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National Policy Statement on Urban Development Capacity

Price efficiency indicators technical report: Industrial zone differentials

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1. Introduction

This technical report sets out the approach to calculating land value differentials across industrial zone boundaries for urban places¹ in New Zealand. It presents the results of this analysis for five high-growth “extended urban areas”: Auckland, Christchurch, Hamilton, Tauranga, and Queenstown.

These results, along with industrial zone differentials for other areas, are available on the dashboard on the Ministry of Business, Innovation and Employment’s website.

This technical report should be read alongside part six of the *National Policy Statement on Urban Development Capacity: Guide to evidence and monitoring*, on the Ministry for the Environment’s website.

These tools are designed to help local authorities give effect to National Policy Statement on Urban Development Capacity (NPS-UDC) requirements to monitor market indicators and use indicators of price efficiency. The tools were developed with the assistance of technical experts in economic consultancies, central government, local authorities and Property Council New Zealand.

Most district plans include spatial zones that permit some activities to occur but exclude others. Industrial zones typically allow manufacturing, warehousing, and trade supply businesses to locate within them as a permitted (“by-right”) activity but may require offices or retail facilities to obtain resource consent to establish within them. They also generally exclude residential dwellings.

Different land uses have different needs and preferences for location and proximity to amenities. For instance, proximity to the coast or major inland water bodies creates amenity for residential uses, resulting in higher prices for residential-zoned land. On the other hand, industrial activities do not usually benefit from proximity to coastal amenity and hence industrial-zoned land in coastal areas may not be more valuable than inland industrial sites. This means that industrial-zoned land in a coastal area may be valued at a discount to nearby residential-zoned land, while there may not be a differential in an inland area.

Land value differentials across zoning boundaries can therefore provide two important pieces of information:

- First, they provide information about the relative value that different land uses place on locating in a specific place. For instance, if the value of commercial-zoned land is considerably higher than the value of adjacent industrial-zoned land in a specific location, then it may indicate that that location is more beneficial for commercial activities than industrial activities.

¹ Industrial zone differentials were calculated within “extended urban areas”, which are the largest geographic unit of analysis used for the market indicators and other price efficiency indicators on the dashboard on the Ministry of Business, Innovation and Employment’s website. An extended urban area comprises the full area of territorial authorities that have jurisdiction over an “urban area” as defined by Statistics New Zealand in 2017. Some of these geographic areas cross the boundaries of more than one territorial authority, so some industrial zones may be in one territorial authority area and others in another territorial authority area. This reflects that fact that urban settlement has created a single housing and labour market crossing the boundaries of these local authorities. So, for example, most of the industrial zone differentials calculated for the greater Christchurch area are in Christchurch city, but there is also one in Rolleston (Selwyn District).

- Second, they provide information about the relative sufficiency of development capacity for different uses throughout the city. If, for instance, there are differentials between industrial and rural land values in many locations, it may indicate that development capacity for industrial uses is in scarce supply relative to rural uses.

This report sets out a replicable and robust method for measuring land value differentials across zone boundaries within urban areas. The underlying concept is to attempt to make 'like for like' comparisons between land with different zoning. This is accomplished by comparing sites that are in close physical proximity with each other – i.e. within small 'bands' around the boundaries between zones.

This makes it possible to control for many other factors that may influence land values, such as accessibility to jobs and regional amenities and the availability of network infrastructure. Because the comparisons are made between properties that are, at most, 500 metres away from each other, there are unlikely to be large differences in the attractiveness of these sites for development. However, it is still important to apply planning judgment and awareness of context when interpreting and using these measures.

The methodology can be applied to additional urban areas or extended back to earlier dates, to understand how land values have evolved over time.

This report includes the following sections:

- An overview of the methodology; and
- One section summarising the results for each individual urban area.

2. Methodology

This section sets out the approach for calculating industrial zone differentials. This methodology addresses the following topics:

- The data used for the analysis
- Identifying the location of zoning boundaries
- Identifying relevant land units either side of the zoning boundary
- Identifying and standardising land values within urban areas
- Estimating the difference in land values across zoning boundaries
- Measuring whether observed differentials are statistically significant.

2.1 Underlying data

The analysis is based on CoreLogic rating valuation data from the most recent valuation cycle. CoreLogic data was provided to the Ministry of Business, Innovation and Employment under a data licence arrangement for use in research and analysis of this nature.

Ratings valuation data includes rich information on the characteristics of properties, including:

- Total rateable values and land values (calculated as total rateable values minus the replacement value of improvements on the site)
- The location of the property, which has been geocoded and can be matched with Land Information New Zealand data on parcel boundaries
- Various characteristics of the property, including existing buildings on the site
- And, importantly for this exercise, the zoning that applied to the site on the valuation date, which aligns closely with council zoning information.

2.2 Identifying the location of zoning boundaries

Spatial analysis techniques were applied to CoreLogic data to define zoning boundaries for each urban area. Because the CoreLogic data includes information on zoning as at the most recent valuation date, this provides an indication of the location of different types of broad zones at that date. Subsequent plan changes or district plan reviews may have altered those boundaries – these should be picked up in the next ratings valuation period.

Identification of zoning boundaries involved the following steps:

- Identification of all parcels within approximately 10 kilometres of the edge of the urban area, which may include parcels in multiple territorial authority areas
- Identification of the broad zoning code associated with each property centroid in the CoreLogic dataset
 - One-digit CoreLogic zoning codes were used to identify broad zoning categories. In a limited number of cases, it was necessary to use two-digit detailed zoning codes to better align with council zoning maps

- The focus was on boundaries between four broad zoning categories: Industrial (CoreLogic zoning code 7); Commercial (8); Residential (8); Rural (1 and 2)
- Other zoning categories, including reserves, community uses, and recreational zones, were excluded from the analysis.
- Generation of space-filling polygons around each individual property centroid to enable identification of contiguous areas of urban and rural zoned land. This was performed by:
 - dividing road areas and other types of land with unclassified zoning into a grid of 50 metre by 50 metre cells and,
 - then assigning each cell the zoning of the closest zoned land.
- The merging of contiguous areas of land with the same underlying zoning to identify the overall size and shape of individual types of zones.
- The definition of boundaries between different types of zones, excluding locations where zoning bordered on coastlines or inland water bodies as well as locations where zoning bordered on other types of zones that were excluded from the analysis
 - This resulted in up to three types of boundaries for each individual industrial zone: an industrial-commercial boundary; an industrial-residential boundary; and an industrial-rural boundary.

Tests showed that CoreLogic zoning codes generally align well with council zoning maps, except for property centroids that are mapped onto road zones, which does not pose a major problem for the analysis.

However, there are cases in which the CoreLogic zoning does not appear to align with council zoning maps. These reflect classification errors in the CoreLogic data that cannot be addressed by using 2-digit zoning codes from the CoreLogic data. There are both 'overs' and 'unders' and hence these classification errors are not expected to bias the overall results.

2.3 Identifying land to compare

The industrial zone differentials use property data at the most disaggregate level available (ie the rating valuation unit), which enables a precise estimate of the impact of zoning boundaries on land values. The focus was properties that were zoned for either industrial, commercial, residential, or rural uses.

Land value differentials were estimated on a zone-by-zone basis, rather than averaging differentials across all zones in the city. This enables a more localised and therefore contextualised understanding of behaviour in the urban area. Up to three differentials were estimated for each individual industrial zone, depending upon what other types of zones abutted it:

- The differential between industrial land values and the value of adjacent commercial-zoned land
- The differential between industrial land values and the value of adjacent residential-zoned land

- The differential between industrial land values and the value of adjacent rural-zoned land.

The first step in measuring these differentials was to identify all the property parcels within 1000 metres of the boundary, and measure the straight-line distance between the parcel centroids and the relevant zoning boundary.

In order to conduct a ‘like for like’ comparison between property parcels located in a similar area, with a similar level of proximity to other land uses, transport networks, and natural and man-made amenities, the focus was on properties within a shorter, 250 metre distance band of the boundary.

2.4 Standardising land values

As valuation dates differ between councils, or even within council areas in some cases, land values were adjusted to a consistent date (2017 Quarter 1) using the sales price to appraisal ratio (SPAR) index at a TA level. The SPAR index is available at a territorial authority level on the dashboard on the Ministry of Business, Innovation and Employment’s website.

The following table summarises the urban areas and corresponding territorial authorities included in the analysis and the date of the most recent valuation period for each territorial authority area.

Table 1: The date of the most recent rating valuation for territorial authorities included in the analysis

Urban area	Territorial authority	Most recent valuation
Auckland	Auckland	1/07/14
Hamilton	Hamilton City	1/09/15
	Waikato District	1/07/14
	Waipa District	1/08/16
Tauranga	Tauranga City	1/07/15
	Western Bay of Plenty District	1/07/15
Christchurch	Christchurch City	1/08/16
	Selwyn District	1/07/15
	Waimakariri District	1/08/16
Queenstown	Queenstown-Lakes District	1/07/14

2.5 Estimating industrial zone differentials

For each boundary between different zone types, the weighted average land value for industrial-zoned properties and non-industrial zoned properties was calculated using the formulas in Equation 1.

Equation 1: Formulas for calculating weighted average land values near zoning boundaries

$$AvgLV_{Ind} = \frac{\sum_i LV_i}{\sum_i Area_i}, \text{ for all } i \text{ within 250m of boundary and inside industrial zone}$$

$$AvgLV_{Non-ind} = \frac{\sum_j LV_j}{\sum_j Area_j}, \text{ for all } j \text{ within 250m of boundary and in non industrial zone}$$

where $AvgLV_{Ind}$ = weighted average land value for industrial properties near (within 250 metres of) the zoning boundary; $AvgLV_{Non-ind}$ = weighted average land value for non-industrial properties near (within 250 metres of) the zoning boundary; LV_i = SPAR-adjusted land value of property parcel i ; and $Area_i$ = area in square metres of property parcel i .

Then, two measures of the difference in land values were calculated: the difference in dollar terms, and the ratio of industrial to non-industrial land values. These measures are explained in Equation 2.

Equation 2: Formulas for calculating measures of land value differentials

$$DollarDifference = AvgLV_{Ind} - AvgLV_{Non-ind}$$

$$Ratio = \frac{AvgLV_{Ind}}{AvgLV_{Non-ind}}$$

2.6 Measuring the statistical significance of industrial zone differentials

These measures provide an easy-to-interpret comparison of whether any differences in land values across zoning boundaries are ‘practically’ significant – ie large in dollar terms or large as a proportion of land values at that site. However, they do not necessarily provide information on whether these differences are *statistically* significant, which is also important.

If there are a small number of parcels within 250 metres of the zoning boundary and significant ‘scatter’ in land values at a parcel level, differences in weighted average land values for industrial and non-industrial zoned land may not be statistically significant. As an example, consider a case in which:

- There are five industrial parcels near the zoning boundary. The weighted average industrial land value is \$200/m² but land values for individual parcels range from \$180/m² to \$270/m².
- There are also five residential parcels near the zoning boundary. The weighted average residential land value is \$225/m² but land values for individual parcels range from \$150/m² to \$300/m².

On average, industrial land is worth \$25/m² less than adjacent residential land. However, the distribution of industrial land values at the parcel level falls within the distribution of residential land values at the parcel level. Thus it may not be the case that the two distributions are actually different.

Therefore, a measure of whether there is a statistically significant difference in the distribution of land values for individual property parcels on either side of the zoning boundary is reported. The Wilcoxon signed-rank test was used to carry out this test, rather than the paired Student’s

t-test, as this test does not rely upon the assumption that land values follow a normal distribution.² The Wilcoxon test statistic is used to identify whether to reject the null hypothesis that industrial and non-industrial land values follow the same underlying distribution at the 5 percent significance level.³

Differentials that are not statistically significant should be given less weight when interpreting and using the results. Even if there are seemingly large 'practical' differences in land values, these differences may simply reflect random 'noise' in the data rather than an issue that requires policy attention.

² For an explanation of this test, see https://en.wikipedia.org/wiki/Wilcoxon_signed-rank_test

³ A 5 percent significance level is customarily used in many applications. It indicates the likelihood of erroneous rejection of a null hypothesis, that is, at a 5 percent significance level the null might be rejected in one out of every 20 cases. Some researchers have argued that a higher significance level should be used. It would be possible to report results at a different significance level.

3. Summary of results

A broad comparison of results between different cities is provided here before presenting in-depth results for individual urban areas. This highlights the qualitative differences between cities, and between different industrial zones within urban areas.

Table 2 summarises results for differentials calculated at the zone level for each of these urban areas. The third column shows the number of zone boundaries that were identified in each city – for instance, in Auckland, there are 66 industrial zones that share a border with residential zones, and 53 that share a border with commercial zones.

The subsequent columns show the number of zones in which there were:

- Statistically significant positive differentials, indicating that industrial land was valued more highly than adjacent non-industrial land; or
- Statistically significant negative differentials, indicating that industrial land was valued at a discount to adjacent non-industrial land.

This analysis shows, for instance, that:

- Industrial land is worth less than adjacent residential land in 59 percent of cases in Auckland, but only 35 percent of cases in Christchurch.
- Industrial land is worth more than adjacent rural land in 25 percent of cases in Hamilton, compared with 50 percent of cases in Tauranga and two out of three cases in Queenstown
- There are relatively few cases where industrial land is valued more highly than adjacent commercial land (the exception is in Queenstown). However, the most common outcome is for there to be no statistically significant difference in land values for these two uses.

In general, there is a tendency for industrial land to be valued less highly than commercial or residential land, and more highly than rural land, rather than vice versa. This may reflect insufficient development capacity for one use relative to other uses at an urban area level.

However, differentials in many locations are not large and/or statistically significant. This highlights that competing demands for alternative land uses may be balanced appropriately in many individual locations. In short, this does not seem to be an indicator that always points in one direction – rather, it appears to reflect some local nuances and variations.

Table 2: High-level overview of industrial zone differentials in five urban areas

Geographic area	Differential type	Number of zone boundaries	Statistically significant <u>positive</u> differential		Statistically significant <u>negative</u> differential	
			Number	Share	Number	Share
Auckland	commercial	53	0	0%	23	43%
	residential	66	5	8%	39	59%
	rural	12	7	58%	1	8%
Hamilton	commercial	5	0	0%	2	40%
	residential	10	0	0%	8	80%
	rural	12	3	25%	1	8%
Tauranga	commercial	12	1	8%	6	50%
	residential	13	0	0%	7	54%
	rural	10	5	50%	1	10%
Christchurch	commercial	18	0	0%	8	44%
	residential	37	7	19%	13	35%
	rural	17	6	35%	0	0%
Queenstown	commercial	2	1	50%	0	0%
	residential	3	1	33%	0	0%
	rural	3	2	67%	0	0%

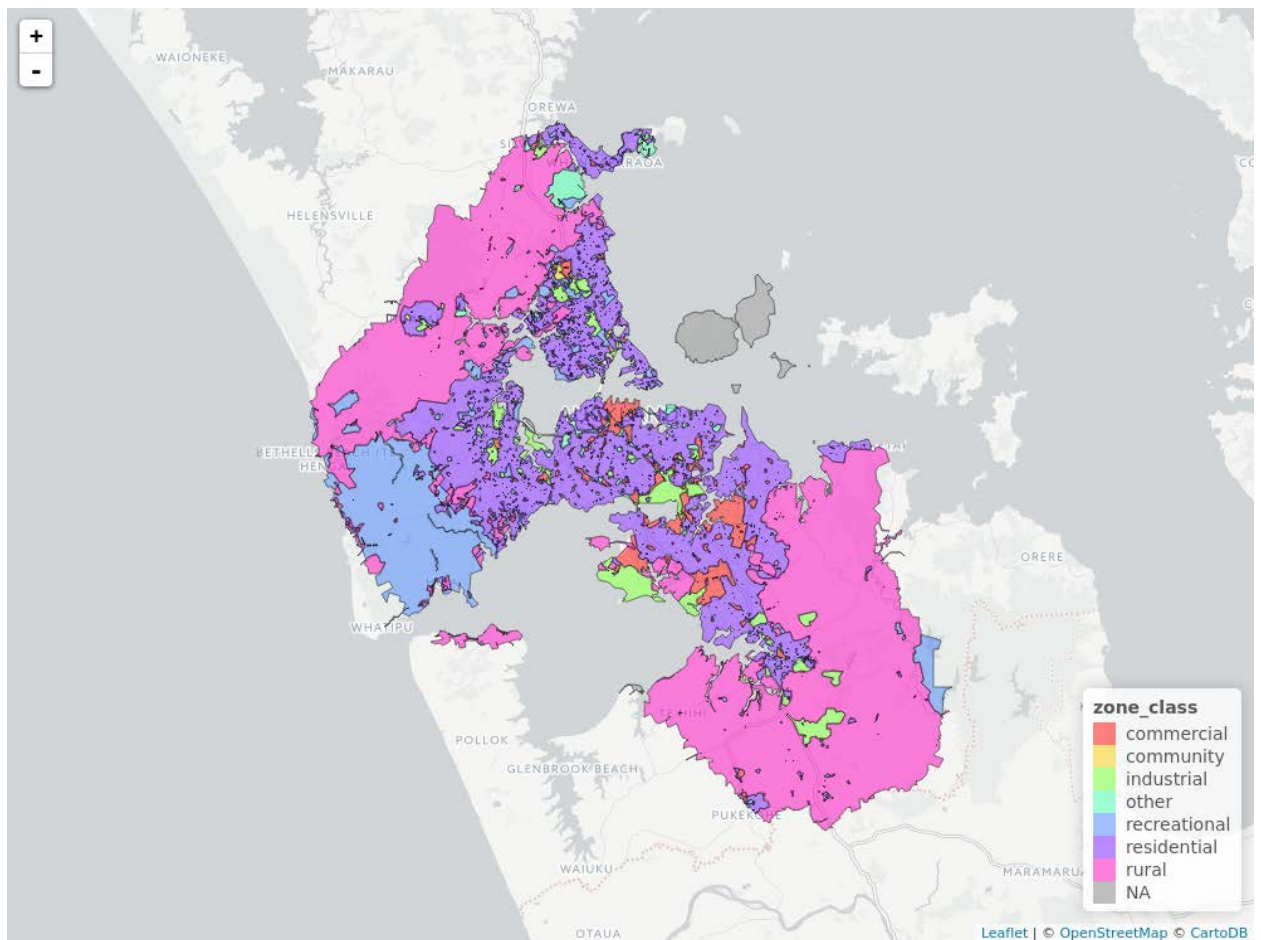
4. Auckland

This section summarises key industrial zone differentials results for Auckland.

4.1 Maps of industrial zones

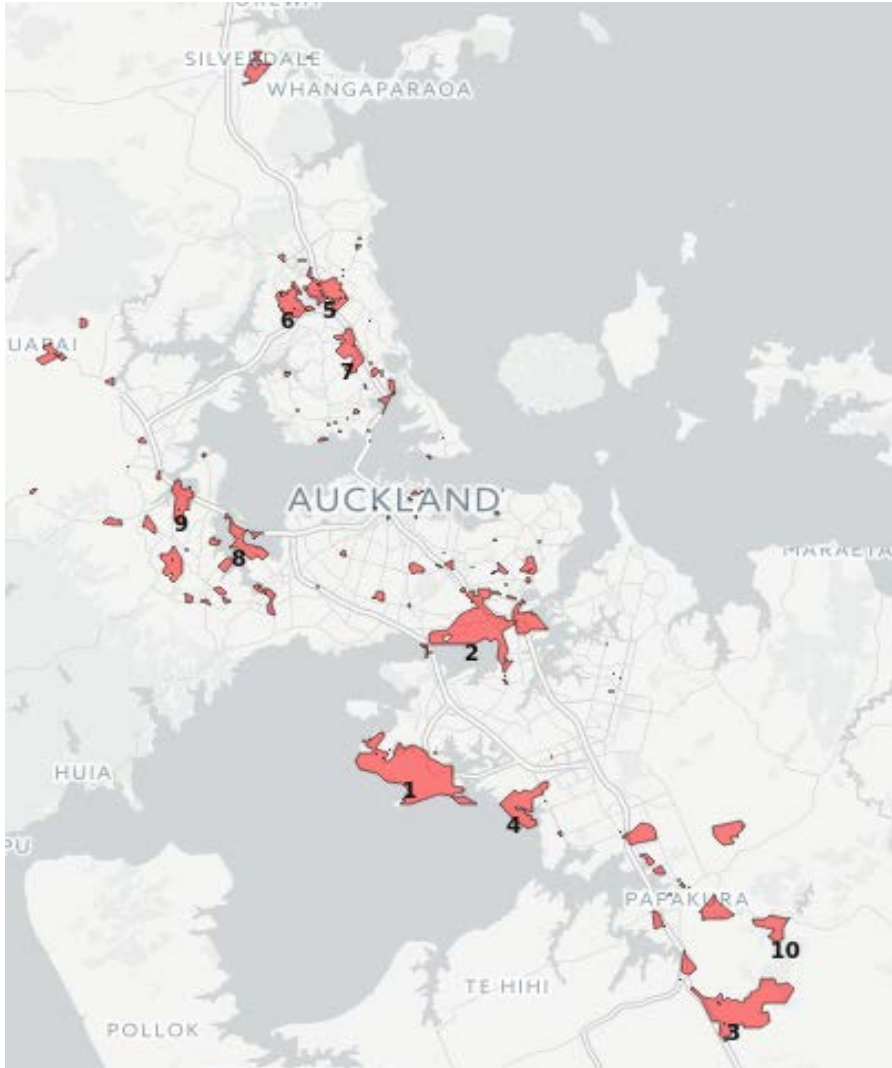
The following map shows the estimated location of zoning in this urban area, based on the most recent valuation data. Zoning is broken down into several broad use categories.

Figure 1: Estimated location of rural, residential, commercial, and industrial zoning in Auckland



Based on this, the following map shows the location of contiguous industrial-zoned land in this urban area. Industrial zones are numbered according to their size. For example, the largest industrial zone in the urban area is given the number 1, and so on.

Figure 2: Location of contiguous industrial-zoned land in Auckland



4.2 Graphing land values around industrial zone boundaries

The following graphs show the distribution of land values immediately inside and outside of the boundaries of the five largest industrial zones in the urban area. Each individual point is an individual property parcel that is located within 1000 metres of the boundary. The three columns show land values around three different types of boundaries:

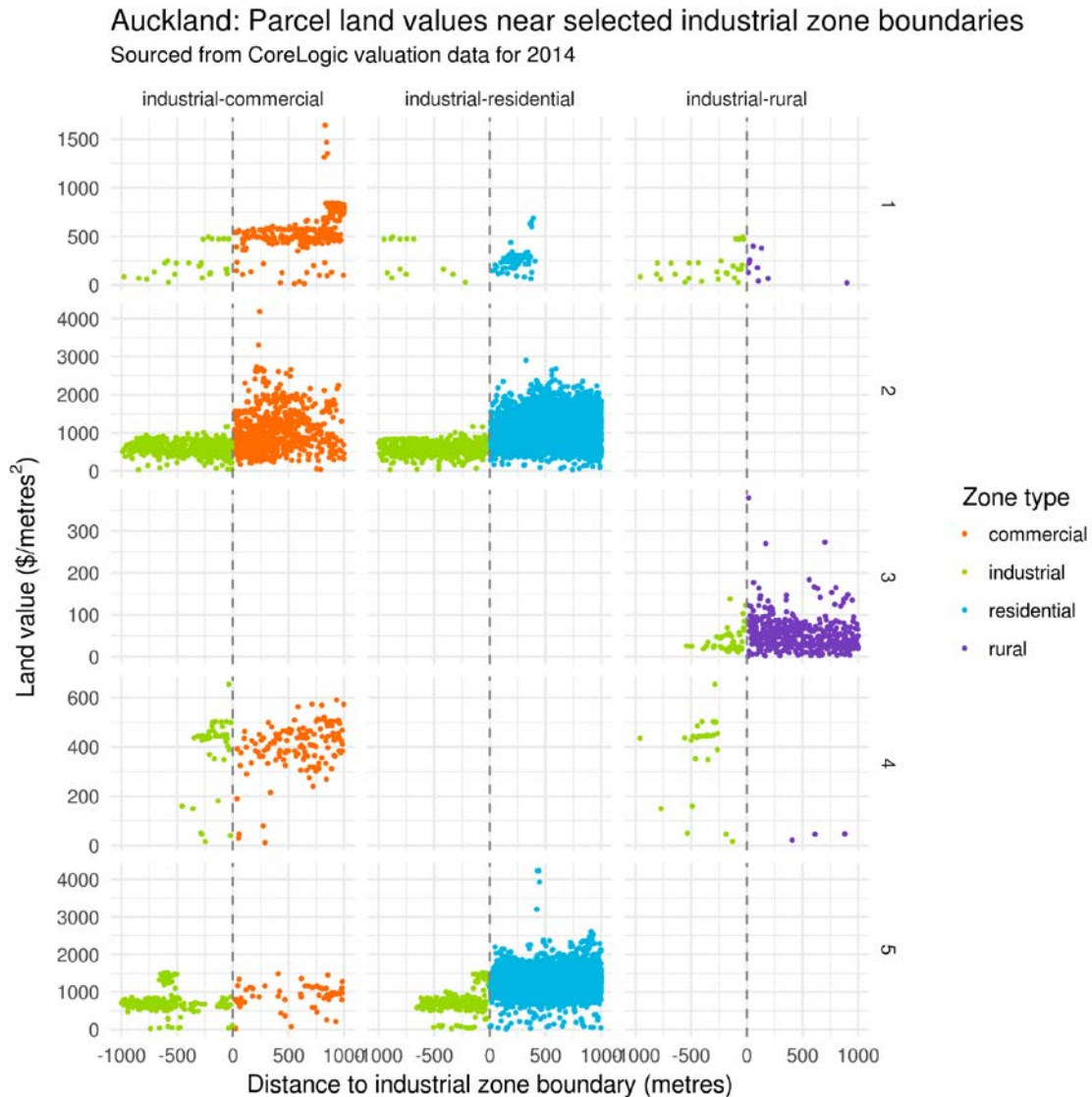
- Boundaries between industrial and commercial zones, with commercial land values shown in red
- Boundaries between industrial and residential zones, with residential land values shown in blue
- Boundaries between industrial and rural zones, with rural land values shown in purple.

Industrial land values are in green. Each individual row shows results for one industrial zone. Some industrial zones do not share borders with all other types of zones.

These results provide a basic illustration of how land values change across various types of zoning boundaries, in different locations. For instance:

- The largest industrial zone (located at the Auckland Airport) does not seem to have a large difference between industrial and residential land values
- By contrast, there does seem to be a significant jump in land values at the boundary of the second largest industrial zone (the Onehunga-Penrose-Mt Wellington industrial zone).
- The third largest industrial area (Drury South) only abuts rural land. There does not seem to be a large difference in land values.
- In the fifth largest industrial area (located at Constellation Drive / Rosedale on the North Shore) there appears to be a larger difference between industrial and residential land values than between industrial and commercial land values.

Figure 3: Distribution of land values immediately inside and outside of the five largest industrial zones in Auckland



4.3 Differences in land values in dollar and ratio terms

This data is used to calculate differences in land value across industrial zoning boundaries, expressed both in dollars per square metre and as a ratio. The following table presents summary statistics for the ten largest industrial zones in the urban area. These zones can be identified by referring to the map above. Each individual row reports the differential between industrial land values and land values in adjacent commercial, residential, or rural zones for a single industrial zone.

The final three columns present summary statistics showing:

- The difference in average land values in dollar terms – negative numbers indicate that industrial land values are lower than adjacent non-industrial land values. Large numbers (either negative or positive) indicate that there may be economically meaningful differences in land values between industrial zoned land and adjacent non-industrial land.

- The ratio of industrial land values to adjacent non-industrial land values – numbers below one indicate that industrial land is less valuable, on average, than non-industrial land. Ratios close to one indicate that land values are more similar between alternative uses.
- An indicator of whether the difference in the distribution of industrial and non-industrial land values is statistically significant at the 5 percent significance level – this provides an indicator of whether differences in land values are statistically ‘meaningful’ or whether they may simply reflect random ‘noise’ due to a lack of sufficient data.

The largest industrial zone, which is located at the Auckland Airport, illustrates how these measures can be used to understand the impact of zoning on land values:

- Commercial land close to the zone boundary is worth \$227/m² more than similarly located industrial land. This difference is large in economic terms, and is statistically significant.
- Residential land located close to the zone boundary appears to be worth significantly more than industrial land. However, this difference is *not* statistically significant, as there is only a single industrial parcel that is within 250 metres of the boundary.
- There is no significant difference between the value of industrial and rural land located near the zone boundary. The difference in average land values is small (\$12/m²) and is not statistically significant.

This data suggests that:

- At this location, there may be insufficient development capacity for commercial uses, relative to industrial uses.
- There is insufficient evidence to conclude that there is a relative lack of residential development capacity at this location.
- There is not a large gap between industrial and rural land values.
- The difference is highly dependent on location. For example the industrial differentials in the airport zone are much less significant than those in the Onehunga/Mt Wellington area.

Table 3: Summary differentials for largest industrial zones (250 metres distance from boundary) in Auckland

Zone ID	Adjacent non-industrial zone	Number of industrial parcels	Average industrial land value (\$/m ²)	Number of non-ind parcels	Average non-ind land value (\$/m ²)	Difference in land value (\$/m ²)	Ratio of land values	Statistically significant at 5 percent level?
1	commercial	10	\$138	33	\$365	-\$227	0.38	yes
	residential	1	\$28	39	\$198	-\$170	0.14	no
	rural	15	\$157	10	\$145	\$12	1.08	no
2	commercial	393	\$479	563	\$552	-\$72	0.87	yes
	residential	191	\$522	1403	\$757	-\$234	0.69	yes
3	rural	40	\$22	151	\$39	-\$17	0.57	yes
4	commercial	39	\$341	17	\$363	-\$22	0.94	yes
5	commercial	26	\$615	18	\$723	-\$108	0.85	yes
	residential	127	\$544	1049	\$1,088	-\$544	0.50	yes
6	commercial	26	\$605	1	\$416	\$189	1.46	no
	residential	78	\$457	968	\$997	-\$540	0.46	yes
7	residential	292	\$654	1239	\$1,094	-\$440	0.60	yes
8	residential	81	\$490	343	\$1,066	-\$577	0.46	yes
9	commercial	14	\$890	3	\$1,076	-\$186	0.83	no
	residential	31	\$580	467	\$795	-\$214	0.73	no
10	rural	2	\$5	20	\$8	-\$3	0.62	no

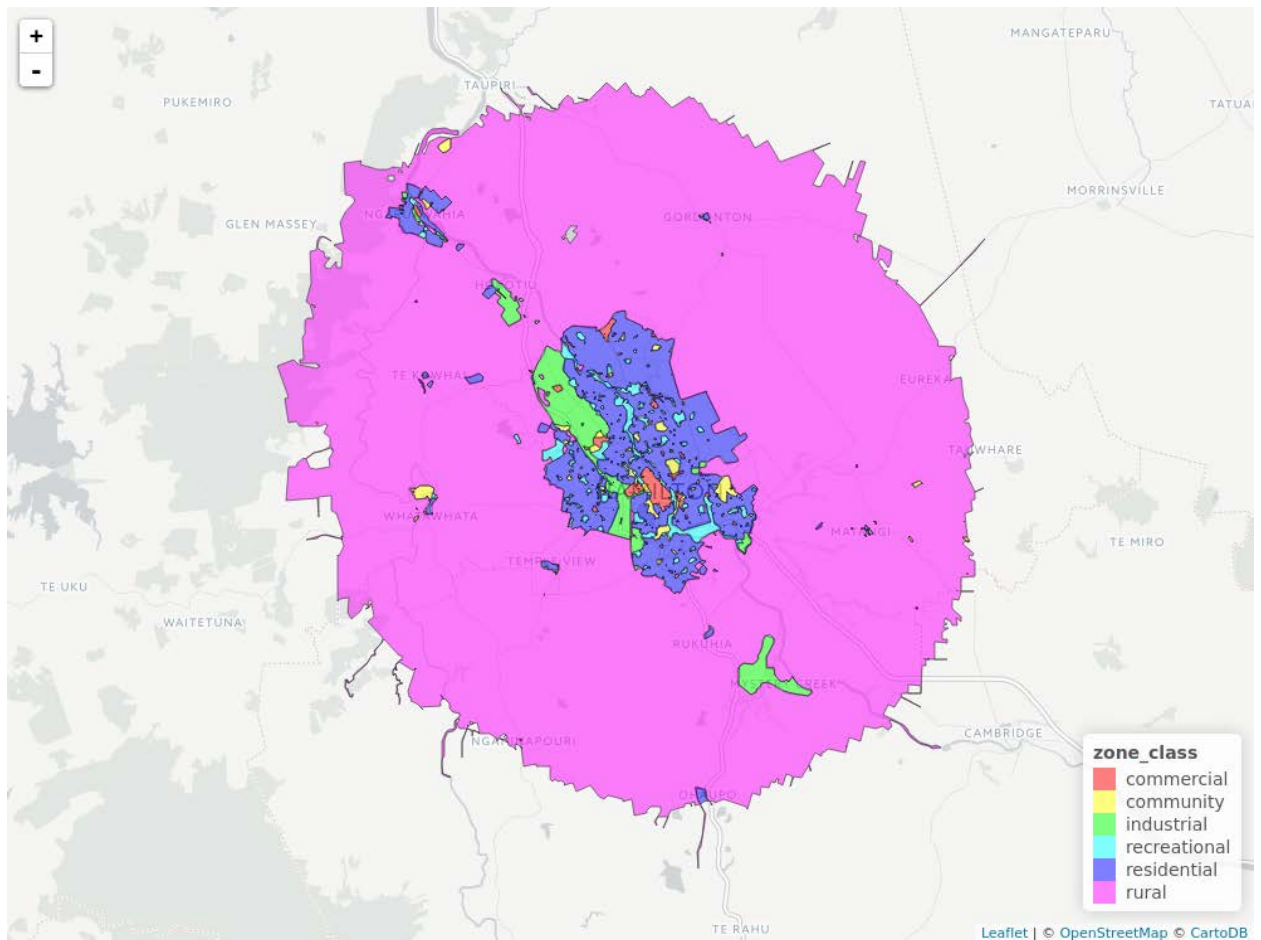
5. Hamilton

This section summarises key industrial zone differentials results for Hamilton.

5.1 Maps of industrial zones

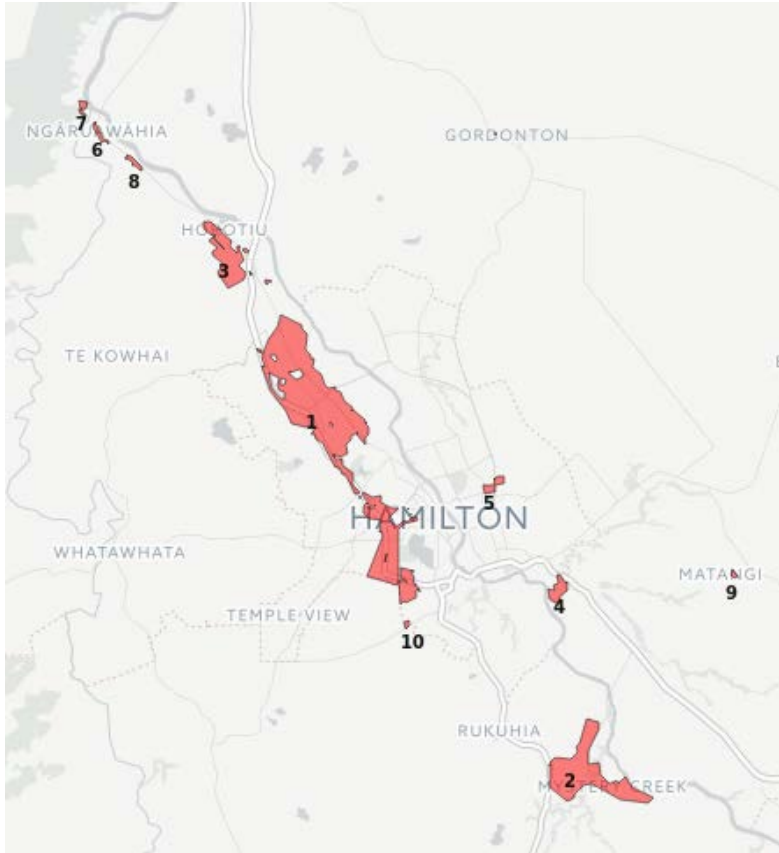
The following map shows the estimated location of zoning in this urban area, based on the most recent valuation data. Zoning is broken down into several broad use categories.

Figure 4: Estimated location of rural, residential, commercial, and industrial zoning in Hamilton



Based on this, the following map shows the location of contiguous industrial-zoned land in this urban area. Industrial zones are numbered according to their size. For example, the largest industrial zone in the urban area is given the number 1, and so on.

Figure 5: Location of contiguous industrial-zoned land in Hamilton



5.2 Graphing land values around industrial zone boundaries

The following graphs show the distribution of land values immediately inside and outside of the boundaries of the five largest industrial zones in the urban area. Each individual point is an individual property parcel that is located within 1000 metres of the boundary. The three columns show land values around three different types of boundaries:

- Boundaries between industrial and commercial zones, with commercial land values shown in red
- Boundaries between industrial and residential zones, with residential land values shown in blue
- Boundaries between industrial and rural zones, with rural land values shown in purple.

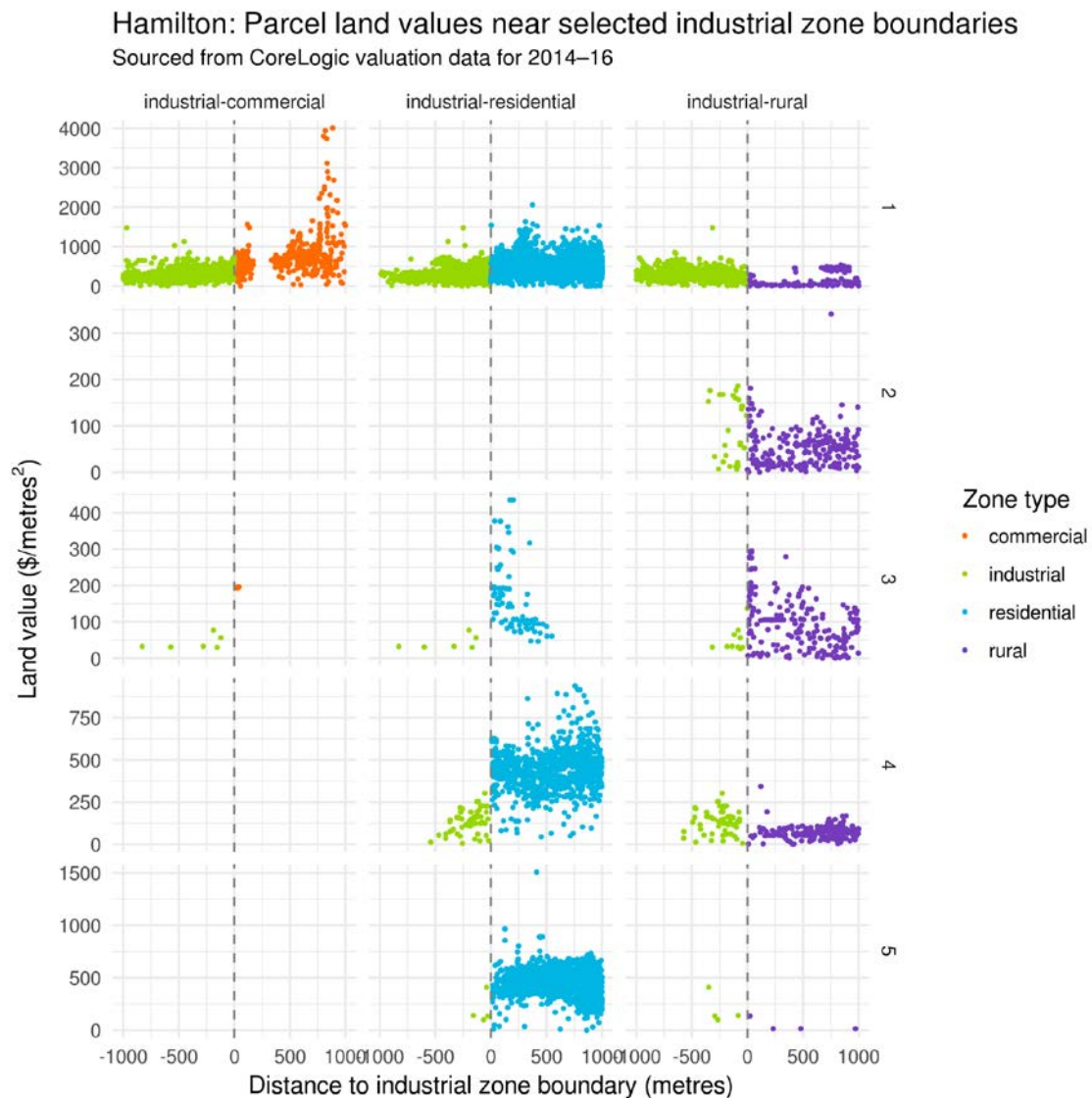
Industrial land values are in green. Each individual row shows results for one industrial zone. Some industrial zones do not share borders with all other types of zones.

These results provide a basic illustration of how land values change across various types of zoning boundaries, in different locations. For instance:

- The largest industrial zone, which occupies a large strip of land on the west side of the city, along the rail line, shows some evidence of a negative difference between industrial land values and commercial and residential land values, and a positive difference with rural land values.

- The second largest industrial area (around the Hamilton Airport) only abuts rural land. There does not seem to be a large difference in the distribution of land values.
- In the fourth largest industrial area (Riverlea, at the south of the city) industrial land values appear to be lower than residential land values but slightly higher than rural land values.

Figure 6: Distribution of land values immediately inside and outside of the five largest industrial zones in Hamilton



5.3 Differences in land values in dollar and ratio terms

This data is also used to calculate differences in land value across industrial zoning boundaries, expressed both in dollars per square metre and as a ratio. The following table presents summary statistics for the ten largest industrial zones in the urban area. These zones can be identified by referring to the map above. Each individual row reports the differential between industrial land values and land values in adjacent commercial, residential, or rural zones for a single industrial zone.

The final three columns present summary statistics showing:

- The difference in average land values in dollar terms – negative numbers indicate that industrial land values are lower than adjacent non-industrial land values. Large numbers (either negative or positive) indicate that there may be economically meaningful differences in land values between industrial zoned land and adjacent non-industrial land.
- The ratio of industrial land values to adjacent non-industrial land values – numbers below one indicate that industrial land is less valuable, on average, than non-industrial land. Ratios close to one indicate that land values are more similar between alternative uses.
- An indicator of whether the difference in the distribution of industrial and non-industrial land values is statistically significant at the 5 percent significance level – this provides an indicator of whether differences in land values are statistically ‘meaningful’ or whether they may simply reflect random ‘noise’ due to a lack of sufficient data.

The largest industrial zone, which is located along the west side of the city near the rail line, illustrates how these measures can be used to understand the impact of zoning on land values:

- Commercial land close to the zone boundary is worth \$154/m² more than similarly located industrial land. This difference is significant in economic terms, and is also statistically significant.
- Residential land located close to the zone boundary is worth \$198/m² more than similarly located industrial land. This difference is also statistically significant.
- Industrial land is worth \$98/m² more than similarly located rural land. This difference is also statistically significant.

This data suggests that:

- At this location, there may be insufficient development capacity for residential and commercial uses, relative to industrial uses.
- There may also be insufficient development capacity for industrial uses, relative to rural uses.

Table 4: Summary differentials for largest industrial zones (250 metres distance from boundary) in Hamilton

Zone ID	Adjacent non-industrial zone	Number of industrial parcels	Average industrial land value (\$/m ²)	Number of non-ind parcels	Average non-ind land value (\$/m ²)	Difference in land value (\$/m ²)	Ratio of land values	Statistically significant at 5 percent level?
1	commercial	287	\$279	175	\$433	-\$154	0.64	yes
	residential	626	\$181	2861	\$378	-\$198	0.48	yes
	rural	241	\$141	27	\$43	\$98	3.31	yes
2	rural	23	\$31	61	\$21	\$10	1.45	no
3	commercial	3	\$41	3	\$195	-\$154	0.21	no
	residential	3	\$41	64	\$162	-\$121	0.25	yes
	rural	9	\$34	65	\$58	-\$25	0.58	yes
4	residential	40	\$121	212	\$371	-\$250	0.33	yes
	rural	37	\$88	21	\$58	\$30	1.52	yes
5	residential	4	\$229	234	\$361	-\$132	0.64	yes
	rural	1	\$141	2	\$23	\$117	6.05	no
6	commercial	21	\$95	32	\$310	-\$215	0.31	yes
	residential	21	\$95	296	\$176	-\$81	0.54	yes
	rural	5	\$90	1	\$56	\$33	1.59	no
7	residential	8	\$33	94	\$122	-\$89	0.27	yes
	rural	8	\$33	9	\$5	\$28	6.23	yes
8	residential	3	\$76	235	\$159	-\$83	0.48	no
	rural	3	\$76	10	\$32	\$44	2.36	no
9	commercial	2	\$29	5	\$377	-\$348	0.08	no
	residential	2	\$29	41	\$274	-\$246	0.10	yes
	rural	2	\$29	25	\$34	-\$5	0.85	no
10	residential	5	\$117	184	\$425	-\$308	0.28	yes
	rural	5	\$117	3	\$17	\$100	6.70	no

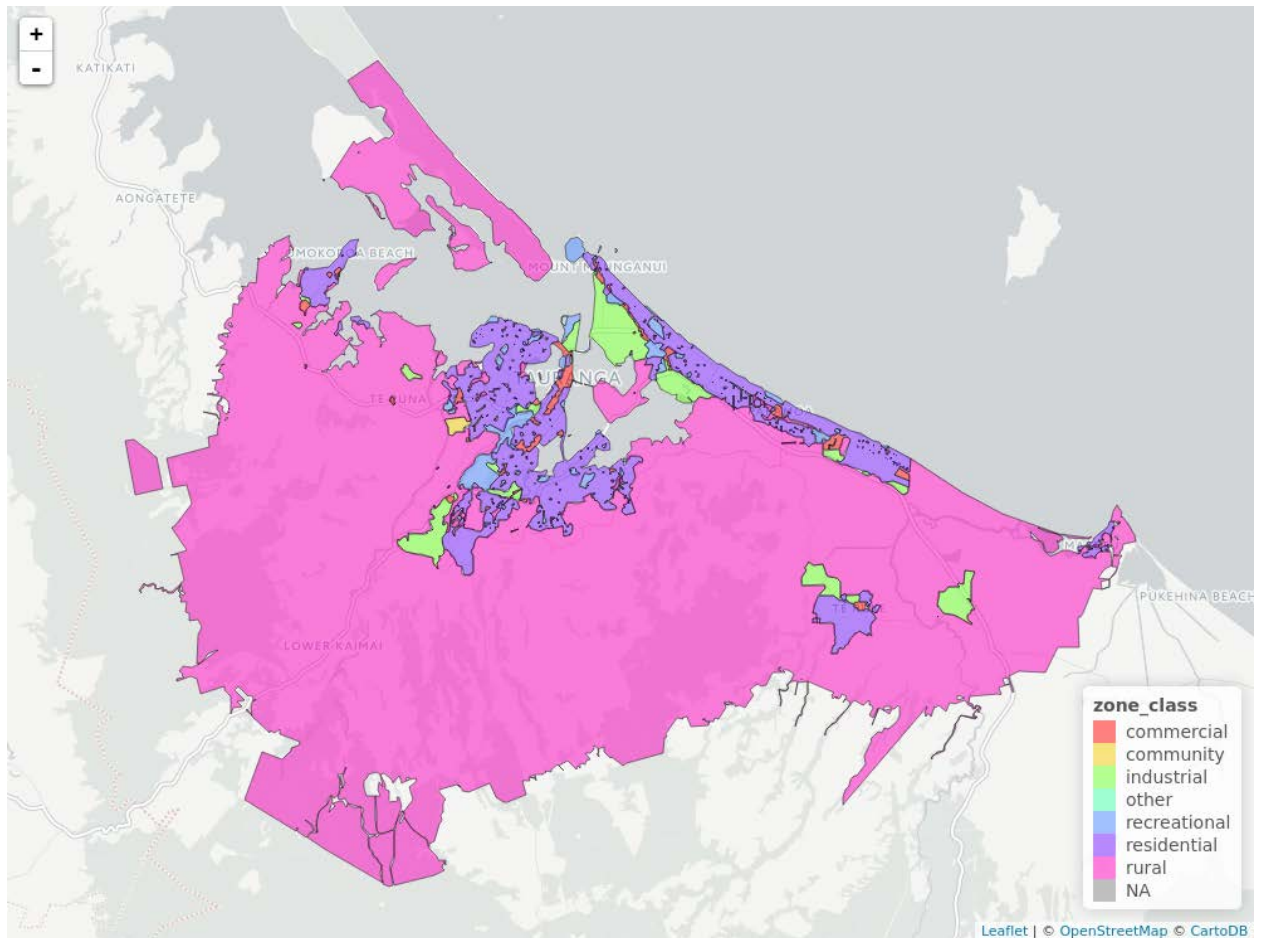
6. Tauranga

This section summarises key industrial zone differentials results for Tauranga.

6.1 Maps of industrial zones

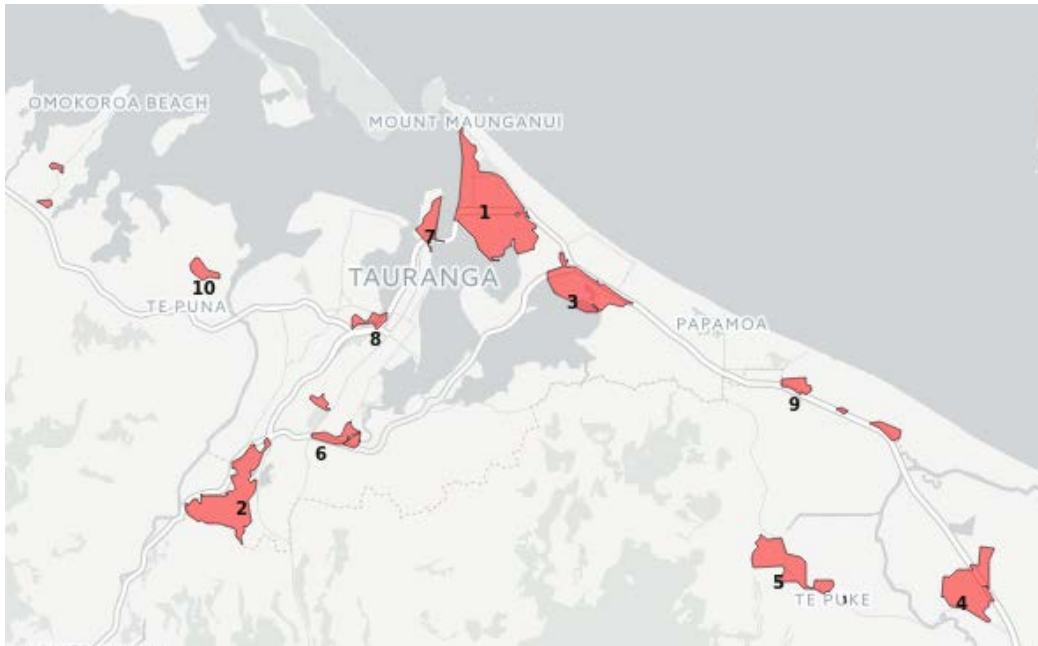
The following map shows the estimated location of zoning in this urban area, based on the most recent valuation data. Zoning is broken down into several broad use categories.

Figure 7: Estimated location of rural, residential, commercial, and industrial zoning in Tauranga



Based on this, the following map shows the location of contiguous industrial-zoned land in this urban area. Industrial zones are numbered according to their size. For example, the largest industrial zone in the urban area is given the number 1, and so on.

Figure 8: Location of contiguous industrial-zoned land in Tauranga



6.2 Graphing land values around industrial zone boundaries

The following graphs show the distribution of land values immediately inside and outside of the boundaries of the five largest industrial zones in the urban area. Each individual point is an individual property parcel that is located within 1000 metres of the boundary. The three columns show land values around three different types of boundaries:

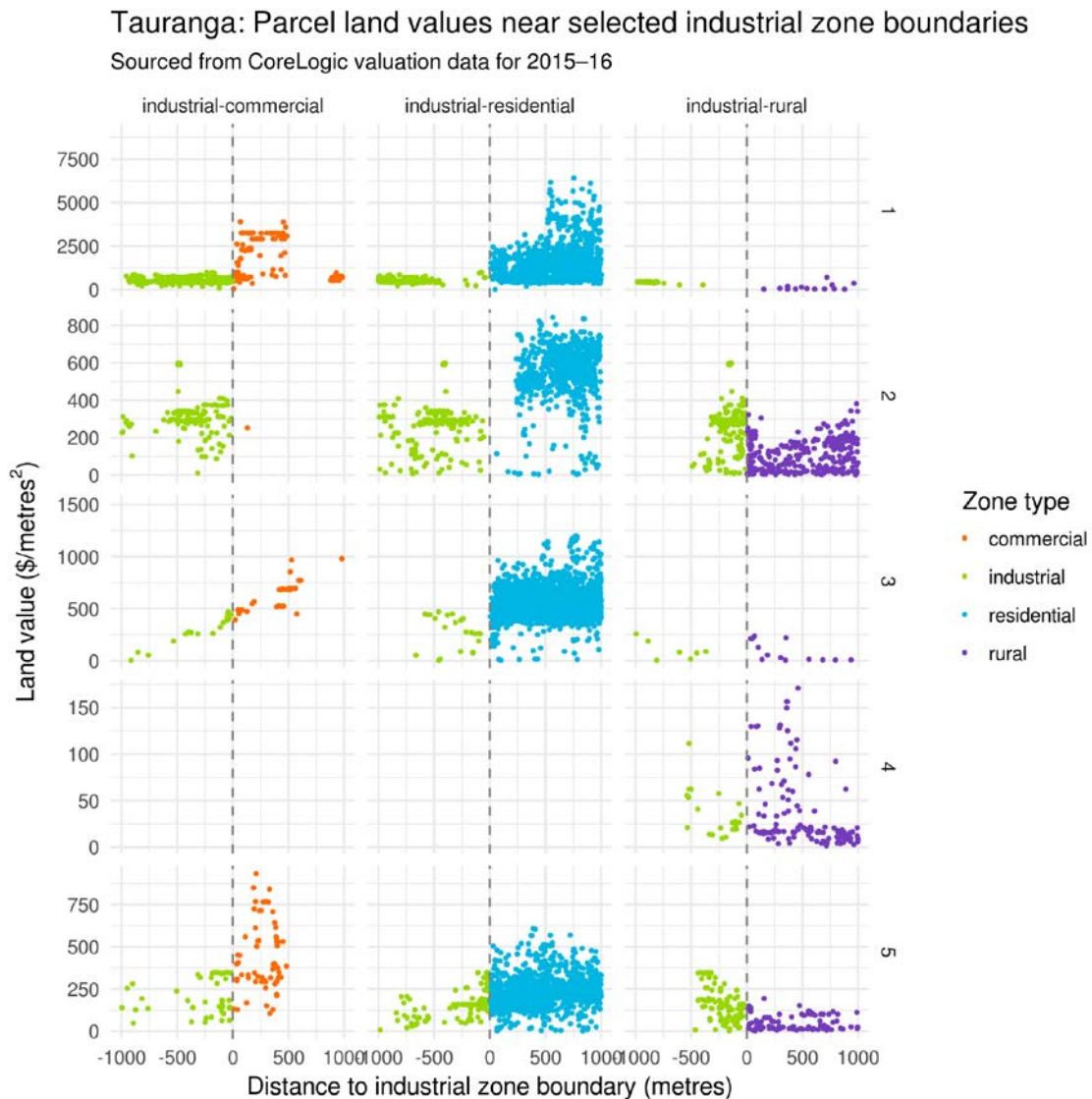
- Boundaries between industrial and commercial zones, with commercial land values shown in red
- Boundaries between industrial and residential zones, with residential land values shown in blue
- Boundaries between industrial and rural zones, with rural land values shown in purple.

Industrial land values are in green. Each individual row shows results for one industrial zone. Note that some industrial zones do not share borders with all other types of zones.

These results provide a basic illustration of how land values change across various types of zoning boundaries, in different locations. For instance:

- The largest industrial zone (located around the Mt Maunganui port) appears to have significant differences between industrial and commercial land values, as well as between industrial and residential land values.
- There may be some differences between residential and industrial land values at the second largest industrial area (Tauriko West), although it is unclear whether these differences are significant given the small number of residential parcels immediately next to the boundary. Industrial land appears to be valued more highly than rural land.

Figure 9: Distribution of land values immediately inside and outside of the five largest industrial zones in Tauranga



6.3 Differences in land values in dollar and ratio terms

This data is also used to calculate differences in land value across industrial zoning boundaries, expressed both in dollars per square metre and as a ratio. The following table presents summary statistics for the ten largest industrial zones in the urban area. These zones can be identified by referring to the map above. Each individual row reports the differential between industrial land values and land values in adjacent commercial, residential, or rural zones for a single industrial zone.

The final three columns present summary statistics showing:

- The difference in average land values in dollar terms – negative numbers indicate that industrial land values are lower than adjacent non-industrial land values. Large numbers (either negative or positive) indicate that there may be economically meaningful differences in land values between industrial zoned land and adjacent non-industrial land.

- The ratio of industrial land values to adjacent non-industrial land values – numbers below one indicate that industrial land is less valuable, on average, than non-industrial land. Ratios close to one indicate that land values are more similar between alternative uses.
- An indicator of whether the difference in the distribution of industrial and non-industrial land values is statistically significant at the 5 percent significance level – this provides an indicator of whether differences in land values are statistically ‘meaningful’ or whether they may simply reflect random ‘noise’ due to a lack of sufficient data.

The largest industrial zone, which is located around the Mt Maunganui port, illustrates how these measures can be used to understand the impact of zoning on land values:

- Commercial land located close to the zone boundary is worth \$420/m² more than similarly located industrial land. This difference is large in economic terms and statistically significant.
- Residential land located close to the zone boundary is worth \$349/m² more than similarly located industrial land. This difference is also large in economic terms and statistically significant.
- There are not enough rural properties near the boundary to calculate rural-industrial land value differentials.

This data suggests that:

- At this location, there may be insufficient development capacity for residential and commercial uses, relative to industrial uses.

Table 5: Summary differentials for largest industrial zones (250 metres distance from boundary) in Tauranga

Zone ID	Adjacent non-industrial zone	Number of industrial parcels	Average industrial land value (\$/m ²)	Number of non-ind parcels	Average non-ind land value (\$/m ²)	Difference in land value (\$/m ²)	Ratio of land values	Statistically significant at 5 percent level?
1	commercial	137	\$436	142	\$856	-\$420	0.51	yes
	residential	10	\$330	199	\$679	-\$349	0.49	yes
2	commercial	36	\$198	1	\$252	-\$54	0.79	no
	residential	17	\$128	9	\$71	\$57	1.81	no
	rural	144	\$77	81	\$28	\$50	2.80	yes
3	commercial	12	\$378	10	\$455	-\$76	0.83	yes
	residential	9	\$131	613	\$478	-\$347	0.27	yes
4	rural	11	\$15	26	\$17	-\$2	0.89	no
5	commercial	31	\$112	27	\$297	-\$185	0.38	yes
	residential	68	\$108	437	\$160	-\$53	0.67	no
	rural	69	\$55	34	\$26	\$30	2.16	yes
6	commercial	14	\$316	5	\$275	\$42	1.15	yes
	residential	89	\$252	812	\$363	-\$111	0.69	yes
	rural	86	\$267	3	\$41	\$226	6.49	yes
7	commercial	15	\$430	20	\$833	-\$403	0.52	yes
	residential	2	\$331	19	\$1,188	-\$857	0.28	yes
8	commercial	43	\$378	13	\$432	-\$54	0.87	no
	residential	109	\$355	318	\$418	-\$63	0.85	yes
9	commercial	56	\$116	62	\$168	-\$52	0.69	no
	rural	94	\$166	2	\$5	\$161	33.99	yes
10	rural	2	\$13	25	\$31	-\$18	0.41	yes

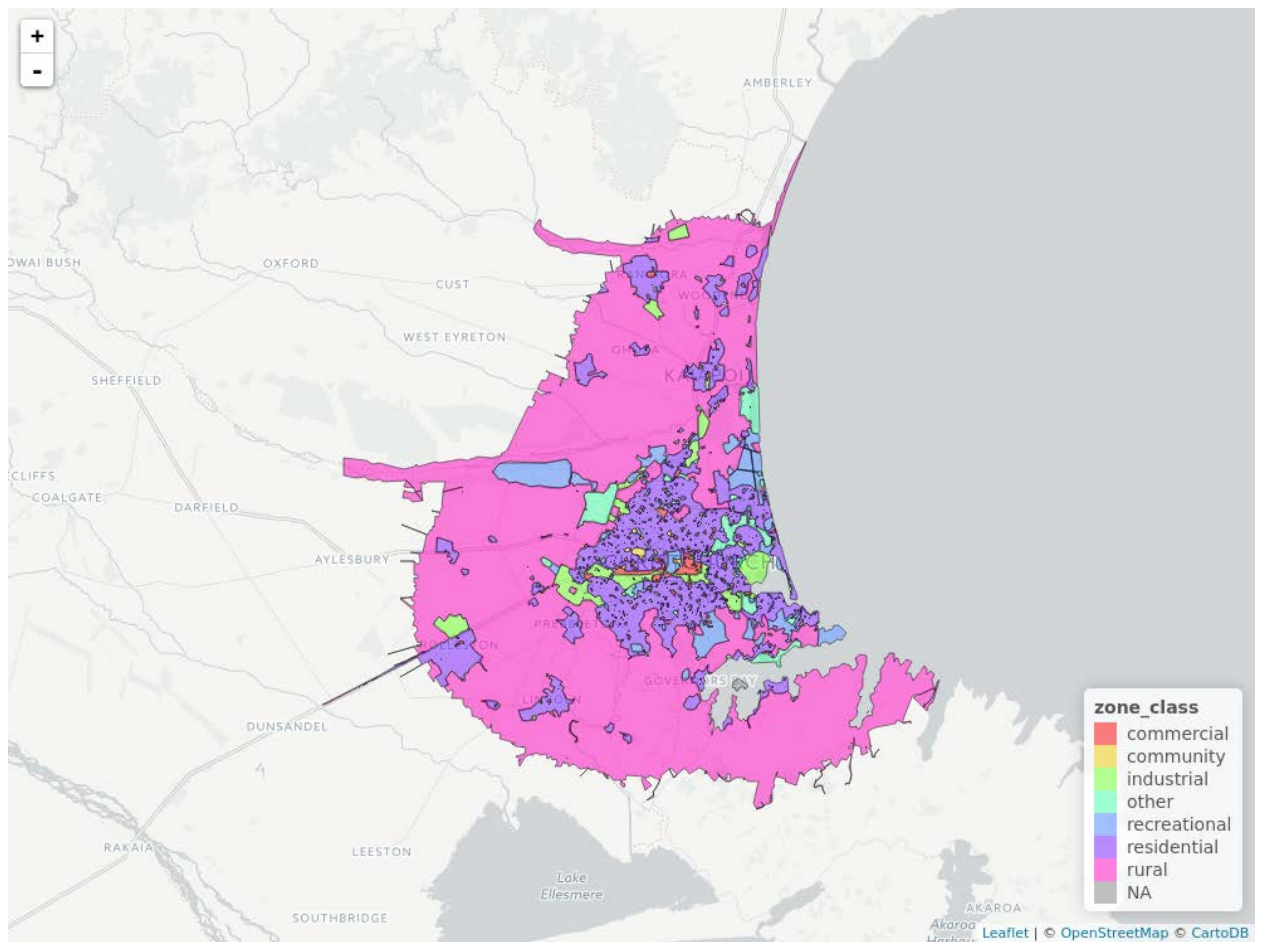
7. Christchurch

This section summarises key industrial zone differentials results for Christchurch.

7.1 Maps of industrial zones

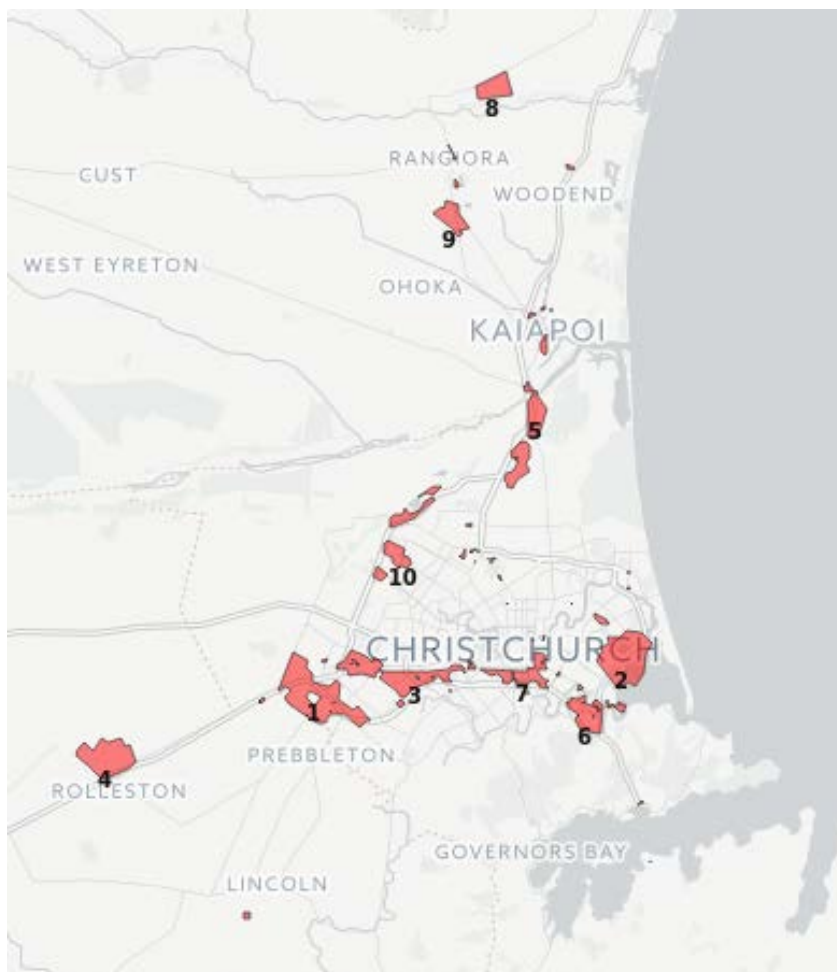
The following map shows the estimated location of zoning in this urban area, based on the most recent valuation data. Zoning is broken down into several broad use categories.

Figure 10: Estimated location of rural, residential, commercial, and industrial zoning in Christchurch



Based on this, the following map shows the location of contiguous industrial-zoned land in this urban area. Industrial zones are numbered according to their size. For example, the largest industrial zone in the urban area is given the number 1, and so on.

Figure 11: Location of contiguous industrial-zoned land in Christchurch



7.2 Graphing land values around industrial zone boundaries

The following graphs show the distribution of land values immediately inside and outside of the boundaries of the five largest industrial zones in the urban area. Each individual point is an individual property parcel that is located within 1000 metres of the boundary. The three columns show land values around three different types of boundaries:

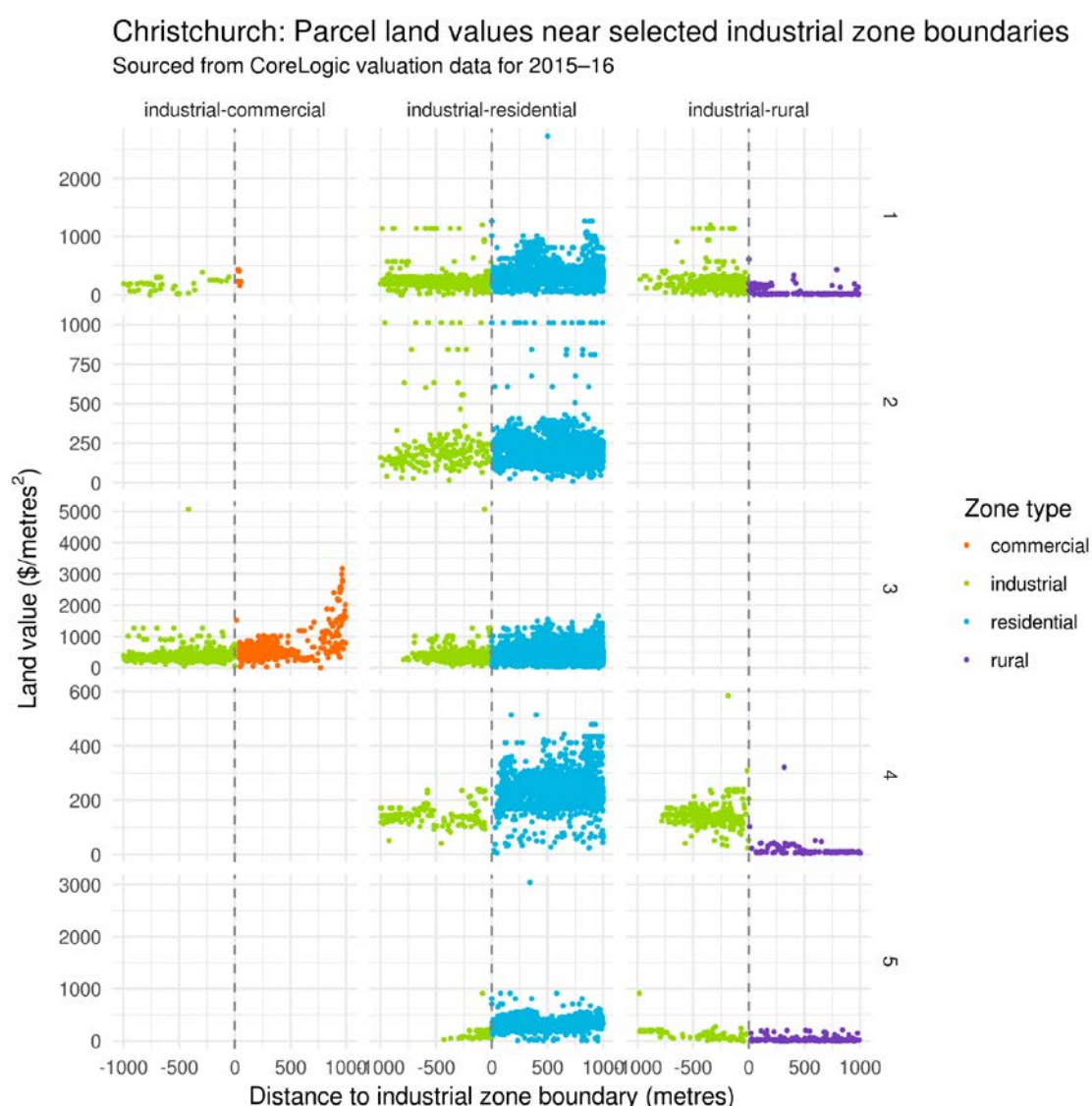
- Boundaries between industrial and commercial zones, with commercial land values shown in red
- Boundaries between industrial and residential zones, with residential land values shown in blue
- Boundaries between industrial and rural zones, with rural land values shown in purple.

Industrial land values are in green. Each individual row shows results for one industrial zone. Some industrial zones do not share borders with all other types of zones.

These results provide a basic illustration of how land values change across various types of zoning boundaries, in different locations. For instance:

- The largest industrial zone (located at Hornby South) does not seem to have a large difference between industrial and commercial land values, but industrial land does seem to be valued more highly than rural land.
- The second largest industrial area (Bromley) only abuts residential land. There does not seem to be a large difference in the distribution of land values.
- In the fourth largest industrial area (located in Rolleston) industrial land values appear to be lower than residential land values but significantly higher than rural land values.

Figure 12: Distribution of land values immediately inside and outside of the five largest industrial zones in Christchurch



7.3 Differences in land values in dollar and ratio terms

This data is used to calculate differences in land value across industrial zoning boundaries, expressed both in dollars per square metre and as a ratio. The following table presents summary statistics for the ten largest industrial zones in the urban area. These zones can be identified by referring to the map above. Each individual row reports the differential between

industrial land values and land values in adjacent commercial, residential, or rural zones for a single industrial zone.

The final three columns present summary statistics showing:

- The difference in average land values in dollar terms – negative numbers indicate that industrial land values are lower than adjacent non-industrial land values. Large numbers (either negative or positive) indicate that there may be economically meaningful differences in land values between industrial zoned land and adjacent non-industrial land.
- The ratio of industrial land values to adjacent non-industrial land values – numbers below one indicate that industrial land is less valuable, on average, than non-industrial land. Ratios close to one indicate that land values are more similar between alternative uses.
- An indicator of whether the difference in the distribution of industrial and non-industrial land values is statistically significant at the 5 percent significance level – this provides an indicator of whether differences in land values are statistically ‘meaningful’ or whether they may simply reflect random ‘noise’ due to a lack of sufficient data.

The largest industrial zone, which is located at Hornby South, illustrates how these measures can be used to understand the impact of zoning on land values:

- Commercial land close to the zone boundary is similar in value to industrial land. This difference is small in economic terms, and is not statistically significant.
- Residential land located close to the zone boundary is worth \$79/m² more than similarly located industrial land. This difference is statistically significant.
- Industrial land is worth \$95/m² more than similarly located rural land. This difference is also statistically significant.

This data suggests that:

- There is insufficient evidence to conclude that there is a lack of development capacity for commercial uses at this location, relative to industrial uses.
- At this location, there may be insufficient development capacity for residential uses, relative to industrial uses.
- There may also be insufficient development capacity for industrial uses, relative to rural uses.

Table 6: Summary differentials for largest industrial zones (250 metres distance from boundary) in Christchurch

Zone ID	Adjacent non-industrial zone	Number of industrial parcels	Average industrial land value (\$/m ²)	Number of non-ind parcels	Average non-ind land value (\$/m ²)	Difference in land value (\$/m ²)	Ratio of land values	Statistically significant at 5 percent level?
1	commercial	7	\$249	7	\$259	-\$10	0.96	no
	residential	98	\$125	1026	\$204	-\$79	0.61	yes
	rural	184	\$130	83	\$35	\$95	3.76	yes
2	residential	48	\$150	464	\$177	-\$27	0.85	no
3	commercial	270	\$294	208	\$375	-\$81	0.78	yes
	residential	412	\$282	1668	\$302	-\$20	0.93	yes
4	residential	44	\$125	276	\$177	-\$52	0.71	yes
	rural	98	\$88	17	\$12	\$76	7.13	yes
5	residential	53	\$107	470	\$246	-\$139	0.44	yes
	rural	22	\$40	39	\$17	\$23	2.40	no
6	commercial	21	\$244	2	\$259	-\$15	0.94	no
	residential	269	\$147	856	\$193	-\$46	0.76	no
	rural	28	\$141	1	\$32	\$109	4.36	no
7	commercial	571	\$463	264	\$703	-\$240	0.66	yes
	residential	759	\$420	1556	\$393	\$27	1.07	yes
8	rural	1	\$6	8	\$4	\$2	1.39	no
9	residential	17	\$297	128	\$187	\$110	1.59	yes
	rural	58	\$68	19	\$8	\$60	8.56	yes
10	commercial	30	\$350	13	\$364	-\$15	0.96	no
	residential	50	\$277	527	\$448	-\$171	0.62	yes
	rural	52	\$184	13	\$37	\$147	4.96	yes

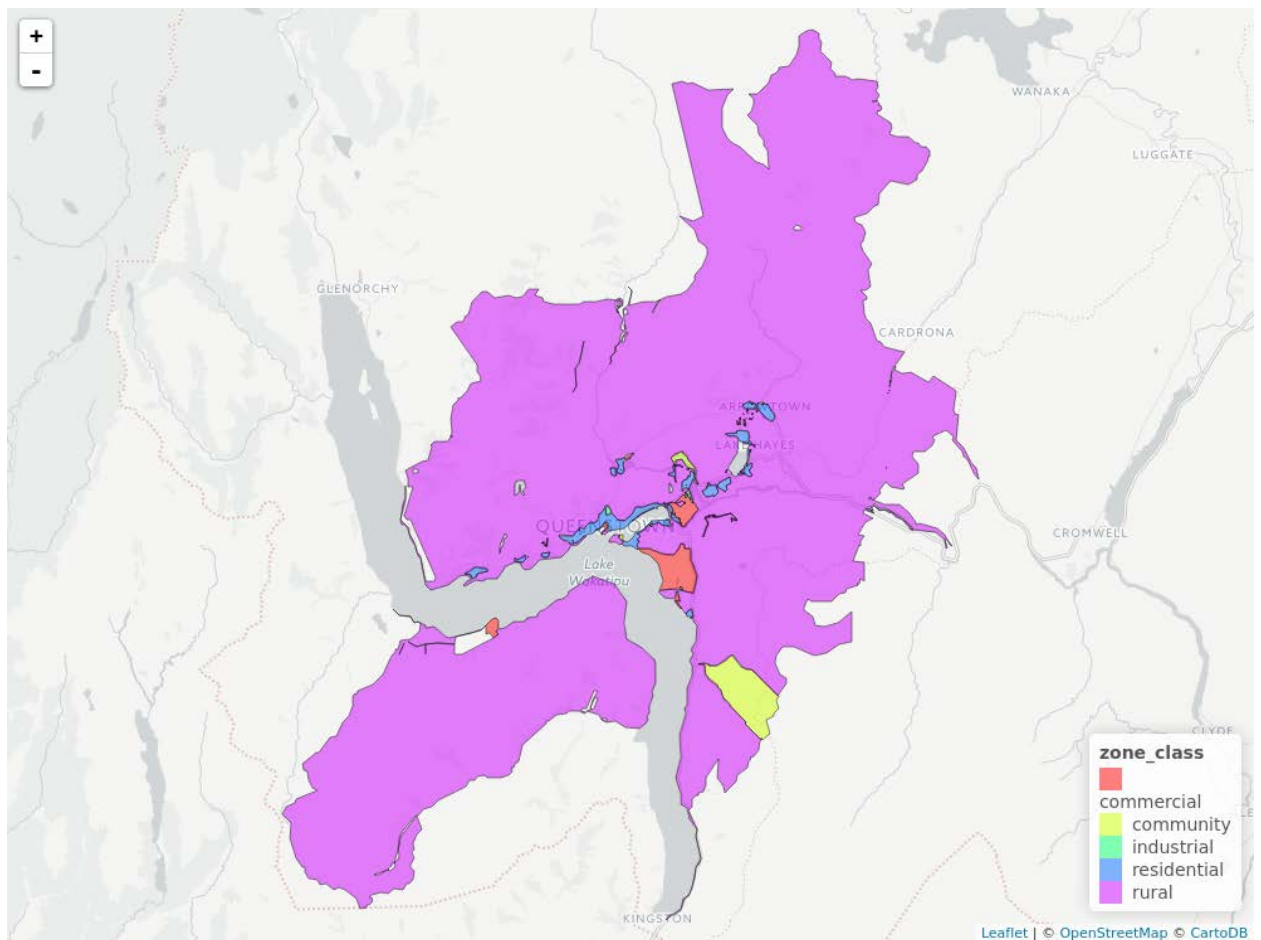
8. Queenstown

This section summarises key industrial zone differentials results for Queenstown.

8.1 Maps of industrial zones

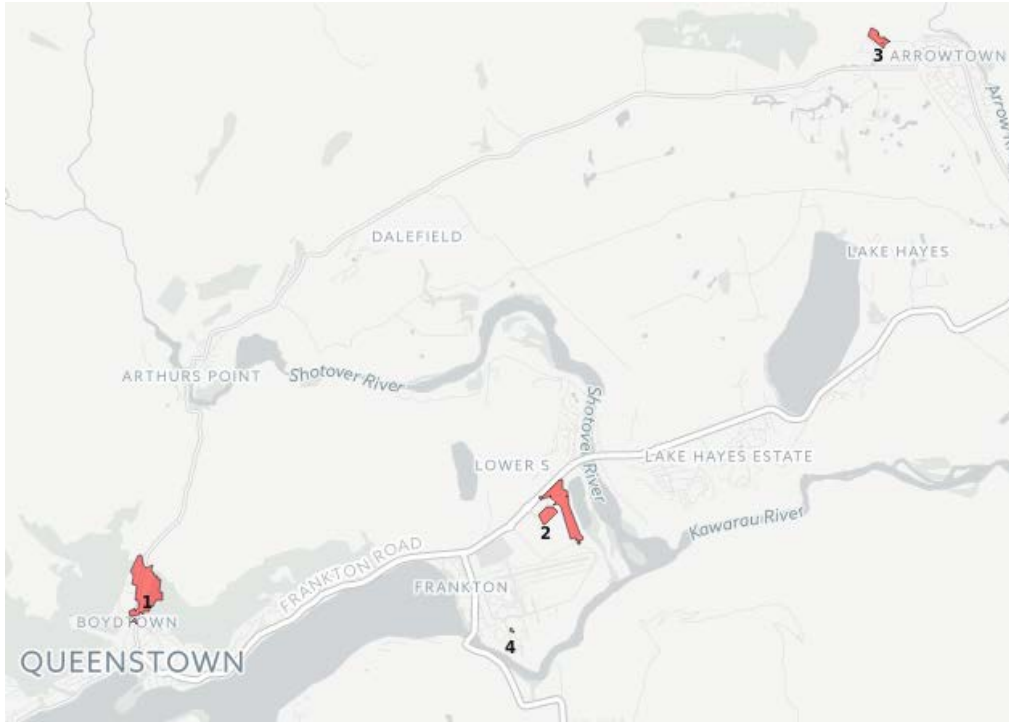
The following map shows the estimated location of zoning in this urban area, based on the most recent valuation data. Zoning is broken down into several broad use categories.

Figure 13: Estimated location of rural, residential, commercial, and industrial zoning in Queenstown



Based on this, the following map shows the location of contiguous industrial-zoned land in this urban area. Industrial zones are numbered according to their size. For example, the largest industrial zone in the urban area is given the number 1, and so on.

Figure 14: Location of contiguous industrial-zoned land in Queenstown



8.2 Graphing land values around industrial zone boundaries

The following graphs show the distribution of land values immediately inside and outside of the boundaries of the four industrial zones in the urban area. (NB: There appears to only be a single parcel within the fourth-largest industrial zone.) Each individual point is an individual property parcel that is located within 1000 metres of the boundary. The three columns show land values around three different types of boundaries:

- Boundaries between industrial and commercial zones, with commercial land values shown in red
- Boundaries between industrial and residential zones, with residential land values shown in blue
- Boundaries between industrial and rural zones, with rural land values shown in purple.

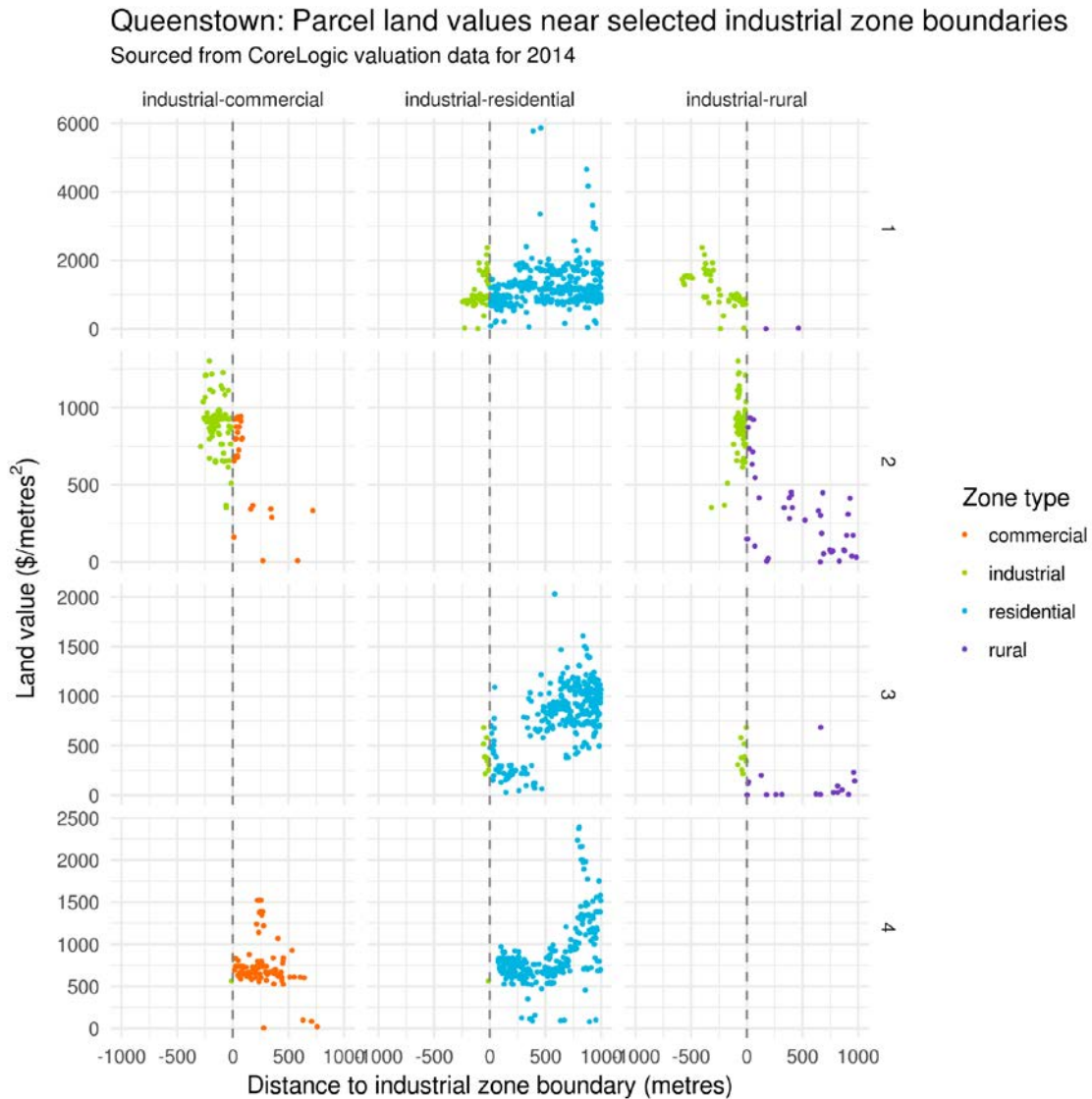
Industrial land values are in green. Each individual row shows results for one industrial zone. Note that some industrial zones do not share borders with all other types of zones.

These results provide a basic illustration of how land values change across various types of zoning boundaries, in different locations. For instance:

- The largest industrial zone (located to the north of the Queenstown CBD) does not seem to have a large difference between industrial and residential land values. Industrial land may be valued more highly than rural land, but given the small number of rural parcels it may be difficult to make a robust estimate of the difference.
- The second largest industrial area (north of the airport) abuts both commercial and rural zones. In both cases, industrial land values appear to be as high as, or higher, than surrounding land values.

- In the third largest industrial area (located in Arrowtown) industrial land values appear to be similar to residential land values but higher than rural land values.

Figure 15: Distribution of land values immediately inside and outside of the five largest industrial zones in Queenstown



8.3 Differences in land values in dollar and ratio terms

This data is also used to calculate differences in land value across industrial zoning boundaries, expressed both in dollars per square metre and as a ratio. The following table presents summary statistics for the three largest industrial zones in the urban area. These zones can be identified by referring to the map above. Each individual row reports the differential between industrial land values and land values in adjacent commercial, residential, or rural zones for a single industrial zone.

The final three columns present summary statistics showing:

- The difference in average land values in dollar terms – negative numbers indicate that industrial land values are lower than adjacent non-industrial land values. Large numbers (either negative or positive) indicate that there may be economically

meaningful differences in land values between industrial zoned land and adjacent non-industrial land.

- The ratio of industrial land values to adjacent non-industrial land values – numbers below one indicate that industrial land is less valuable, on average, than non-industrial land. Ratios close to one indicate that land values are more similar between alternative uses.
- An indicator of whether the difference in the distribution of industrial and non-industrial land values is statistically significant at the 5 percent significance level – this provides an indicator of whether differences in land values are statistically ‘meaningful’ or whether they may simply reflect random ‘noise’ due to a lack of sufficient data.

The largest industrial zone, which is located to the north of the Queenstown CBD, illustrates how these measures can be used to understand the impact of zoning on land values:

- Residential land located close to the zone boundary is worth \$154/m² less than similarly located industrial land. This difference is statistically significant.
- Rural land near this zone is worth less than industrial land, but this difference is *not* statistically significant because there is only a single rural parcel close to the boundary.

This data suggests that:

- At this location, there may be insufficient development capacity for industrial uses, relative to residential uses.
- There is insufficient data to conclude that there is a lack of development capacity for industrial uses at this location, relative to rural uses.

Table 7: Summary differentials for largest industrial zones (250 metres distance from boundary) in Queenstown

Zone ID	Adjacent non-industrial zone	Number of industrial parcels	Average industrial land value (\$/m ²)	Number of non-ind parcels	Average non-ind land value (\$/m ²)	Difference in land value (\$/m ²)	Ratio of land values	Statistically significant at percent level?
1	residential	60	\$842	115	\$687	\$154	1.22	yes
	rural	34	\$551	1	\$2	\$549	271.89	no
2	commercial	86	\$684	32	\$525	\$159	1.30	yes
	rural	89	\$741	13	\$42	\$699	17.45	yes
3	residential	10	\$328	38	\$128	\$201	2.57	no
	rural	10	\$328	5	\$18	\$310	18.00	yes