to pay for the land, and so the value is low.

In contrast, land in the study area zoned for residential has a much higher land value, at $531.25/m^2. This indicates buyers are willing to pay a higher price, which implies they value residential activity more than industrial. Other land uses, particularly retail or offices, are higher value activities. However, the proposed rezoning will not expand allowances for these activities. Amenity value in the area might increase residential land values.

These numbers indicate that residential activity is the highest value use of land that will be allowed under the rezoning. This means that if the rezoning under option 2 is implemented,

that much of the land will shift toward residential uses. This conclusion if reinforced by the estimates of building height, measured as the floor-to-building plate ratio (FBR).

Building upwards is costly. Greater building heights on land zoned for a particular activity are another indication of the value of that activity in that location. The FBR for residential is 1.4, higher than the FBR for industrial land at 1.1.

Table 7: Residential is A Higher Value Use of Land Than Industrial Activity
Measures of urban form

Land Use	Land value ($/m^2)	FBR[4]
Industrial	$467.10	1.1
Commercial	$530.14	1.1
Retail	$708.95	1.1
Offices	$610.56	2.8
Residential	$531.25	1.4

Source: Sense Partners analysis from Christchurch NZ data

Aggregate travel costs across the city will likely fall

There are three factors which suggest that option 2 will lower transport costs. These are:

- proximity to the city centre,
- urban form,
- public transport service coverage.

The study area is closer to the central city than many suburbs zoned for medium density housing. Statistics New Zealand data indicates there are 215,355 filled jobs in Christchurch city as of 2021. The Christchurch City Council dashboard shows the 41,930 central city jobs.[5] The city centre has the highest concentration of jobs in the city, at 7,843 employees per square kilometre.

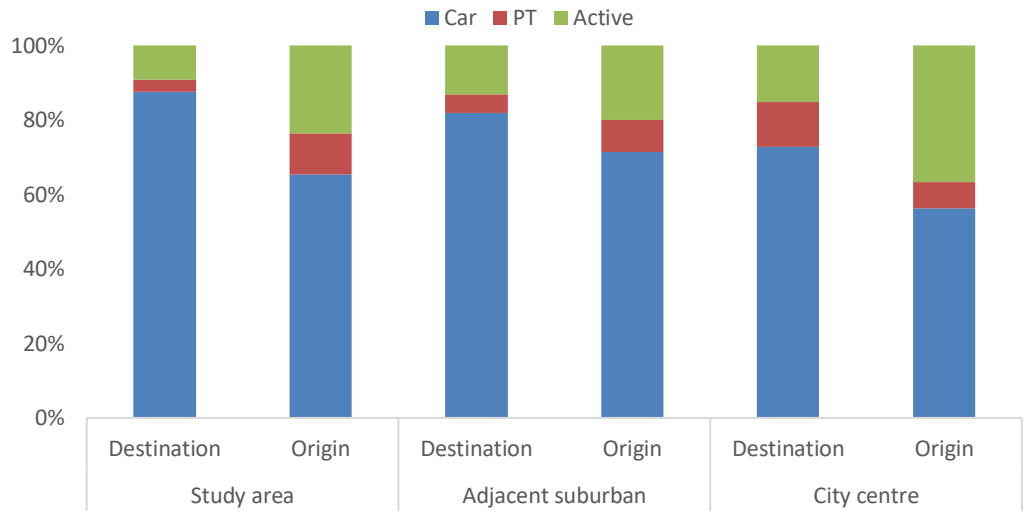
This proximity to a major source of employment implies lower transport costs. People working in the city centre, who would otherwise have had to live further away, are able to enjoy shorter commutes.

Urban form is a factor that influences mode shares of transport. Higher density brings more people within walking and cycling distances of day-to-day destinations. This is seen in the higher mode share of active modes and public transport for residents of the city centre (see

[4] Floor to building plate ratio. Indicates the average heigh of buildings in floors (including ground floor).
[5] See https://ccc.govt.nz/culture-and-community/central-city-christchurch/our-progress

Figure 10). Origin indicates journeys made by residents of each area. Destination indicates journey made by people travelling to that area, including residents.

Figure 10: Active and Pt Modes Have A High Share In The Study Area
Mode of travel, 2018



Source: Statistics New Zealand

With urban form expected to shift toward that seen in the city centre, we also expect that transport patterns will reflect those in the city centre. This implies mode shift toward walking, cycling, and public transport. Typically, people would only shift modes from car-based travel if the alternative mode was less costly in some respect than taking a car[6]. As a result, this implies a reduction in the cost of travel.

Going into further depth on public transport, Figure 11 overleaf shows the service coverage across the reference areas. The colours indicate how far away any given point in the street network is from the nearest bus stop. This is grouped into four bands.

- 100m: between 0m and 100m distance to the nearest bus stop
- 200m: between 100m and 200m
- 500m: between 200m and 500m
- >500m: over 500m distance to nearest stop.

The distance to the nearest stop is one factor that will determine the quality of the service provided, and thus ridership. The more closely spaced stops are, the shorter the walking distance from any point to access the service. However, this comes at the expense of a slower service due to more frequent stopping.

[6] This is not necessarily the case where the cost of driving has increased because of moving into the area. However, there is nothing to indicate that the cost of driving from the study area to the city centre would be higher than the cost for driving from further suburbs to the city centre.

Further spacing of stops can speed up a service, however this does not necessarily reduce coverage. People are willing to walk further distances to access a faster service. Achieving the balance must also consider service frequency, or how often buses run along the route.

Most of the study area lies within 500m of a bus stop. Whether this is sufficient will depend on the frequency of the service and the travel time to the desired destination. 500m may be a small distance for able bodies people to travel to access a frequent and fast service. For a slower service, and for disabled people, 500m may be too far to travel.

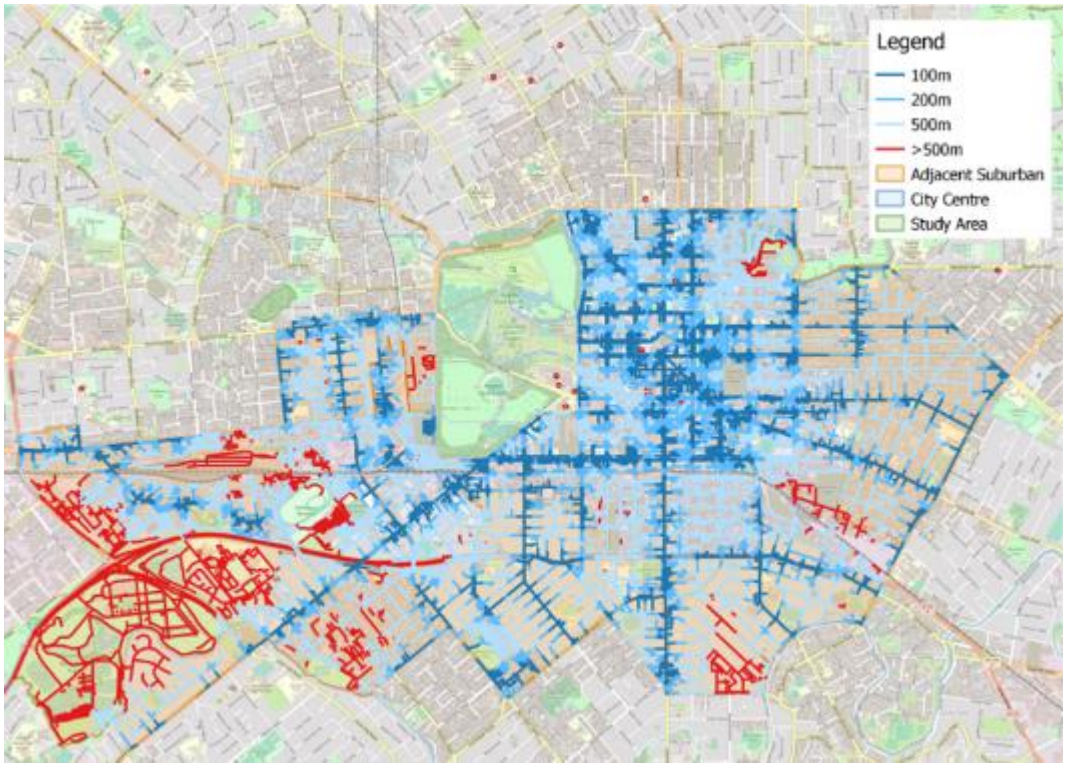
Adjacent suburbs have more patches of low coverage than the study area. Compromises in service coverage increase further from the city centre. This implies that residents closer to the city centre will have access to better public transport services than residents further out. As a result, enabling more housing in the study area will enable more people to take advantage of these services. This area will contribute to greater uptake of walking and cycling as a mode of transport given the cycling infrastructure in the area and the proximity to City centre.

The economy of the study area will likely mirror nearby suburbs

Figure 12 shows the estimate of the number of employees and businesses in each area. The data label above the blue columns also shows the average number of employees per business, a proxy measure for size. The data label above the red column shows the number of employees per square kilometre. This gives an indication of the spatial intensity of employment.

Figure 11: Service coverage depends on distance to stop and quality

Public transport service catchments



Source: Openstreetmap

The study area and the central city both have a high concentration of employees to land area, at 6,100 and 7,843 people per square kilometre respectively. This is, of course, a direct outcome of planning decisions. The central city and study area are both zoned for employment generating activities. Restrictions prevent businesses from setting up in the predominantly residential zones of the adjacent suburbs.

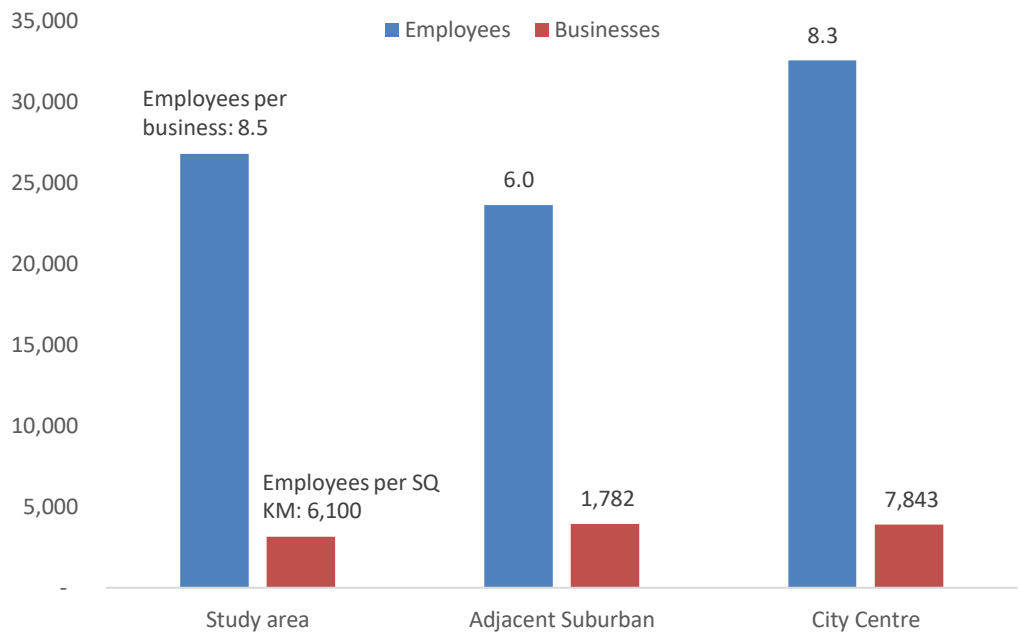
The proposed rezoning in option 2 will not allow for commercial or retail activity in areas currently zoned IG. As noted above, land use is expected to shift toward primarily residential uses. This means the number of jobs in the area is likely to drop towards something resembling the adjacent suburbs. This means fewer industrial jobs per km^2.

The sectoral composition of jobs is also likely to shift toward something resembling the adjacent suburbs. This is because the expected urban pattern of primarily residential use is interspersed with town centres where permitted, thus more closely resembling the adjacent suburbs. Existing land zoned for retail, hospitality, and commercial within the study area will function as these town centres. This includes the Sydenham commercial zone along Colombo Street.

Figure 13 below shows the number of jobs in each of the five largest sectors in each area. The largest sector in the study area, shown by the bottom blue bar, is professional, scientific, and technical services, with 4,690 jobs. The letter denotes the ANZSIC industry classification.

Figure 12: Adjacent suburbs have fewer jobs and smaller businesses

Employee and business count, 2018



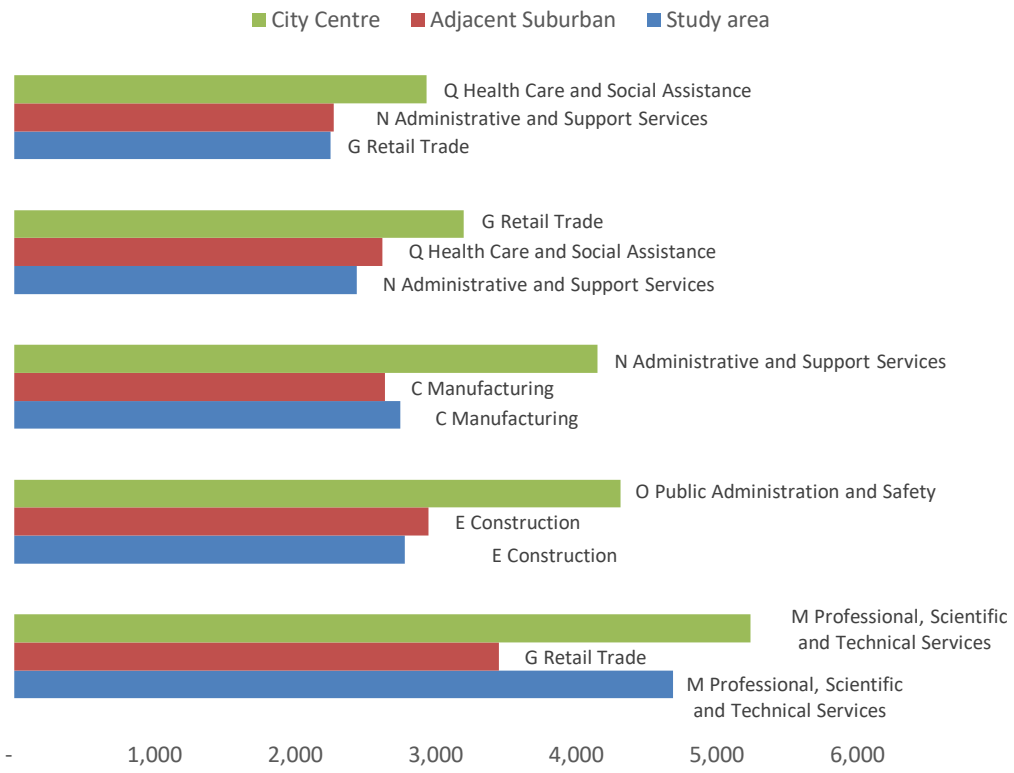
Source: Statistics New Zealand

If the study area is rezoned, the number of jobs in manufacturing will fall. Land will be used for its most efficient use, housing rather than industrial activity. Given this we would expect

employment in this sector to fall although some retail activity could be expected to offset these moves in the location of employment.

Note that the adjacent suburban area is much larger than the study area, so while jobs numbers are currently similar in some sectors, the spatial intensity of employment (jobs/km^2) is much lower.

Figure 13: Employment in the study area mirrors the Central city
Employee count by sector, top 5 in each area, 2018



Source: Statistics New Zealand

The transition will be gradual over a period of decades

Historically, the study area was primarily residential up until the mid-1950s. Figure 14 shows that in about 1945, the area was primarily residential homes, closely resembling surrounding suburbs.

Figure 14: The Study area was zoned for residential until the mid-1950s

Source: Canterbury Maps Open Data

The Town and Country Planning Act 1953 was New Zealand's first primary urban planning legislative tool[7]. Coinciding with the passing of this act, the urban pattern in the study areas begins to change. This is likely the result of a rezoning to industrial uses taking place.

The transition toward industrial uses was gradual. It is not until the 1990s that aerial footage shows no easily visible trace of residential activity. Figure 15 below shows aerial footage of the study area circa 1970. Much of the land has been converted to industrial uses but there are pockets of residential land, around the intersection of Gasson and Coleridge Streets.

[7] https://www.environmentguide.org.nz/activities/land-use/a-brief-history-of-town-planning/

Figure 15: The study area in 1970 shows some sites converted to industrial uses

Source: Canterbury Maps Open Data

On this basis, we do expect the shift from industrial to be gradual. The amount of land yet to be developed in the city centre proper means that some demand could be readily absorbed there. Alongside the more broader upzoning entailed in the Medium Density Residential Standards (MDRS), this may slow the conversion to residential in the study area.

3.4. Option three

Where permitted, land use will shift to residential

The types of benefits under policy option 3 are likely to be the same as options 2. However, since the policy spans a much smaller area, expects both costs and benefits to be of a lower scale due to a portion of the land being retained as IG zoning.

As with option 2, the higher value of land zoned residential implies that land use will shift toward residential where it is permitted. If a portion of the study area is retained as IG, then naturally that land will remain restricted to industrial uses.

The reduction in travel costs that option 2 brings is dependent on the number of additional dwellings the option enables. With less land rezoned to allow for residential activity, fewer dwellings will likely be provided. This means that the potential travel cost savings are lower with only a partial rezoning.

4. Method

4.1. Framework

Broad approach

Assessing the likely impact of the proposed policy change is challenging. To address the objectives of the NPS-UD -that include ensuring well-functioning urban environments and promoting competitive land markets – the policy seeks to embed a particular build type (four storey plus apartments) that are not currently a material element of Christchurch's urban form.

Enabling a particular build type is different to the commercial feasibility of a specific type of residential building. To make progress on the costs and benefits of the proposed policy we proceed with the following three step procedure:

- Step 1: Assess likely uptake rate for 4+ storey apartments
- Step 2: Assess likely change in the number and distribution of people across the city
- Step 3: Assess likely costs and benefits

Implicitly we are also assuming there is sufficient demand for housing based on Statistics New Zealand population projections for not just Christchurch but other regions. When housing supply increases, demand can be realised from both within the city and people living elsewhere that seek to benefit from lower housing costs than would occur without the increase in housing supply.

Estimating costs and benefits from the proposed zoning changes requires assessing the likely uptake rate for the proposed building type (4 storeys and above) not just today, but into the future.

Assessment of uptake rates based on the current environment suggests that in the future, buildings above six stories in the range of suburban centres explored, are feasible. However, for some years, other build types are commercially preferred over apartments of six stories and above since they return a higher yield given the cost of land and dwelling construction.

We focus on thinking about the likely path of the relative prices of housing and land, and how that can drive changes in the feasibility of different build types over time.

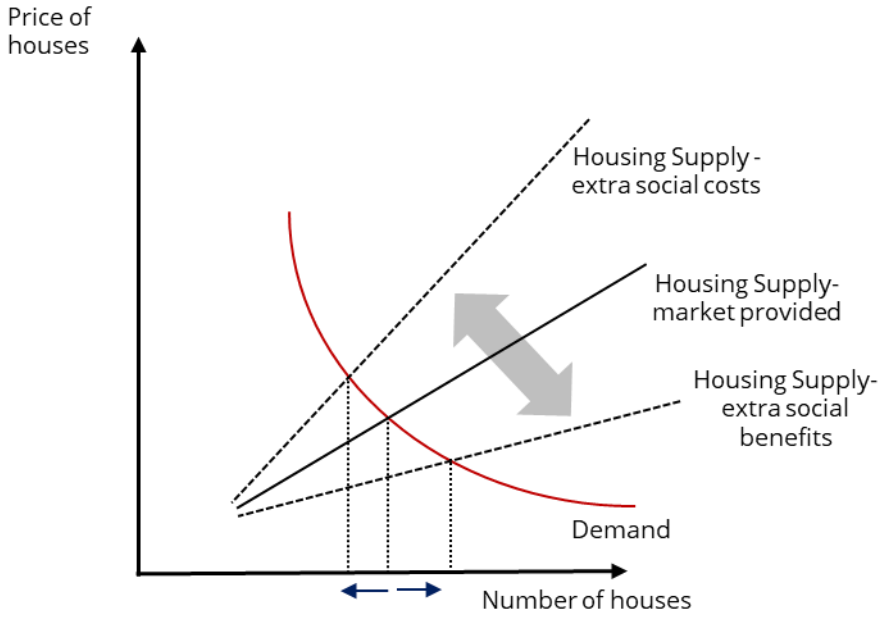
With the development sites in hand, then we can assess range of costs and benefits including:

- more efficient labour markets and knowledge spillovers that increase productivity and increase economic activity
- changes in commuting times that can increase or lower congestion depending on the nature of impacts
- environment costs that accrue form different urban forms
- impacts on local amenity including views and sunshine lost

- the opportunity cost of using the industrial land for other purposes.

What is critical is to evaluate, not just the commercial benefits of each project, but the wider social benefits – and costs – of the proposed zoning policies. Social impacts are likely to be broader than the impacts on prices alone (see Figure 16).

Figure 16: We seek to quantify social costs and benefits not just house price impacts



Source: Sense Partners

Step 1: Assess the uptake rate

To realise our analysis, we use a simplified version of the feasibility model developed by MBIE.[8] We restrict our analysis to the next thirty years, but this requires assumptions on:

- Demand for housing
- Commercial feasibility of 4+ storey apartments
- Relative profitability of different build types including detached, duplex, terrace, 2-3 storey apartments, 4-7 storey apartments and 8-12 storey apartments.
- Relative movements in the cost of land and construction costs that impact profitability

[8] The model is available on-line at https://www.hud.govt.nz/.

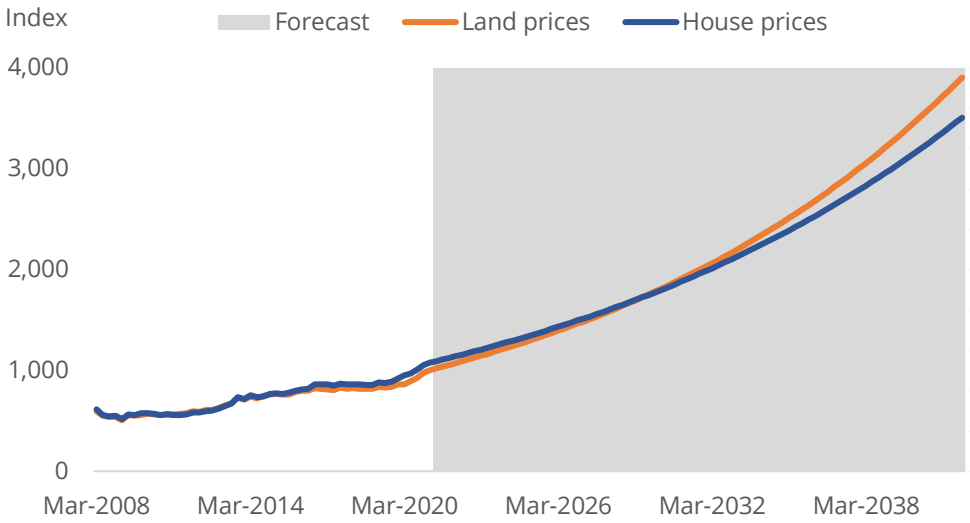
The development of different build types is sensitive to the relative cost of land and construction. When the land costs rise, the relative profitability of dense build forms rises. Figure 17 shows that growth in land prices outstrip growth in house prices over history.

Figure 17: History suggests land prices will grow faster than the price of housing
Relative land prices selected New Zealand cities (historical growth rates, Mar 1996- Mar 2021)

Source: Sense Partners

We use these growth rates to show expected Christchurch land and house prices in Figure 18.

Figure 18: Expected land prices Christchurch



Source: Sense Partners

Then we compute to show the change in profitability of build type over time in Table 8. It takes several years before apartments above 4 storeys are more profitable than traditional builds like detached, duplex or terraced-housing models. Other factors (including access to finance

for example) matte. But we use the model to guide our timing of when development occurs in the study area.

Table 8: The relative price of land drives profitability of different build types

Relative development profiles applying land cost estimates in MBIE's development model

	Detached	Duplex	Terrace	Apartment 2-3 storeys	Apartment 4-7 storeys	Apartment 8-12 storeys
Land costs						
2021	$859,280	$880,000	$901,220	$922,952	$945,208	$968,000
2026	$1,191,729	$1,220,465	$1,249,895	$1,280,035	$1,310,901	$1,342,512
2031	$1,652,799	$1,692,655	$1,733,471	$1,775,271	$1,818,079	$1,861,920
2036	$2,292,255	$2,347,530	$2,404,138	$2,462,110	$2,521,481	$2,582,283
2041	$3,179,112	$3,255,772	$3,334,281	$3,414,682	$3,497,023	$3,581,349
2046	$4,409,087	$4,515,406	$4,624,289	$4,735,798	$4,849,995	$4,966,947
2051	$6,114,929	$6,262,383	$6,413,392	$6,568,043	$6,726,422	$6,888,621
Other costs						
2021	$1,106,607	$1,916,042	$2,474,050	$5,136,339	$14,332,68	$27,429,501
2026	$1,412,343	$2,445,409	$3,157,585	$6,555,414	$18,292,54	$35,007,766
2031	$1,802,547	$3,121,030	$4,029,968	$8,366,554	$23,346,44	$44,679,766
2036	$2,300,557	$3,983,313	$5,143,373	$10,678,07	$29,796,63	$57,023,962
2041	$2,936,159	$5,083,829	$6,564,392	$13,628,23	$38,028,89	$72,778,631
2046	$3,747,365	$6,488,397	$8,378,013	$17,393,46	$48,535,57	$92,886,025
2051	$4,782,693	$8,281,022	$10,692,70	$22,198,95	$61,945,05	$118,548,72
Sales						
2021	$2,504,348	$3,592,174	$4,226,087	$7,513,043	$17,739,13	$30,052,174
2026	$3,327,737	$4,773,222	$5,615,556	$9,983,210	$23,571,46	$39,932,841
2031	$4,421,843	$6,342,580	$7,461,859	$13,265,52	$31,321,38	$53,062,110
2036	$5,875,673	$8,427,918	$9,915,197	$17,627,01	$41,619,34	$70,508,070
2041	$7,807,498	$11,198,88	$13,175,15	$23,422,49	$55,303,11	$93,689,979
2046	$10,374,47	$14,880,89	$17,506,93	$31,123,43	$73,485,87	$124,493,72
2051	$13,785,43	$19,773,48	$23,262,92	$41,356,30	$97,646,84	$165,425,23
Profit						
2021	$538,461	$796,132	$850,816	$1,453,753	$2,461,234	$1,654,673
2026	$723,666	$1,107,348	$1,208,075	$2,147,761	$3,968,021	$3,582,563
2031	$966,496	$1,528,896	$1,698,421	$3,123,702	$6,156,865	$6,520,424
2036	$1,282,860	$2,097,075	$2,367,687	$4,486,828	$9,301,236	$10,901,825
2041	$1,692,228	$2,859,279	$3,276,480	$6,379,577	$13,777,19	$17,329,998
2046	$2,218,025	$3,877,087	$4,504,628	$8,994,167	$20,100,31	$26,640,751
2051	$2,887,814	$5,230,081	$6,156,828	$12,589,30	$28,975,36	$39,987,894
Percent						
2021	27.4%	28.5%	25.2%	24.0%	16.1%	5.8%
2026	27.8%	30.2%	27.4%	27.4%	20.2%	9.9%
2031	28.0%	31.8%	29.5%	30.8%	24.5%	14.0%
2036	27.9%	33.1%	31.4%	34.1%	**28.8%**	18.3%
2041	27.7%	34.3%	33.1%	37.4%	**33.2%**	22.7%
2046	27.2%	35.2%	34.6%	40.6%	**37.7%**	27.2%
2051	26.5%	36.0%	36.0%	43.8%	**42.2%**	31.9%

NB Bold font shows profitability for 4-7 storey apartments higher than detached housing

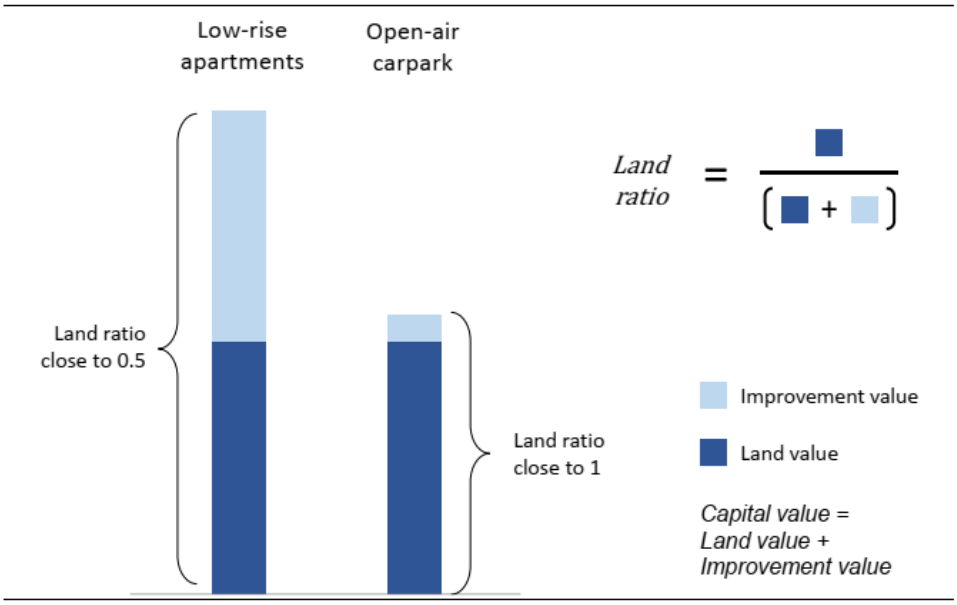
Source: Sense Partners

Table 8 underpins our assumption that it takes 15 years before 4-storey plus apartment building starts to be realised within the study area. The analysis in Table 8 is a city-wide market analysis. Sites closer to the CBD are likely developed for apartments prior to the study area.

But conversely, other developers that might have longer investment horizons (such as Kainga Ora or Christchurch NZ) could develop sites earlier than the market, bringing forward development a little. So we accompany our baseline with a high apartment development profile that begins in 10 years' time.

Then we examine the likely development sites with the study area by calculating the quality score (that uses land value, capital value, distance to the CBD and parcel size) for each site. Figure 19 shows that sites that can be more readily developed, such as open-air carparks have higher quality land ratios that help drive the quality score we construct.

Figure 19: The quality score suggests sites with little capital are ripe for development

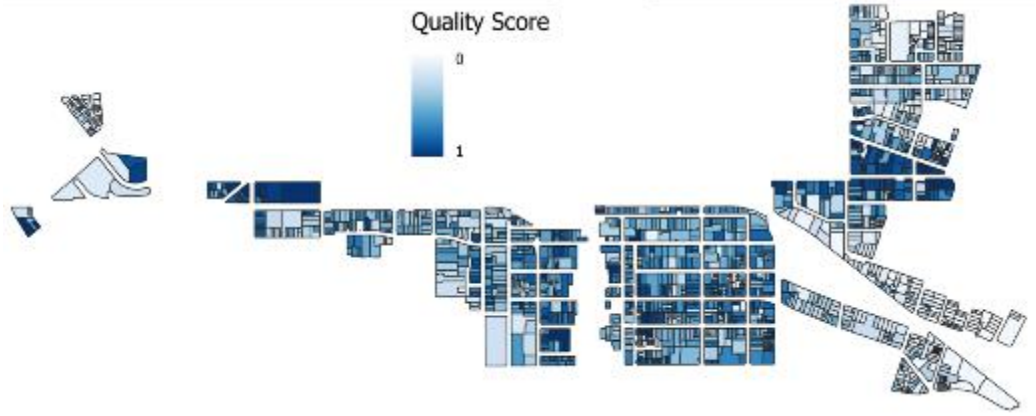


Source: PWC and Sense Partners (2021)

We map the quality score (see Figure 20) for the study area. Our analysis suggests a gradual increase in development over time and we lock this profile into our CBA analysis. This is supported by the histogram of the quality score (Figure 21) that shows a range of outcomes and the histogram of parcel size (Figure 22) that shows many small parcels in the study area.

We map the quality score (see Figure 20) for the study area. Our analysis suggests a gradual increase in development over time, in line with population growth, that produces a total of 4,887 new dwellings in the study area over a 20-year period, beginning in 15 years. A more fast or rapid "high" scenario enables the same number of dwellings but starts in 10 years' time. We also test a low scenario that embodies a weaker development track with 2,976 dwellings.

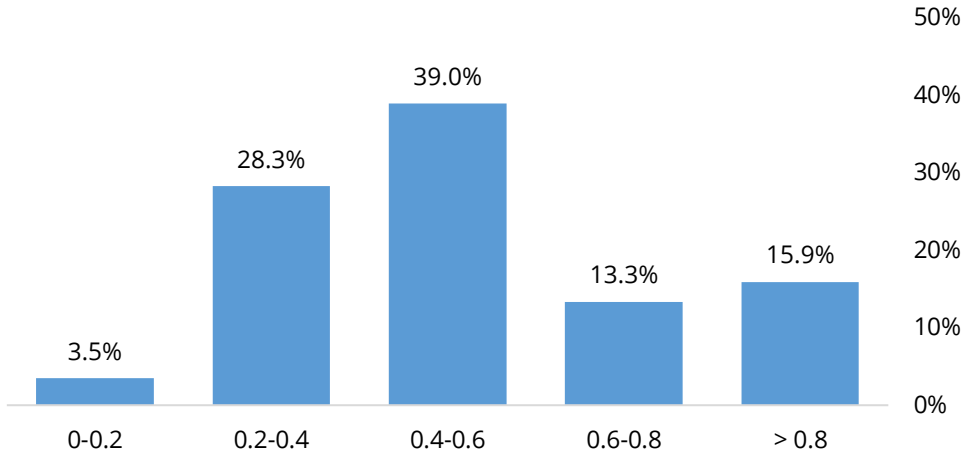
Figure 20: The quality score helps map likely sites for improvement



Source: Sense Partners

Figure 21: The distributions of the land ratio suggest a variety of sites

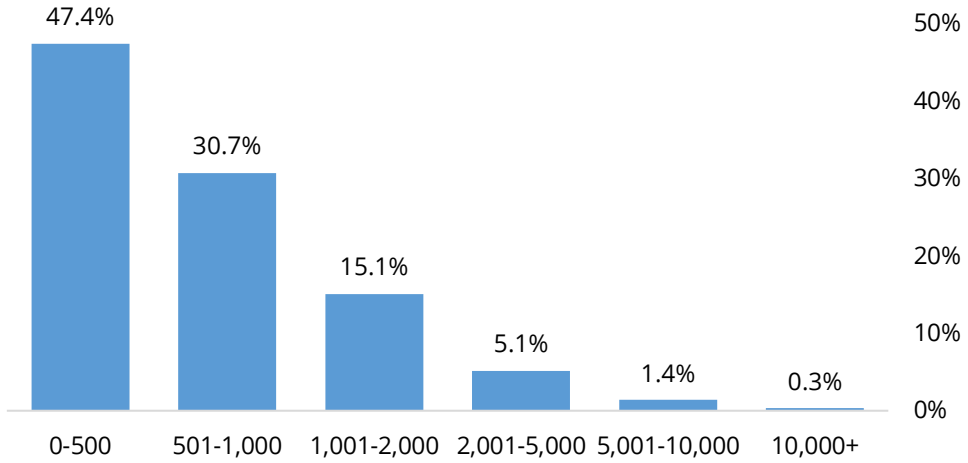
Distribution of the land ratio for parcels in the study area



Source: Sense Partners

Figure 22: The many small sites within the study area may be harder to develop

Distribution of the parcel size in the study area



Source: Sense Partners

Step 2: Assess the number of residents added to the city

Both policy options rezone land for residential purposes, increasing the supply of land for housing purposes and lowering the cost of housing.

This will draw people to the study area from two different sources:

(i) from people living in other locations in the city, perhaps either living with family or renting that on the margin, which can now establish a household;

(ii) new residents attracted to Christchurch from other regions.

It is difficult to be precise about the relative strength of each source of demand. We know from migration data that relative house prices are a strong attractor to a region. Equally, we can see new household formation in the data. We follow the approach in the MRDS CBA and average across both sources. Using Statistics New Zealand's expected family size for Christchurch in 2038 of 2.5, this implies a total of 12,218 people living in the study area under the base and high scenarios with half of this population drawn from outside the city.

Step 3: Assess likely costs and benefits

We use the broad framework from the Medium Residential Density Standards Cost -Benefit Analysis to identify the most pertinent costs and benefits to quantify. They include:

- Housing
- Agglomeration Benefits
- Transport costs
- Environment benefits
- Infrastructure benefits

4.2. Housing

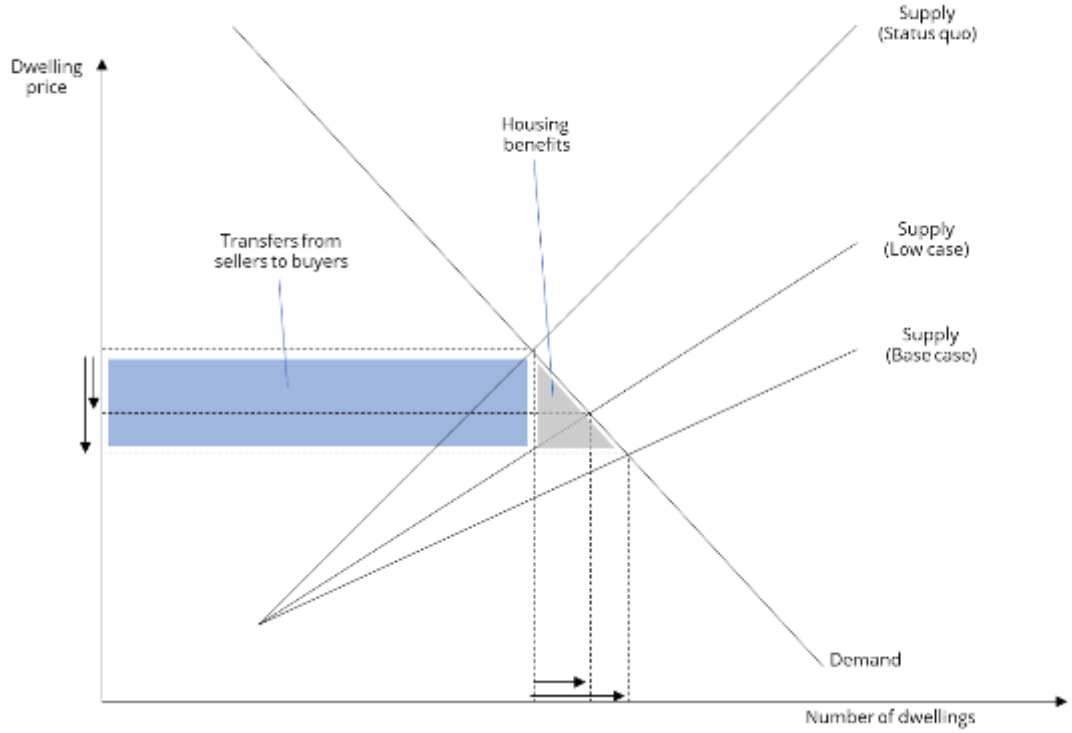
Increasing the supply of housing will lower prices. But most house sales are transfers from sellers to buyers. The impacts of lower prices of these transactions are net zero – good for buyers but not for sellers.[9]

But economic benefits do arise from the increase in the volume of transactions made possible by the increase in the stock of housing in the city. For these additional transactions, the difference between the willingness to pay and the price level are economic benefits.

[9] Decisionmakers may still wish to think about equity issues. We calculate the size of these transfers but then follow standard CBA procedures and set these issues to one side.

Figure 23 shows both the economic benefits (grey area) and the transfers (blue area) that we seek to calculate. We use the estimates of the price elasticity of demand for Christchurch to calculate these impacts.[10]

Figure 23: Housing benefits accrue from new transactions, not transfers



4.3. Infrastructure costs

Urban development typically requires the expansion of infrastructure. This includes roads, public transport, three-waters, electricity, telecommunications, and community infrastructure (parks, pools, and playgrounds). We focus on those elements likely to result in a cost to ratepayers, namely transport, three-waters, and community infrastructure. In this area, street amenity from pocket parks and general green area is likely to be high and should be included in costs.

Infrastructure costs can be lumpy. This is because upgrades to expand network capacity occur only periodically. When they do, they must expand to allow for growth over a suitable period. The total cost of the upgrade cannot be allocated just to the new residents who triggered the upgrade. Doing so would give a free ride to future residents who do not tip network capacity into upgrade territory. The cost of lumpy infrastructure must be smoothed over time and fairly allocated amongst residents new and old.

[10] We use the estimate of -1.332 used in the MRDS CBA (see PWC and Sense Partners 2021).

This does mean that developer contributions (DC) only cover a portion of the total cost of expanding infrastructure network capacity. MRCagney et al. (2016) estimate that as little as 73% of infrastructure costs of urban intensification in Auckland are covered by DCs. So omitted developer contributions could count as a cost.

We follow the MRDS CBA approach and consider additional infrastructure costs not covered by development contributions. This requires thinking through the infrastructure costs associated with building more dwellings at high urban intensities rather than the typologies that would exist in the absence of the zoning change. We assume that if the zoning change did not enable additional apartment dwellings, then a mix of brownfield and greenfield dwellings would be needed.

The new dwellings come with infrastructure costs we assess using the estimates of unrecovered developments costs of infrastructure from the MRDS CBA. These are costs.

We then consider the infrastructure costs for the greenfields development that would occur in the absence of the rezoning. These costs are no longer incurred and are rezoning benefits.

4.4. Agglomeration

Agglomeration benefits occur where people and firms are in closer proximity to each other. This reduction in economic distance yields benefits beyond immediate reductions in the cost of travel. These benefits include:

- **Deeper labour markets.** More potential workers within an economic commute means a larger pool to recruit from. This improves the chances of an ideal match between employer and employee, benefiting both.
- **Greater knowledge transfer.** Proximity of firms allows easer transfer of knowledge between workers and firms. This includes spontaneous collaboration between firms.
- **Economies of scale and network.** Being closer to more suppliers and customers means firms have more choice in who they buy from and sell to.

We calculate agglomeration benefits using the standard equation:

$$\Delta Productivity = \left(\frac{New\ city\ size}{Old\ city\ size}\right)^{elasticity}$$

This is a simple, one step process when applied to population forecasts in 2048. The key variable is the elasticity. There is a high level of uncertainty on the scale of agglomeration benefits, as it is usually highly contextual.

Rather than use MRDS CBA estimates provided Maré and Graham (2009)[11], we use new, recent estimates provided in Donovan et al. (2022) that are close to 0.04 for Christchurch city.

We follow the approach in the MRDS and omit hard-to-measure agglomeration benefits in consumption that occur when residents can access a variety of goods and services made

[11] Maré, David C. & Graham, Daniel J., 2013. "Agglomeration elasticities and firm heterogeneity", *Journal of Urban Economics*, Elsevier, vol. 75(C), pages 44-56.

possible by dense urban locations.[12] On balance these benefits are too hard to quantify but should be considered as modest upsides to our benefits estimates that are likely smaller in magnitude than the productivity estimates.[13]

4.5. Congestion and environmental impacts

Congestion

To estimate the benefits of the proposed zoning policy we rely on the costs of congestion estimated for Christchurch in the MRDS CBA. This work estimated an annual cost of congestion of $295 million dollars.

Since the suburbs in the study area are less commuting intensive than dwellings in greenfields areas, the reduction in commuting costs from the rezoning are benefits to the rezoning activity. We calculate the size of these benefits by examining the relative number of people living accommodated in brownfields accommodation rather than a mix of brownfield and greenfield accommodation.

Environmental impacts

To assess the environmental impacts, we use the values discussed at length in analysis provided by MR Cagney on the costs and benefits of urban development. We use values updated for inflation from the MRDS CBA we show in Table 9.

Table 9: Environment costs of urban development associated with different urban form

Costs	Brownfield	Greenfield
Loss of per-urban land		$201.61
Air quality[14]	$289.41	$242.80
Freshwater quality		$135.49
Coastal water quality	$	$149.25
Total	$289.41	$725.15

Source: MR Cagney et al. 1996, PWC and Sense Partners 2021

[12] See Ahlfeldt and Pietrostefani 2019 for example.
[13] See Donovan et al. 2022.
[14] Differences in air quality might be expected to change over time with take-up of electric vehicles.

4.6. Industrial land benefits

Using the land identified in the study area for housing comes with the opportunity cost of foregoing use of the land for industrial purposes. McDonald (2011) lays some of the relevant costs that include:

i. Relative tax takes from industrial land relative to residential uses

ii. Labour market benefits of industrial land use

iii. Transport benefits from workers who live near the industrial area.

We do not document relative differences between (i) and (ii). Right now, land values for industrial land are much lower than the comparative use as residential land. So relative local tax takes will be higher if the rezoning proceeds.

There can be value in terms of labour market outcomes from using the land for industrial purposes, but a specific set of conditions needs to apply, in particular, underemployed labour is needed, but at least for now, there are few unemployed workers within the Christchurch labour market compared to history. It is unlikely that the zoning change will increase unemployment in the city. Instead, firms will move to locations further out from the city centre where land costs are cheaper.

But transport cost can matter. On one hand, new residents benefit from the reduction in vehicle kilometres travelled (VKT) experienced by those who can relocate to the study area, closer to work in the city centre.

While the supply of land is fixed, the supply of houses is not. Greater urban density allows more houses to be built in proximity to amenities. This means more people can afford to live close to amenities and opportunities without having to pay high transport costs.

Zoning restrictions place an additional, artificial constraint on the supply of housing. This increases the cost of housing throughout the city and forces people to live further away from amenities and opportunities. As a result, they must pay higher transport costs to reach those amenities and opportunities.

The city centre is the focal point of the urban economy and has the highest concentration of economic opportunities. It can also support a high concentration of many types of amenities, such as hospitality and retail, and community facilities which benefit from economies of scale.

Removing restrictions on residential activity and allowing greater density in the study area will enable more people to live closer to the city centre, and its amenities and opportunities. In line with the Alonso-Muth-Mills model, we expect this will lower housing costs and transport costs.

A closer look at commuting costs

The first step is to calculate the VKT in a typical morning peak. We use Statistics New Zealand data on SA2 level population and SA2 level travel patterns. For each SA2, the proportion of the population who commute to work by car each morning is calculated using the transport data. This excludes those who are passengers in the vehicle.

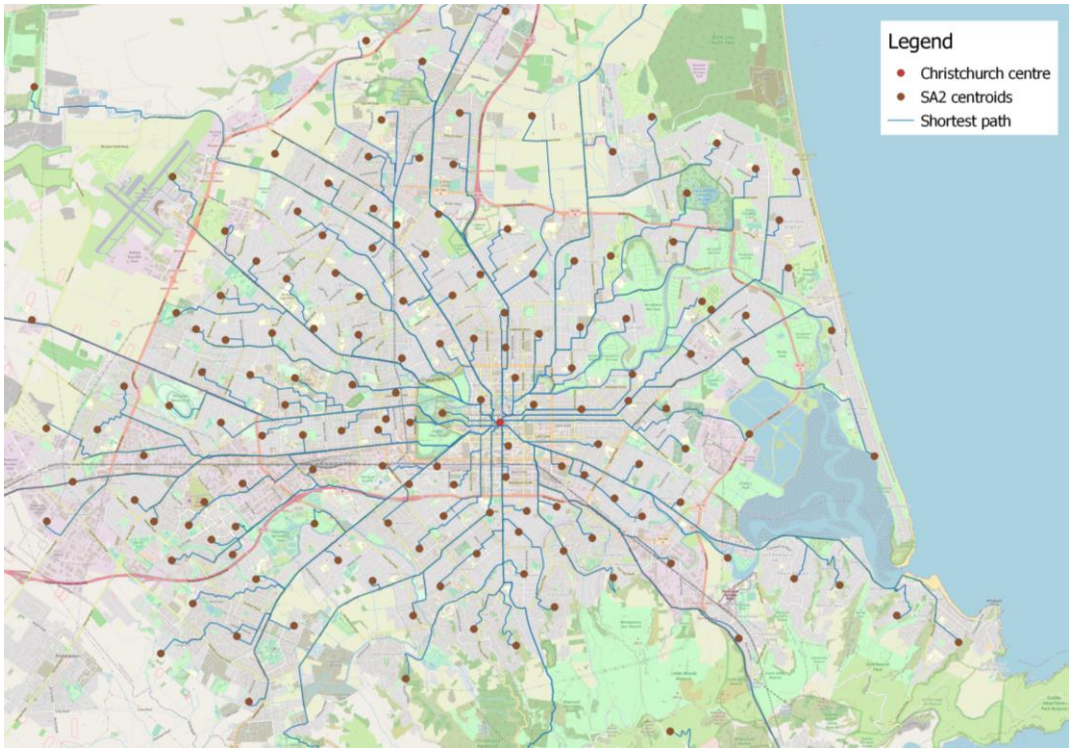
The average proportion across all SA2s in Christchurch, 0.53, is then applied to all SA2s uniformly when calculating the number of individuals commuting by car. QGIS and street network data from Open Street Maps is used to calculate the distance each commuter takes. This is done at the SA2 level, using a shortest-path algorithm that calculates the distance from the centre of the SA2 to the city centre. This is shown in Figure 24 below.

The distance in each SA2 is multiplied by the number of people commuting by private or company vehicle in each SA2 to get total VKT in a single peak.

Thinking about the change in the spatial distribution of workers and residents

The increase in population arising from the increase in dwellings calculated in the housing benefit analysis is used next. Of the increase in the population of the study area, it is assumed that half of this increase consists of people who would otherwise have lived somewhere else in Christchurch.

Figure 24: We Calculate Distance to the Centre of the City
Shortest path from SA2 centroids to city centroid



Source: Sense Partners, Open Street Map

We also assume that the individuals who would move to this city-centre adjacent area most likely work in the city centre. If they had to live elsewhere, we assume they would have commuted into the centre. As a result, those individuals who would have lived elsewhere now have a shorter commute to the city centre.

As an estimate of where these individuals would otherwise have lived, we assign half the increase in study population to each of the SA2s in Christchurch. This is based on each SA2s

share of projected future population using Statistics New Zealand 2018 high population growth projections.

Then we examine the likely profile of commute time in the city when jobs are moved from the study area location to the perimeter of the city.

To value the commute times, we use the marginal cost per VKT calculated by Wallis & Lupton[15]. This is adjusted for inflation to Q1 2022. This yields a marginal cost of $0.76. This is applied to the reduction in VKT each year to estimate a monetary value to the reduction. A discount rate of 5% is applied when calculating a net present value.

We find that the benefits of smaller commute times for residents in the city area is likely to outweigh the costs for workers at industrial sites displaced to the edge of the city. Smaller commercial operators might be expected to relocate to nearby cheaper locations.

Given the number of uncertainties that underpin precise distributions of where firms and residents locate, rather than providing quantitative estimates we simply note that this exercise provides evidence that commuting costs are improved by the zoning change.

5. Results

5.1. Option two: A full rezoning

Impacts

For option two, the full rezoning of the study area, we present the results of our analysis in Table 10. The first section of the table shows the impacts on the number of dwellings in the study area and the number of extra people in the study areas – living in apartments of 4-6 storeys.

Since we assume that half the people that are attracted to the study area come from within the city and half from outside the city, the implied city-wide population change is half the numbers report in Table 10.

[15] See Wallis and Lupton 2013.

Table 10: Our analysis suggests material benefits from option 2, a full rezoning

Element	Low	Base	High
		Policy impacts	
Extra people	2,976	4,887	4,887
Extra dwellings	2,380	3,910	3,910
House prices	-$15,484	-$25,438	-$25,438
		Benefits	
Cheaper houses	$15,377,019	$41,502,259	$55,539,385
Infrastructure benefits	$1,382,235	$2,270,815	$2,879,059
Less congestion	$1,344,388	$2,195,121	$2,812,461
Environmental impacts	$2,455,113	$4,033,165	$5,165,144
Productivity	$19,027,125	$31,172,693	$39,925,165
Total benefits	$39,585,880	$81,174,052	$106,321,214
		Costs	
Infra costs	$1,005,411	$1,652,100	$2,093,977
Shade	$1,224,265	$3,016,234	$5,099,827
Loss of views	$934,654	$2,300,434	$3,889,547
Total costs	$3,164,331	$6,968,769	$11,083,351
		Summary	
Net benefits	$36,421,549	$74,205,284	$95,237,863
Benefit-Cost ratio	12.51	11.65	9.59

NB Dollar values are in the present value, 2022 dollars
Source: Sense Partners

Benefits

Table 10 sets out the benefits we quantify. Since the economic benefits only accrue to new dwellings, we find that the change in house prices generate small benefits compared with other impacts. In our base, case $1,318,000 are delivered through house purchases where the buyer pays less than their willingness to pay.

But this masks large transfers in the housing market. The implied price change delivers a transfer of wealth from sellers to buyers of $438 million in the low case and $719 million in the baseline and high case.

Infrastructure benefits occur when housing occurs at relatively efficient sites. Listed benefits accrue from council not having to bear the cost of infrastructure provision at more expensive greenfield sites.

Two factors make the reported numbers appear lower than might be expected. First, the numbers relate to unrecovered development contributions only, costs that might be expected to be incurred by the community. Second, since our analysis suggests the proposed development takes many years before becoming commercially preferred, future benefits are heavily discounted. Recall that a $1 million dollars of costs or benefits realised in 25 years' time is worth a little under $300,000 in present value terms.

Our analysis also provides estimates of the benefits of reduced congestion and lower impact on the environment from medium density dwellings that attract people from a mix of brownfield and greenfield sites. These numbers are equivalent to the analysis within the MRDS CBA that derives a per capita congestion estimate that is then scaled down for brownfield urban development relative to greenfield development. Improvements in congestion amount to $1,334,000 in our base case and better environmental outcomes are $2,451,000.

The lion's share of benefits come from changes agglomeration impacts. These impacts come from deepening labour markets, greater knowledge transfers and economics of scale that occur when a city grows. These benefits are small for any worker in any particular year – less than $20 a year extra income. But since the benefits apply to all workers in the city each year after the development occurs, total benefits are large.

Costs

We set out three key costs we quantify in Table 10: (i) infrastructure costs, (ii) shade and (iii) loss of views.

Infrastructure costs are the counterpoint to the benefits identified in Table 10: unrecovered development contributions for brownfield intensification. On a net basis, note that the proposed rezoning delivers net benefits in terms of infrastructure.

We also include costs for shade and views.

At first blush, this can appear odd since the apartments are new. But relative to the alternative of greenfield development, the average dwelling is expected to have less sun and less expansive views. We have calculated these costs by rating down the costs and views in the MRDS CBA for Christchurch for intensive urban development.[16]

5.2. Option three: A partial rezoning

In addition to the full zoning, we calculate costs and benefits from the partial zoning change set out in option 3 and display these results in Table 11.

[16] This work is based on city-specific samples, in this case 100 properties from within Christchurch. With more knowledge of which sites will be developed, our in-house model, Icarus, which we use to calculate impacts of sun and views with more specificity.

We find smaller impact since the scale of the partial zoning change is expected to result in one-third of the number of new dwellings in the study area based on the size, location and quality of the land partially rezoned.

Fewer dwellings reduce both the benefits and costs of the rezoning. Impacts are not always precisely one-third smaller because of small non-linear impacts in the CBA analysis.

In the base case, the partial rezoning results in over $6 million of net benefits. Notably, the CBA is scalable: Benefit-Cost ratios are high and similar to the full rezoning case.

Table 11: Our analysis suggests smaller benefits from option 3 a partial zoning change

Element	Low	Base	High
Policy impacts			
Extra people	992	1,629	1,629
Extra dwellings	794	1304	1304
House prices	-$5,166	-$8,484	-$8,484
Benefits			
Cheaper houses	$1,711,539	$4,616,260	$6,177,597
Infrastructure benefits	$460,745	$756,938	$959,259
Less congestion	$444,290	$728,964	$934,926
Environmental impacts	$819,468	$1,344,388	$1,722,568
Productivity	$6,315,498	$10,391,446	$13,307,962
Total benefits	$9,751,540	$17,837,997	$23,102,312
Costs			
Infra costs	$335,686	$551,249	$697,992
Shade	$408,088	$1,005,411	$1,699,515
Loss of views	$311,003	$766,811	$1,296,089
Total	$1,054,777	$2,323,471	$3,693,596
Summary			
Net benefits	$8,696,763	$15,514,526	$19,408,715
Benefit-Cost ratio	9.25	7.68	6.25

Source: Sense Partners

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