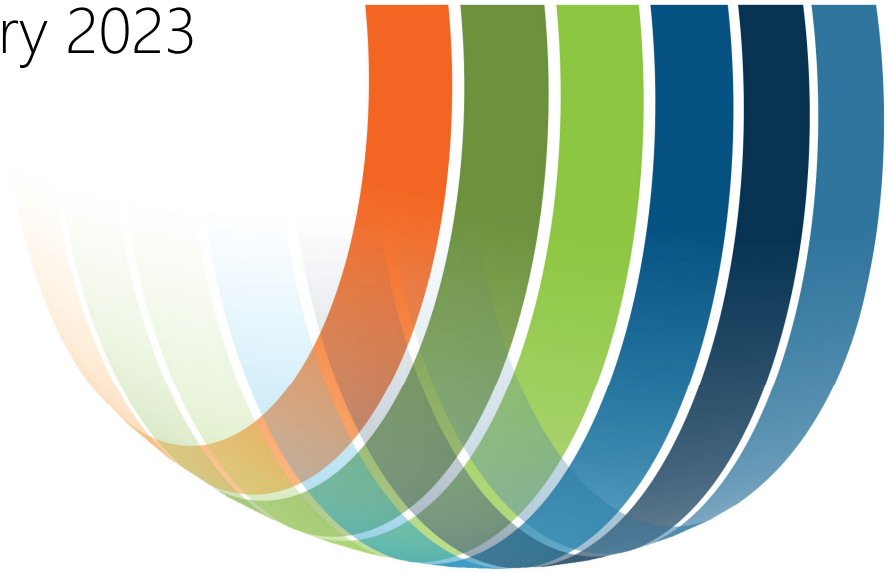
Examining aggregates trends in New Zealand

for Fulton Hogan

January 2023



Infometrics

Economics put simply

Authorship

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Executive Summary

Fulton Hogan have asked Infometrics to prepare a report examining the importance of aggregates to the economy, how aggregates contribute to infrastructure and building costs, and how the cost of transporting aggregates requires aggregates to be sourced as close to projects occurring as possible.

This report is expected to be used to support Fulton Hogan's submission on the Natural and Built Environment Bill.

Examining aggregates volumes

- Annual aggregates production averaged 30.6m tonnes over the last decade.
- In 2020, 29.4m tonnes were produced, with a value of $510m.
- Most aggregates are used for roading, with 69% of the total in 2020.
- Underreporting of aggregates production could mean actual production was just more than 100m tonnes higher (+37%) over the last decade.
- Aggregates are produced across the country, and future economic activity is likely to drive demand for aggregates higher.

Examining aggregates' contribution to building costs

- Aggregates make up 18% of materials costs for network infrastructure projects and make up 5% of total costs for these projects.
- Overall, aggregates are the fourth-largest cost by single item for network infrastructure projects, behind civil engineering services, special trade construction services, and metal-based materials.

Examining the cost of transporting aggregates

- Transport costs are a major consideration for aggregates production, as they make up a substantial proportion of the total cost of aggregates.
- To keep transport costs low and manageable, aggregates need to be sourced close to where they are intended to be used on a project.
- Having to transport aggregates beyond 30km in New Zealand adds substantial cost to aggregates, and as a result, most aggregates in New Zealand are not usually transported inter-regionally (except for near-border movements).
- An international study reinforces the view that increasing transport distances for aggregates substantially increases total aggregates costs, with the study showing that increasing the transport distance above 50km doubles the cost of the aggregate required.

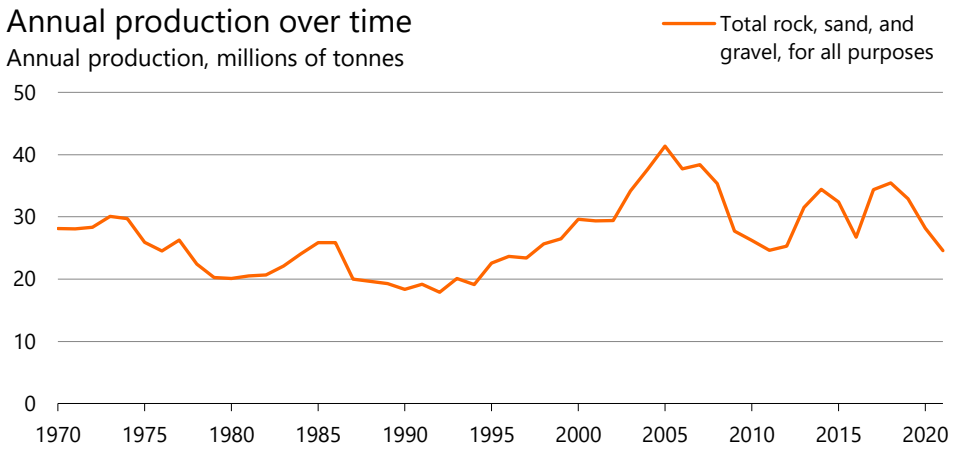
Examining aggregates volumes

There is considerable use of aggregates in New Zealand, primarily for construction efforts in infrastructure and housing. This section details the volume of aggregate produced, what it is used for, where it comes from, and how aggregates use is expected to rise in the future.

Substantial and sustained aggregates needs

Infometrics analysis of aggregates production shows that since 1970, New Zealand production has averaged 26.8m tonnes of aggregates a year. Over the last decade, that average has increased to 30.6m tonnes (see Graph 1).

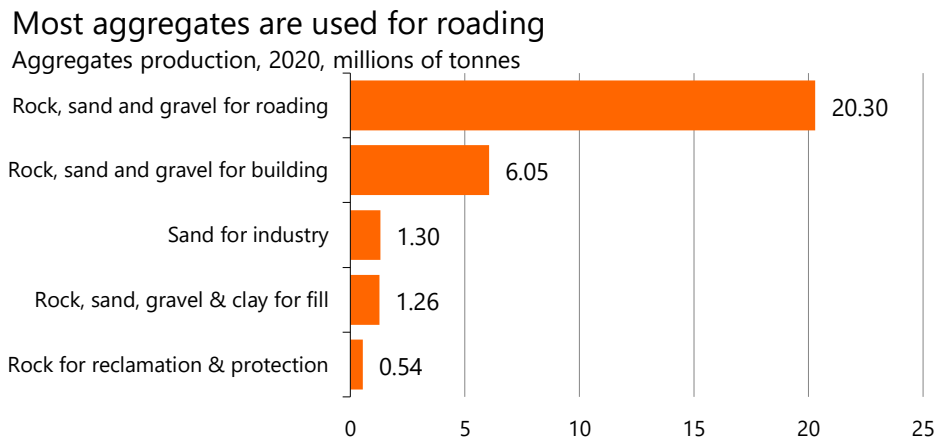
Graph 1



Includes an estimate for 1997, when no data was recorded.

In 2020, the value of aggregates production totalled $510m in nominal terms, with 29.4m tonnes produced. Most aggregates are used for roading, as Graph 2 shows. In 2020, 20.3 of the total aggregates produced were used for roading, 69% of the total.

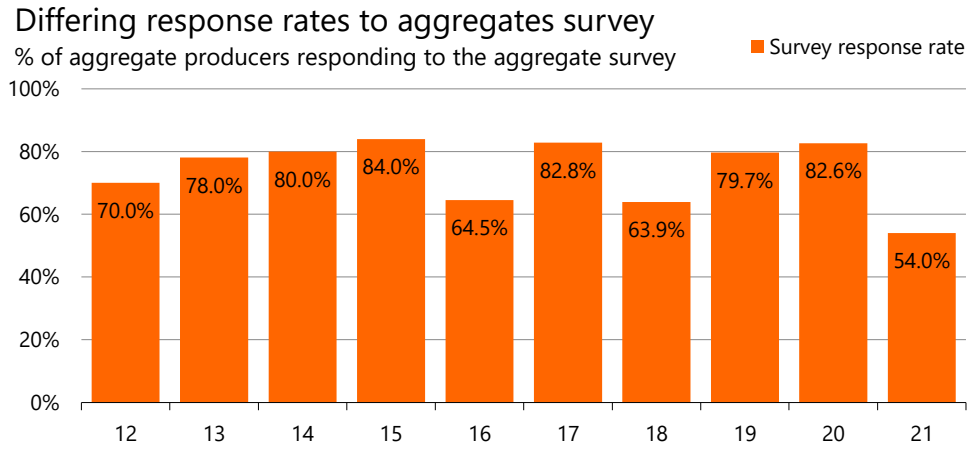
Graph 2



Poor aggregates information means more is needed than what's recorded

However, data in recent years is likely to underrepresent the total amount of aggregates produced. Aggregates data is produced by New Zealand Petroleum & Minerals, within MBIE, from a survey of quarries across New Zealand. Graph 3 sets out the survey response rate, with the most recent year, 2021, showing just a 54% response rate.

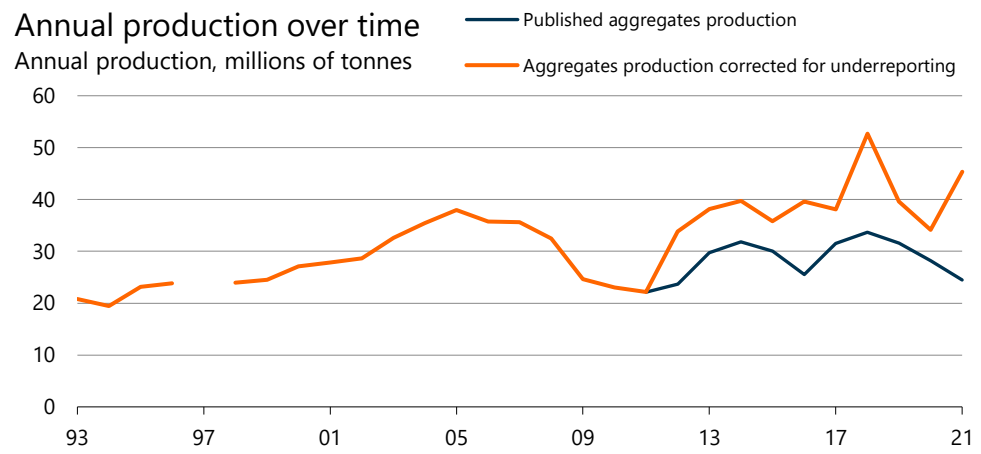
Graph 3



No response rates are published before 2012. The very low response rate in 2021 means that our analysis concentrates on the 2020 result to provide a more comprehensive picture of reported aggregates production.

If the level of aggregates production is upweighted to account for the (sometimes substantial) production underreporting, aggregates production could have been 10.6m tonnes more on average a year (see Graph 4).

Graph 4



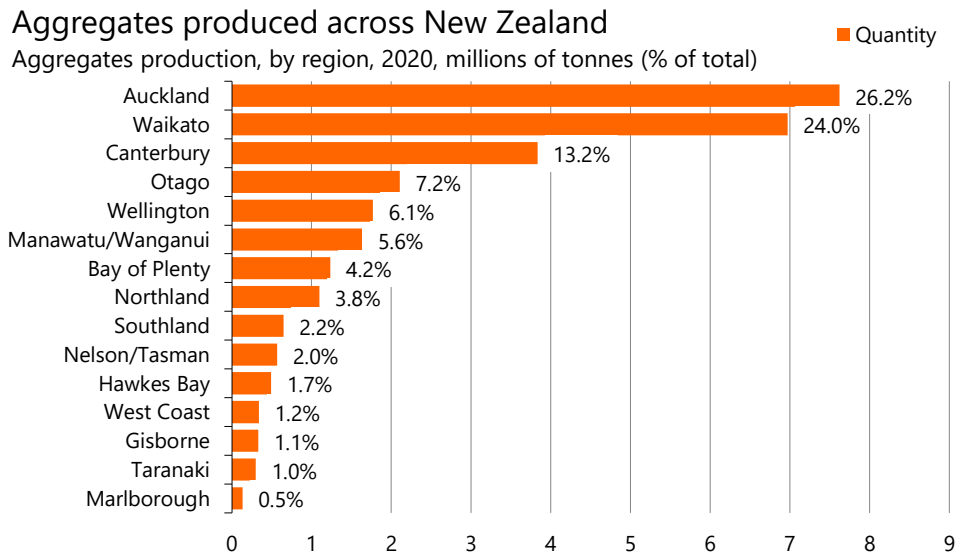
No data was produced in 1997.

Correcting for this underreporting could add over 100m tonnes over the last decade to aggregates production, a 37% uplift. Regardless, both the raw and corrected values show a considerable and sustained level of aggregates use across New Zealand.

Aggregates required across all of New Zealand

Aggregates are currently sourced from across New Zealand, with aggregates usually sourced from as close as possible to where the aggregate is required. The next section on the transport of aggregates details this trend. Infometrics analysis of aggregates production across New Zealand in 2020 shows that Auckland and Waikato account for the largest regional production shares for aggregates, with 50% of total production (see Graph 5). For comparison, the area contributes 43% of New Zealand's population, and 46% of GDP.

Graph 5



However, aggregates are produced across the country, with large levels of production occurring in Canterbury, Otago, Wellington, and the Manawatū. The spread of aggregates production, coupled with the high cost of long-distance transport of aggregates, underscores the importance of maintaining aggregates access across all regions.

However, there are concerns that regional access to aggregates is, and will become, more difficult. A 2022 report for Waka Kotahi noted that *"As city boundaries expand and land development intensification increases the nation's carbon footprint, growing environmental and cultural sensitivities have made it more difficult to operate quarrying businesses close to demand. This has led to the planning and consenting of future aggregate sources taking much longer than before. Regional land use planning and zoning requires secure areas for future aggregate resources."*[1]

Modelling from the same report highlights that aggregates demand levels are positively correlated with increases in Gross Domestic Product (GDP) and roading investment. The 2022 report found that, based on their model of aggregates production and economic activity indicators:

- *"A 10% increase in roading investments from Waka Kotahi and local authorities would boost the production of aggregates by 13%. This result implied that aggregate demand/supply at the national level was significantly influenced by the overall economy and the government's fiscal response. Moreover, aggregate demand/supply increased more than proportionally to the increase in roading investments.*
- *An increase in roading investments and population growth would also increase New Zealand's GDP"*

Although economic activity is expected to contract in the year to June 2024, Treasury expects economic activity to then grow by between 2.1% and 3.3%pa over the next few years, according to the Half Year Economic and Fiscal Update.[2]

Treasury's Long-term Fiscal Model points to a plausible scenario where real GDP increased by 1.6%pa on average between 2026 and 2061.[3]

Taken together, continued economic expansion across New Zealand in the coming decades underscores the need for continued aggregates production, likely at a higher level than is achieved now.

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[1] Wilson, D., Sharp, B., Sheng, M. S., Sreenivasan, A., Kieu, M., & Ivory, V. (2022). Aggregate supply and demand in New Zealand (Waka Kotahi NZ Transport Agency research report 693). Waka Kotahi NZ Transport Agency. Retrieved from https://www.nzta.govt.nz/assets/resources/research/reports/693/693-aggregate-supply-and-demand-in-new-zealand.pdf (accessed 20 January 2023).

[2] Treasury. (14 December 2022). *Half Year Economic and Fiscal Update*. Treasury. Retrieved from https://www.treasury.govt.nz/system/files/2022-12/hyefu22.pdf (accessed 20 January 2023).

[3] Treasury. (September 2021). *Long-term Fiscal Model for He Tirohanga Mokopuna 2021*. Treasury. Retrieved from https://www.treasury.govt.nz/publications/ltfm/long-term-fiscal-model-he-tirohanga-mokopuna-2021 (accessed 20 January 2023).

Examining aggregates' contribution to building costs

Aggregates are a key materials component to the construction sector, in particular for network infrastructure including roading.

Every year, Stats NZ produce detailed weights that outline the proportional price contribution of different goods and services for each industry group, with these weights utilised in the Producers Price Index (PPI).

Infometrics has reviewed the latest set of PPI weights for 2022, and the input commodity "aggregates" is listed as a major material cost input for the "Heavy and civil engineering construction" industry, which deals with network infrastructure construction.

Aggregates are 18% of materials costs, 5% of total costs

As Table 1 outlines below, Stats NZ figures show that aggregates are the second-largest single goods and materials commodity input for the "Heavy and civil engineering construction" industry.

In 2022, Stats NZ PPI weights showed aggregates contributing 5.1% of the total average input price in the "Heavy and civil engineering construction" industry. This figure is 5.1% across construction services, goods and materials, fuel and power, and other related services and expenses.

Table 1

Heavy and civil engineering construction, input costs

Input commodity	Percentage of total input costs	Percentage of materials input costs
Goods and materials	**28.2%**	**100.0%**
Fabricated metal products, excluding machinery and equipment	8.0%	28.4%
Aggregates	**5.1%**	**18.2%**
Articles of concrete, cement, and plaster	4.5%	16.1%
Plaster, lime, and cement	2.7%	9.7%
Plastic and plastic products	1.7%	6.0%
Wood	1.0%	3.7%
Other goods and materials	5.1%	18.0%

Overall, aggregates are the fourth-largest cost by single item, behind civil engineering services, special trade construction services, and metal-based materials.

Looking just at materials costs in the "Heavy and civil engineering construction" industry aggregates make up 18% of the total materials cost for an average network infrastructure job.

Aggregates also required for housing

The amount of aggregates required for housing is uncertain and not well established in New Zealand, with a variety of estimates used.

Previous analysis of aggregates use, using overseas data, suggest that a standalone house requires 400 tonnes of aggregates, and a medium-to-high density building requires 60 tonnes per $100m^2$.[4] Unsourced material from the Aggregate and Quarry Association noted in 2019 that "*an average house uses 250 tonnes of aggregate and sand.*"[5]

With an average of around 23,400 standalone house consents issued on average annually since 2020, between 5.9m and 9.4m tonnes of aggregates a year could theoretically be needed, with more needed for the rising level of medium-to-high density buildings.

Although this level of aggregates demanded is larger than actual production, construction in recent times has been limited by supply chain issues, building at levels below the record levels consented, and increasingly are increasing density on already-built areas, all of which would reduce actual levels of aggregates required per dwelling.

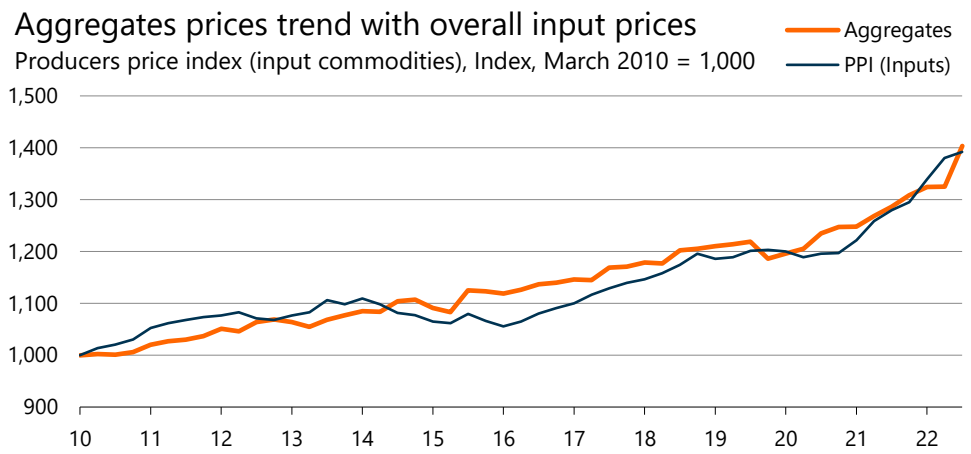
Aggregates have been getting more expensive

Detailed PPI input commodity indexes have only been published for the last decade or so. Infometrics analysis of Stats NZ data is seen in Graph 6 and Graph 7. Graph 6 shows that aggregates prices have generally trended in line with broader business price inputs.

[4] Deloitte, Richard Paling Consulting, Murray King & Francis Small Consulting, and Cooper Associates. (2014). *National Freight Demand Study 2014*. Ministry of Transport. Retrieved from https://www.transport.govt.nz/assets/Uploads/Report/National-Freight-Demand-Study-Mar-2014.pdf (accessed 20 January 2023), based on a 2013 unpublished Market Economic Report.

[5] Scott, W. (2019). *Challenges Facing the New Zealand Aggregates Sector*. Aggregate and Quarry Association. Retrieved from https://cdn.ymaws.com/concretenz.org.nz/resource/resmgr/docs/conf/2019/s3_p4.pdf (accessed 23 January 2023).

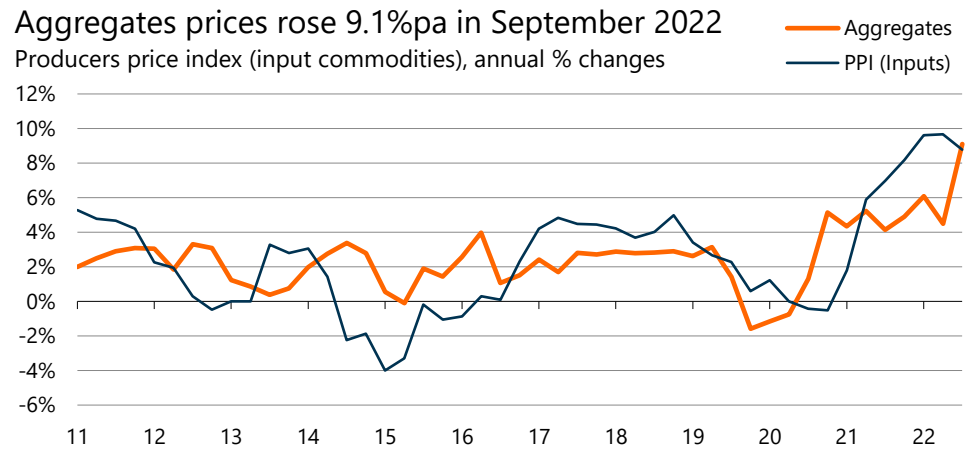
Graph 6



Aggregates price levels rose faster than broad business input prices from around 2015 until late 2019, and then again during 2020-21.

As Graph 7 shows, annual growth in aggregates prices rose faster than broad business input prices over 2020-21, with a recent acceleration towards the end of 2022 as high inflation in general saw many business input price increases head higher or remain high.

Graph 7



Examining the cost of transporting aggregates

Transport costs are a major consideration for aggregates production and can make up a substantial proportion of the total cost of aggregates. Aggregates is a high-volume, low-value commodity.

As a result of these attributes, transport costs are a significant component of overall aggregates cost.[6] The location of aggregates sources close to where the aggregates are required are crucial to keep transport and overall costs low and manageable.

Taken together, the section below makes it clear that transport costs have a significant influence on overall aggregates costs

Most aggregates moved by road

Various editions of the National Freight Demand Study note that aggregates as almost always moved via road, in large trucks. A small amount of aggregates are moved by rail.[7]

The 2014 National Freight Demand Study noted that aggregates are a

> "*bulk product well suited to line haul by rail,* [but] *the short distances transported and distributed destinations make rail impracticable. A study of potential aggregate movement from Huntly to Auckland31 in 2010 found that access to rail at Huntly added cost, as did the need for a distribution terminal in Auckland. While the line haul cost by rail was competitive, the overall move was cheaper by road.*"

A limited amount of aggregates is currently transported by coastal shipping too. A government briefing on coastal shipping notes that "[New Zealand coastal shipping is] *primarily geared towards transporting large, heavy cargoes such as fuel, cement and aggregate and various containerised goods.*"[8]

A 2021 report noted two coastal shipping vessels that move aggregates.[9]

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[6] Walrond, C. (2006). *Rock, limestone and clay – Aggregate.* Te Ara - the Encyclopedia of New Zealand. Retrieved from http://www.TeAra.govt.nz/en/rock-limestone-and-clay/page-2 (accessed 20 January 2023)

[7] Richard Paling Consulting, Murray King & Francis Small Consultancy, and EROAD Limited. (2019). *National Freight Demand Study 2017/18*. Ministry of Transport. Retrieved from https://www.transport.govt.nz/assets/Uploads/Report/NFDS3-Final-Report-Oct2019-Rev1.pdf (accessed 20 January 2023).

[8] Offices of the Minister of Energy and Resource, and Transport. (2022). Retaining or redeploying New Zealand's coastal shipping capability. New Zealand Government. Retrieved from https://www.mbie.govt.nz/dmsdocument/21354-retaining-or-redeploying-new-zealands-coastal-shipping-capability-proactiverelease-pdf (accessed 20 January 2023).

[9] Pacific Marine Management Ltd. (2021). Coastal Shipping Investment Approach Report 1 - State-of-Play. Waka Kotahi NZ Transport Agency. Retrieved from https://www.nzta.govt.nz/assets/resources/coastal-shipping-research/nzta-coastal-shipping-state-of-play-report.pdf (accessed 23 January 2023).

Supply of aggregates from any one quarry is finite, and new quarries and sources of aggregates will be needed.[10] The location of aggregates demand will also shift as different projects are approved and constructed. A wide and shifting range of aggregates origins and destinations means that flexible transport options for aggregates are likely to remain favoured over fixed transport options like rail and coastal shipping.

Aggregates made up 15% of the total freight volume moved around New Zealand in 2018,[11] compared to 11% in 2014,[12] and 26% in 2008.[13]

However, aggregates movements only accounted for between 3% and 13% of the total transport distances carried, given the importance of location for aggregates.

Graph 8

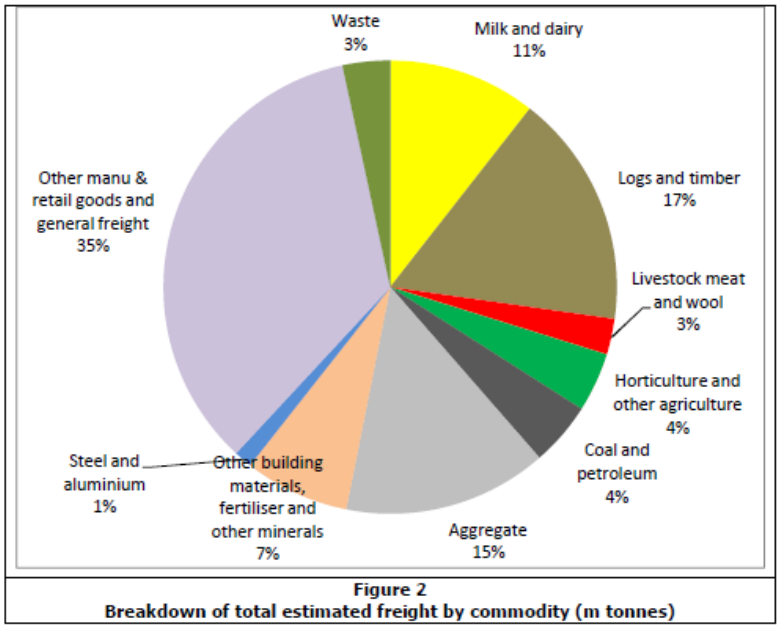


Figure 2
Breakdown of total estimated freight by commodity (m tonnes)

Source: National Freight Demand Study 2017/18

[10] Hill, MP. (2021). Aggregate Opportunity Modelling for New Zealand. GNS Science. Retrieved from https://www.tewaihanga.govt.nz/assets/Uploads/Aggregate-Opportunity-Modelling-for-NZ.pdf (accessed 23 January 2023).

[11] Richard Paling Consulting, Murray King & Francis Small Consultancy, and EROAD Limited. (2019). *National Freight Demand Study 2017/18*. Ministry of Transport. Retrieved from https://www.transport.govt.nz/assets/Uploads/Report/NFDS3-Final-Report-Oct2019-Rev1.pdf (accessed 20 January 2023).

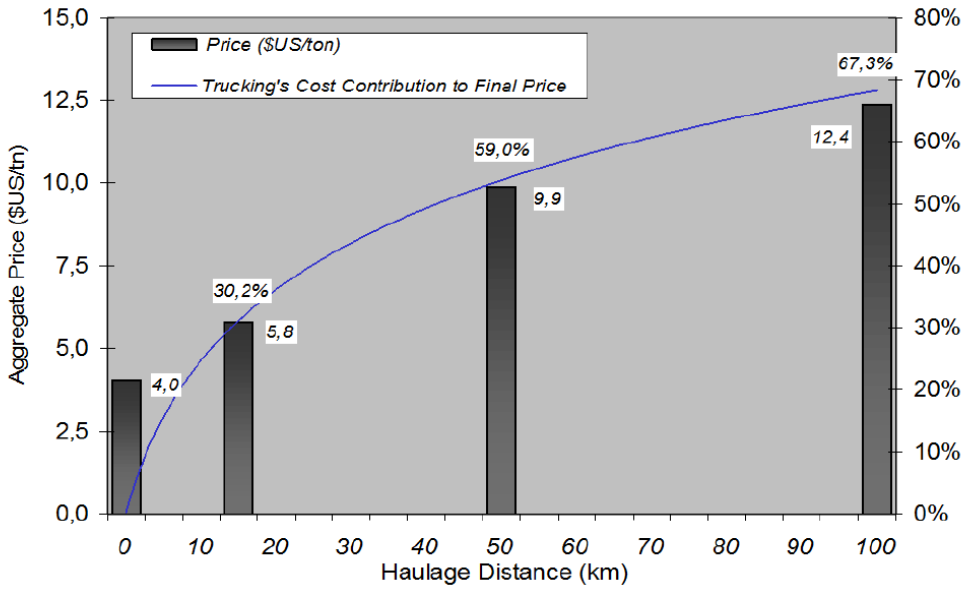
[12] Deloitte, Richard Paling Consulting, Murray King & Francis Small Consulting, and Cooper Associates. (2014). *National Freight Demand Study 2014*. Ministry of Transport. Retrieved from https://www.transport.govt.nz/assets/Uploads/Report/National-Freight-Demand-Study-Mar-2014.pdf (accessed 20 January 2023).

[13] Richard Paling Consulting, IPC & Associates, John Bolland Consulting Ltd, Murray King & Francis Small, and Ascari Partners. (2008). *National Freight Demands Study 2008*. Ministry of Transport. Retrieved from https://www.transport.govt.nz/assets/Uploads/Report/FreightStudyComplete.pdf (accessed 20 January 2023).

Transport costs can contribute more than half the cost at greater distances

International evidence confirms rising transport costs the further away from the source the aggregates has to be moved. A 2000 study from Greece showed that "an increase in the haulage distance, ranging from 50 to 100 km, would result in more than doubling the price of aggregates."[14]

Figure 1



Aggregate price and trucking cost contribution, in relation to the haulage distance.
Source: Kaliampakos & Benardos (2000)

In this study, transporting aggregates 15km from the source sees transport costs contribute around 30% of the overall cost of aggregates material and aggregates transport cost. At 50km, the transport component is 59% of the total cost, and at 100km, the transport component is over 67% of the total cost.

Stylised scenario costs

Applying these proportions to stylised scenarios of New Zealand's aggregates use for building and construction highlights possible cost savings estimates from having aggregates located nearer to where they are demanded.

In 2020, the average value of aggregates used for housing-based purposes ("Rock, sand and gravel for building") was $19.73/tonne. The total quantity of aggregates produced in this category was 6.05m tonnes.

Recognizing the range of distances that aggregates can travel (some closer to their source than others), and with a total quantity of just over 6m tonnes of aggregates used for housing, we have constructed a set of transport cost scenarios to estimate the

[14] Kaliampakos, D. C., and A. G. Benardos. "Quarrying and sustainable development in large urban centres: A contradiction in terms?" CIM (Canadian Mining and Metallurgical) Bulletin 93, no. 1040 (2000): 86-89.

possible scale of additional cost that having aggregates sources located further away from where they are demanded.

In 1m tonne increments (1m T, 2m T, …, 6m T), we modelled the cost of moving the aggregates volume an average of 50km versus moving the same volume of aggregates an average of 15km.

The scenario analysis suggests additional costs of between $19.9m (for 1m tonnes) and $119.6m (for 6m tonnes) a year to transport aggregates over longer distances.

Table 2

Possible cost differences for housing-based aggregates being transported different distances
Scenario analysis

Scenario	Distance from quarry	Aggregates (T)	Cost of aggregates materals ($/T)	Transport cost %[1]	Original materials cost %[2]	Transport Cost component	Delivered Price	Total cost	Difference	Difference ($m)
1m tonnes	Base case: 15km	1,000,000	$19.73	30.0%	70.0%	$8.46	$28.19	28,191,210		
	Further away case: 50km	1,000,000	$19.73	59.0%	41.0%	$28.40	$48.13	48,131,333	19,940,124	$19.94
2m tonnes	Base case: 15km	2,000,000	$19.73	30.0%	70.0%	$8.46	$28.19	56,382,419		
	Further away case: 50km	2,000,000	$19.73	59.0%	41.0%	$28.40	$48.13	96,262,667	39,880,248	$39.88
3m tonnes	Base case: 15km	3,000,000	$19.73	30.0%	70.0%	$8.46	$28.19	84,573,629		
	Further away case: 50km	3,000,000	$19.73	59.0%	41.0%	$28.40	$48.13	144,394,000	59,820,372	$59.82
4m tonnes	Base case: 15km	4,000,000	$19.73	30.0%	70.0%	$8.46	$28.19	112,764,838		
	Further away case: 50km	4,000,000	$19.73	59.0%	41.0%	$28.40	$48.13	192,525,334	79,760,495	$79.76
5m tonnes	Base case: 15km	5,000,000	$19.73	30.0%	70.0%	$8.46	$28.19	140,956,048		
	Further away case: 50km	5,000,000	$19.73	59.0%	41.0%	$28.40	$48.13	240,656,667	99,700,619	$99.70
6m tonnes	Base case: 15km	6,000,000	$19.73	30.0%	70.0%	$8.46	$28.19	169,147,257		
	Further away case: 50km	6,000,000	$19.73	59.0%	41.0%	$28.40	$48.13	288,788,000	119,640,743	$119.64

1: From Kaliampakos & Benardos, 2000
2: One minus the transport cost

Inter-regional aggregates movement cost-prohibitive

In New Zealand, the 2018 National Freight Demand Study reinforces that transport costs are exorbitant over longer distances. According to the Study, "[i]t costs about the same to transport the material 30km as it does to produce it, and the same transport costs are added for every 30km beyond that. This figure was repeated from the 2008[15] and 2014[16] National Freight Demand Studies.

The *Responsibly Delivering Value – Minerals and Petroleum Resource Strategy for Aotearoa New Zealand: 2019–2029* also noted the same trend:

> "*Houses, roads, bridges and buildings would not exist without aggregates. The crushed rock is expensive to transport (the cost of aggregate doubles in the first*

[15] Richard Paling Consulting, IPC & Associates, John Bolland Consulting Ltd, Murray King & Francis Small, and Ascari Partners. (2008). *National Freight Demands Study 2008*. Ministry of Transport. Retrieved from https://www.transport.govt.nz/assets/Uploads/Report/FreightStudyComplete.pdf (accessed 20 January 2023).
[16] Deloitte, Richard Paling Consulting, Murray King & Francis Small Consulting, and Cooper Associates. (2014). *National Freight Demand Study 2014*. Ministry of Transport. Retrieved from https://www.transport.govt.nz/assets/Uploads/Report/National-Freight-Demand-Study-Mar-2014.pdf (accessed 20 January 2023).

30km of transport) which is why it is important that quarries are located near their end uses."[17]

Inter-regional movements of aggregates in the 2008, 2014 and 2018 National Freight Demand Studies showed very low levels of regional aggregates movements, aside from cross-border aggregates movements over short distances.

Table 3

Table 4.42
Total movements of aggregate 2017/18 (m tonnes)

		Destination														
		North-land	Auckland	Waikato	Bay of Plenty	Gisborne	Hawke's Bay	Taranaki	Manawatu-Wanganui	Wellington	TNM	West Coast	Canter-bury	Otago	South-land	Total
Origin	Northland	1.55	0.06	-	-	-	-	-	-	-	-	-	-	-	-	1.61
	Auckland	-	9.98	0.10	-	-	-	-	-	-	-	-	-	-	-	10.08
	Waikato	-	1.15	6.01	1.11	-	-	0.26	-	-	-	-	-	-	-	8.53
	Bay of Plenty	-	-	-	1.61	-	-	-	-	-	-	-	-	-	-	1.61
	Gisborne	-	-	-	-	0.48	-	-	-	-	-	-	-	-	-	0.48
	Hawke's Bay	-	-	-	-	-	0.96	-	-	-	-	-	-	-	-	0.96
	Taranaki	-	-	-	-	-	-	0.47	-	-	-	-	-	-	-	0.47
	Manawatu-Wanganui	-	-	-	-	-	0.02	0.06	1.88	0.15	-	-	-	-	-	2.12
	Wellington	-	-	-	-	-	-	-	-	1.69	-	-	-	-	-	1.69
	TNM	-	-	-	-	-	-	-	-	-	1.05	0.09	-	-	-	1.14
	West Coast	-	-	-	-	-	-	-	-	-	-	0.13	-	-	-	0.13
	Canter-bury	-	-	-	-	-	-	-	-	-	0.09	0.18	8.67	-	-	8.94
	Otago	-	-	-	-	-	-	-	-	-	-	-	0.11	1.93	0.06	2.10
	Southland	-	-	-	-	-	-	-	-	-	-	-	-	-	0.67	0.67
	Total	1.55	11.20	6.11	2.72	0.48	0.98	0.79	1.88	1.83	1.14	0.40	8.78	1.93	0.73	40.52

Source: National Freight Demand Study 2017/18

The figures in Table 3 show that aggregates usually originate from the same region as the destination of the aggregates or move into a neighbouring region. The difference in stated aggregates by region between Table 2 and Graph 5 are both the different time periods (2020 vs 2017/18), and the different corrections that might have taken place to account for reported figures and underreporting.

[17] New Zealand Government. (2019). *Responsibly Delivering Value – A Minerals and Petroleum Resource Strategy for Aotearoa New Zealand: 2019–2029*. MBIE. Retrieved from https://www.mbie.govt.nz/dmsdocument/7148-responsibly-delivering-value-a-minerals-and-petroleum-strategy-for-aotearoa-new-zealand-2019-2029 (accessed 2 February 2023).