Received: 18 December 2022 | Revised: 18 March 2024 | Accepted: 27 March 2024

DOI: 10.1111/nzg.12388

RESEARCH ARTICLE

NEW ZEALAND GEOGRAPHER WILEY

# New Zealand public transport agencies' responses to COVID-19: Understanding public transport services, infrastructure and communication measures

**Jonty Whale** | **Muhammad Imran**

School of People, Environment and Planning, Massey University, Palmerston North, New Zealand

**Correspondence**
Muhammad Imran, School of People, Environment and Planning, Massey University, Palmerston North, New Zealand.
Email: i.muhammad@massey.ac.nz

**Abstract**

COVID-19 brought public health challenges to the public transport system throughout the world. As a result, a range of response measures were implemented to ensure the safety of passengers while maintaining a functioning system. This paper explores the responses of public transport agencies in New Zealand's metropolitan cities (Auckland, Christchurch and Wellington) to the COVID-19 pandemic by examining their physical and communication measures. We analysed public transport agencies' websites to understand the response measures implemented, including the accessibility of COVID-19-related information, and the communication of information via websites and social media platforms. The results show that 13 service responses were implemented across the three public transport agencies, with Auckland implementing the most measures. Seven infrastructural responses were implemented, with Christchurch implementing all seven. Wellington was found to be the public transport agency that used social media the most during the pandemic. The website accessibility findings suggest that the more accessible a public transport agency's website was, the less information was present. The research concludes that all three public transport agencies in New Zealand performed reasonably well and were able to maintain a safe and responsive public transport system.

**KEYWORDS**

COVID-19, New Zealand, public transport

## 1 | INTRODUCTION: PUBLIC TRANSPORT DURING COVID-19

Worldwide, COVID-19 measures such as lockdowns, working from home, compulsory masks and physical/social distancing rules impacted public transport patterns, services, and ridership (Zhang & Hayashi, 2022). However, this response and its impact on ridership had already been experienced during the serious acute syndrome (SARS) outbreak of 2003. For example, Hong Kong public transport patronage declined by 10%–20% overall, and use of the Airport Train dropped by 50% during the SARS pandemic (Siu & Wong, 2004). The perception of high risk associated with contracting the

SARS virus in public transport was so severe that with 'each reported new SARS case there was an immediate loss of about 1200 underground [train] ridership' (Wang, 2014, p. 1) in Taipei. However, the SARS pandemic experience has helped Hong Kong to become well equipped in managing passengers and operators during an outbreak of COVID-19 (Ridango, 2022).

In New Zealand, public transport services were modified and ridership decreased by nearly 47% during 2020–2022 (the COVID-19 period) (see Waka Kotahi links in appendix). There was a clear drop in public transport boardings from 2018 to 2022 in Auckland (40%), Wellington (31%) and Christchurch (25%). The drop occurred because of general negative perceptions of public transport. For example, New Zealand cities moved to Alert Levels 4 and 3 (see Section 2). These regulations encouraged working from home and reduced overall travel. Therefore, public transport decreased (Conrow et al., 2021).

Gray et al. (2021) found public support for banning the use of public transport in the early stages of COVID-19 in New Zealand, with 94% of respondents to the survey supporting a ban on public transport during Alert Level 4, 90% doing so in Level 3, and 88% doing so in Level 2. Waka Kotahi, the central government transport agency, found that most respondents felt that buses and trains were safe throughout the pandemic. But 12% of respondents were less comfortable using public transport when masks were no longer required. New Zealand cities implemented rear door boarding and exiting, and used tape to guarantee physical distancing for drivers. However, passengers were encouraged to leave a seat empty if they could and to try to stay at least 1 m away from other passengers. The physical distancing requirements for passengers were further developed by forcing vehicle capacity limit guidelines because it was considered challenging to strictly implement physical or social distancing in buses and trains. According to media reports, the loose requirements of physical distancing in buses and trains disproportionately affected travel for people with disabilities and other health issues, which made them vulnerable to infection with COVID-19 during travel. Thomas et al. (2021) showed that in New Zealand, positive attitudes towards public transport decreased from pre-COVID-19 times, and increased only slightly after the travel restrictions were removed. This showed that the response of users was more cautious. Public transport may take time to get back to what was considered 'normal' before COVID-19, but the data from Thomas et al. (2021) suggest that this could be the new normal.

Waka Kotahi stated that working remotely and from home are likely to increase and are likely to temper the demand for public transport in the long term (see Waka Kotahi links in appendix). Many businesses are allowing their staff to work from home. Green et al. (2020) argued that it is likely that many workers will want to see working from home continue. Despite public transport patterns and ridership changing during COVID-19, the New Zealand government declared public transport to be an essential service, which forced public transport authorities in different cities to provide these services, with increased priority given to health, safety and the wellbeing of the public. Therefore, it is important to understand how New Zealand transport agencies responded to the pandemic by making public transport safe and communicating information about their public transport services during this critical period. By understanding the COVID-19 response measures implemented, public transport agencies in New Zealand can improve their services and infrastructure plans and communication strategies in future disrupted situations.

This study looked at Auckland Transport (AT), Greater Wellington (GW) and Environment Canterbury (ECan) did to respond to COVID-19 and how they did it. The main purpose was to identify what approaches to controlling the COVID-19 pandemic were implemented in the public transport system in three metropolitan cities and to explain the differences among these cities and organisations. We focused on the period of February 2020, when the first COVID-19 case was reported in New Zealand, and onwards.

Section 2 presents a review of the relationship of the central and local governments during the pandemic regarding measures related to transport. Section 3 presents a detailed description of the research design. Section 4 presents the results, followed by a discussion and conclusion.

## 2 | CENTRAL AND LOCAL GOVERNMENT DURING COVID-19

COVID-19 measures required cross-sectoral and multi-level decision-making (Jarman, 2021). However, worldwide coordination of the public health crisis management, transportation and economic functions of central and local governments were not smooth. For example, in some states in the United States, economic considerations prevailed over public health, resulting in relaxing restrictions on public transport and public spaces too quickly, with a subsequent increase in COVID-19 cases (Jarman, 2021).

In Europe, where local governments normally have considerable autonomy, they still relied on the central government for resources to respond to the pandemic's impact on transportation. For example, the United Kingdom government provided a £1.6 billion emergency fund to Transport for London to keep their public transport services operational, including trains. The UK government allocated

£2 billion to cycling and walking infrastructure, including £250 million for local authorities to fund 'pop-up' infrastructure to facilitate physical distancing (Department for Transport, 2020).

In countries where local governments were left without significant direction and resources from the central government and where different political parties operated in central and local governments, a 'patchwork of outcomes' was evident (Jarman, 2021). For example, local government in Turkey played a key role in disinfecting the streets, public transport and public spaces (Özçürümez, 2021). However, central government realised that metropolitan mayors from opposing parties were gaining political advantages and stopped their response. Similarly, the Hungarian government cut the budget of local governments, especially in Budapest, where the opposition party was ruling the city. These international examples show the inherent contradictions of the structural and policy-related tensions between central and local governments.

In New Zealand, central and local government work collaboratively through policy and funding initiatives to ensure that the country's transport system is functional. The Ministry of Transport prepares policies and works closely with other government agencies, local authorities, interest groups and operators to realise opportunities, mitigate risks and ensure that the transport system improves wellbeing. However, transport policies have failed to operationalise wellbeing in the transport system because of institutional silos, path dependence and a lack of multi-disciplinary approaches to transport planning (Ball et al., 2009; Imran & Pearce, 2015; Inayatullah & Milojevic, 2021). Waka Kotahi provides the vital link between the government's policies and the operation of the transport sector. Waka Kotahi works closely with regional councils and territorial local authorities, which together are responsible for implementing public transport plans, projects and services in their jurisdiction.

Alongside the central–local government relationship, there is a complex relationship between regional councils and territorial/city councils in the operation of public transport services and infrastructure. The regional councils are responsible for planning, communicating and marketing public transport services, while territorial councils are responsible for managing the infrastructure. For example, GW and ECan are responsible for operating public transport in their regions, while the city and district councils in their regions are responsible for maintaining the related infrastructure. Auckland has a unitary council, and AT is a council-controlled organisation responsible for all transport-related functions and operations in the area.

AT, GW, and ECan are responsible for tendering public transport services, which are run by different private companies. For example, ECan is responsible for planning and tendering public transport in Greater Christchurch and Timaru, whereas Go Bus, Ritchies and Black Cat operate bus services in the Greater Christchurch Area. ECan is responsible for marketing and communications, and therefore have the dedicated Metro Canterbury website that provides information, timetable, fares and real-time data. This information was more crucial during the COVID-19 pandemic when uncertainty was high.

New Zealand's central government developed four Alert Levels, which were replaced by the 'traffic light' system in December 2021. In March 2020, the central government announced Alert Level 4 (Lockdown), when no travel was allowed except for essential workers and for necessities (e.g. purchases at supermarkets and pharmacies). Specific measures applied under the alert level system, such as restrictions on movement, mandatory mask wearing and social distancing. These measures were aligned with UITP guidelines for worldwide public transport operators (The International Association of Public Transport, 2020a). Another important mechanism that the New Zealand central government introduced to help combat the spread of COVID-19 was the track-and-trace app, which required everyone to scan into the locations they visited. These measures forced changes in the public transport sector and required response measures to be implemented by the public transport agencies to maintain a safe but efficient public transport network.

During the COVID-19 pandemic, the role of the local government in New Zealand remained peripheral (Bromfield & McConnell, 2020). Stoney et al. (2023) argued that this reflected the highly centralised system of government, in which local governments do not provide social services. Despite the highly centralised pandemic-related instructions and policies, public transport is mainly the responsibility of Auckland Transport (AT), Greater Wellington (GW) and Environment Canterbury (ECan). Because the pandemic lasted for a significant period, it allowed central government to make decisions on mask restrictions. AT, ECan and GW are responsible for setting fares in their jurisdictions. However, the Labour-led central government provided funds for free and discounted fares for public transport, which ended in April 2024. After the pandemic, the former central government also intervened in developing better working conditions and training to overcome a shortage of bus drivers. In normal circumstances, central government and Waka Kotahi consult with local governments for an extended time about policies. However, during the pandemic, central government expected local government to implement its policies with little consultation, creating confusion about whether social distancing measures on well-used public transport routes were practical. The response of central government and

transport agencies produced uncertainty about the causes, spread and cure of the virus. However, it is important to explore what happened in the public transport system before the COVID-19 Protection Framework ended in September 2022.

## 3 | RESEARCH DESIGN

This study used an inductive methodology, namely a case study approach (Yin, 1994). Transport planning scholars use comparative research to explain differences in practices at the local level (Hirschhorn et al., 2019; Legacy et al., 2017). By focusing on three metropolitan cities, namely Auckland (1.8 million), Wellington (0.5 million) and Christchurch (0.6 million), we hoped to learn more about the role their transport agencies (AT, GW and ECan respectively) played during the COVID-19 era. Before COVID-19, Auckland had approximately 100 million public transport boardings per year, followed by 39 million in Wellington and 13.7 million in Christchurch. All three cities differ in their provision of public transport services, modes of public transport and patronage, and Auckland has a unique governance system (a unitary authority with a dedicated transport agency). We see this as a strength of the research, as it allowed us to evaluate how different cities and their transport systems responded to COVID-19. Alongside these differences, the cities had one similarity, namely the dominant role of central government (Stoney et al., 2023). As local governments in New Zealand have no constitutional foundation, the roles of AT, ECan and GW and their councils were peripheral (Bromfield & McConnell, 2020) and were limited to implementing central government's responses. These differences and the similarity provide us with an opportunity to explore the measures related to public transport services, infrastructure and communication adopted by AT, ECan and GW during the pandemic.

First, this research reviewed the websites of each agency to assess the various responses implemented during the pandemic, and reviewed data from the start of the pandemic in 2020 to July 2022. An initial review of all websites was conducted by searching for the keywords 'COVID-19' and 'COVID'. This located all the relevant pages and gave an idea of the categories and response measures that could be used for further searching. Once all the relevant pages had been located, a set of primary categories was created. Once the primary categories had been created, sets of response measures common to all transport agencies were assigned to categories. Our process is similar to that of Diaz et al. (2021). The review was limited to the websites, and other information (such as council documents) was not covered in the analysis. Agencies may have implemented some measures but not communicated information about them via their website. Second, this research reviewed the transport agencies' websites to check the accessibility (not in terms of disability) of the information about COVID-19 and public transport via a search conducted in the middle of July 2022. This was assessed by the number of clicks it took from the home page to reach the relevant information. As the alert levels and their related information kept changing and disappearing, we searched by keyword on the AT, Metlink and Metro websites as the primary public transport websites rather than the websites of GW and ECan. To show accessibility, a scale was created to categorise how easy it was to access the information of each transit agency, where high access = 0–1 click, medium access = 2–3 clicks, and low access = 4+ four, inspired by Diaz et al. (2021) and Currie and Gook (2009).

Third, this research explored the social media communications of the transport agencies. Facebook was the platform selected for collecting these data, as over 82% use Facebook in New Zealand (Statista, 2022). Facebook is an emerging 'cyber research' data source (Hofmann et al., 2013; Sheller & Urry, 2006) which has previously been used in transport research (Shammut et al., 2023; Zayet et al., 2021). Data were collected from the start of the pandemic in 2020 to July 2022. To gain an understanding of the themes, a keyword search was carried out using the search terms 'COVID-19', 'COVID', and 'public transport' throughout the five Facebook pages operated by three public transport agencies. Once the search for common phrases used in posts about COVID-19 was complete, a final set of phrases was confirmed and used as the search terms to analyse the social media pages. Only the original posts themselves were considered, with replies being disregarded. It is important to note that Facebook's page search function can glitch, and sometimes will not bring up all the posts with the search phrases, so the search was conducted numerous times for each phrase to make sure that the data were as accurate as possible. The results are presented in Section 4.

It is important to note that this study was based on a method that assessed public transport agencies' websites and Facebook pages to understand what response measures to the pandemic were implemented and how well these were communicated to the public. There are two limitations. First, we reviewed public information from the transport agencies, rather than what they actually did and how it was perceived by public in the form of metrics (e.g. likes and viewing). Second, we did not examine whether the measures were actually followed by public transport users during the pandemic. This study aimed to investigate only what the public transport agencies put on their websites about the measures they implemented.

## 4 | RESULTS

The review of the websites identified 20 different common physical and communication-related measures, which were separated into two categories: (1) services (changes to services and systems) and (2) infrastructure (onboard mitigation measures and changes to facilities). This list was refined to include 17 response measures. These categories were further divided into implementable measures by getting inspiration from Canadian studies conducted by Diaz et al. (2021). The review was limited to the website analysis and any other information (such as council documents) were not covered in the analysis. There is a possibility that the agencies may have implemented certain measures but not communicated them on their website.

The social media analysis found 4408 posts across five Facebook pages from all transport agencies from January 2020 to the end of July 2022. The average number of posts was worked out by first analysing five individual weeks of activity (27 June to 31 July) and finding the average number of posts per week. That average was then multiplied by the number of weeks (132) since the start of 2020 to work out the average number of posts per transport agency. The reason for selecting 5 weeks of activity on the Facebook pages was because of time and resource constraints, but we believe this time period was sufficient to generalise the results.

### 4.1 | Public transport agencies' responses during COVID-19 (2020–2022)

This section focuses on the responses to COVID-19 of AT, ECan and GW in terms of public transport services, infrastructure and communication strategies.

#### 4.1.1 | Service-related responses

This section includes the changes in public transport services and systems implemented in Auckland, Christchurch and Wellington. In general, public transport services in New Zealand cities are timetabled with peak period frequencies (7:00–9:00 AM and 3:00–6:00 PM) and off-peak frequencies in the Monday to Friday service period and reduced frequencies in the weekend (Saturday and Sunday) and on public holidays. Therefore, service-related responses included modified schedules, reduced schedules, replacement services, additional services, route changes and Saturday and Sunday timetables. System-related changes included discounted fares, masks for users, masks for operators, QR scanning, vaccine passes and contactless payment systems. AT, ECan and GW are responsible for setting fares in their jurisdictions, with any additional funding from former central government if a universally discounted fare has been implemented.

*Service changes*

AT implemented six out of the seven service-related changes. Route changes were the only measure not implemented. AT implemented modified and reduced schedules. For example, bus, train and ferry schedules were modified and reduced following the Omicron outbreak in May 2022, causing several cancellations. Frequency changes were implemented across all modes of public transport. Some bus lines were modified to be available every 15–30-min. In 2022, AT implemented additional services by introducing early morning and late-night bus trips running to support demand. Saturday and Sunday timetables were also implemented. Bus services were changed to Saturday timetables in 2021, with additional services to hospitals; in 2022, 13 bus routes were changed to a Saturday timetable. AT implemented two Sunday timetables in 2021, providing special train services for essential workers, and ferries switched to a Sunday timetable.

ECan implemented five of the seven service-related changes. Route changes and replacement services were not implemented. ECan implemented a modified schedule to ease demand, as well as reduced schedules. ECan explained that this was because of a national driver shortage.[1] ECan was the only public transport agency not to mention replacement services because the whole system is a bus-based service. ECan had information about additional services. ECan's MyWay (on-demand public transport) was initiated in 2020 in the Canterbury region outside the metropolitan Christchurch area. MyWay operated by passengers requesting a vehicle for transport rather than waiting for a bus. MyWay was a pilot project which did not start as a response to COVID-19 but had just started in the beginning of the pandemic. ECan implemented both Saturday and Sunday timetables throughout the pandemic. In March 2020, Sunday timetables were implemented for all bus services until the following month, which then switched to Saturday timetables for most bus services.

GW implemented five of the seven service-related changes: modified and reduced schedules, additional services, route changes, and Saturday timetables. GW struggled with driver shortages and implemented modified and reduced schedules to combat this issue. GW updated public transport users about these altered schedules, and detailed the changes on their website, including updates about additional services and route changes. GW added numerous additional services to the public transport network across the region. GW had many updates


**FIGURE 1** Campaign poster for discounted fares. *Source*: Auckland Transport website.

across their website throughout the pandemic that discussed modified and reduced schedules. GW implemented several Saturday timetables for bus and train services across the region; however, information about these timetables could only be found on two pages on the website during this analysis. There may have been more Saturday timetables implemented; however, there was no information on them. There was a mention of Sunday timetables on the website, but this was a normal Sunday timetable for these bus routes and GW did not implement them as a response measure.

*System-related changes*

AT implemented all six system-related changes. Discounted fares were implemented from 1 April in 2022 to 30 April 2024 (Figure 1); however, this was not by the choice of AT themselves. The former Labour-led New Zealand Government's ploy to encourage people to use public transport again saw AT implement a 50% discount, which applied to buses, trains and ferries.

Masks for users and operators were also implemented. Initially, masks were recommended across the transport network in Auckland, then the central government made masks compulsory in August 2020 (Beehive, 2020). AT implemented a 'no mask, no travel' rule unless a passenger had a medical exemption. Uniquely, AT made masks available through 42 vending machines across their public transport facilities (Figure 2), which distributed 1500 masks among them. Contactless payments, encouraging the scanning of QR codes and vaccine passes measures were also implemented. Central government required New Zealanders to have vaccine passes, making it mandatory for AT to apply this (Beehive, 2021). AT constantly reminded public transport users to scan QR codes for contact tracing.

ECan implemented all six of the system-related changes. ECan had many reminders regarding masks for all public transport users. All updates regarding COVID-19 on their website contained information on whether masks were mandatory at that stage of the pandemic. Discounted fares and the encouragement of contactless payment were both implemented by ECan via a free MetroCard. With funding through their 2020/21 Annual Plan, ECan permanently reduced the price of the MetroCard to $5.00. ECan also released articles regarding safe travel containing information on and encouraging contactless payment methods. ECan had measures encouraging QR scanning and vaccine passes. Like the masks, most posts related to COVID-19 had messages about scanning the QR codes and reminders about vaccine passes.

GW implemented all six system-related changes. Alongside the discounted fares that the government implemented from April 2022 to January 2023, GW also implemented other discounted fares to encourage use and introduced contactless payments. One measure implemented was a 50% discount on all monthly train passes for customers who switched to using EFTPOS during April, May, and June in 2020. GW recommended masks for users and operators on all public transport services. Detailed information on what was classed as a mask was found on their website, as well as the age of students required to wear one. GW provided details in every COVID-19 update regarding face masks. GW's website encouraged users to scan QR codes and keep track of their journeys in all facilities and vehicles. Vaccine passes were also mentioned on their website.

Table 1 summarises the measures implemented by transport agencies.

### 4.1.2 | Infrastructure-related responses

This section includes responses related to infrastructure, especially onboard mitigation of infection and

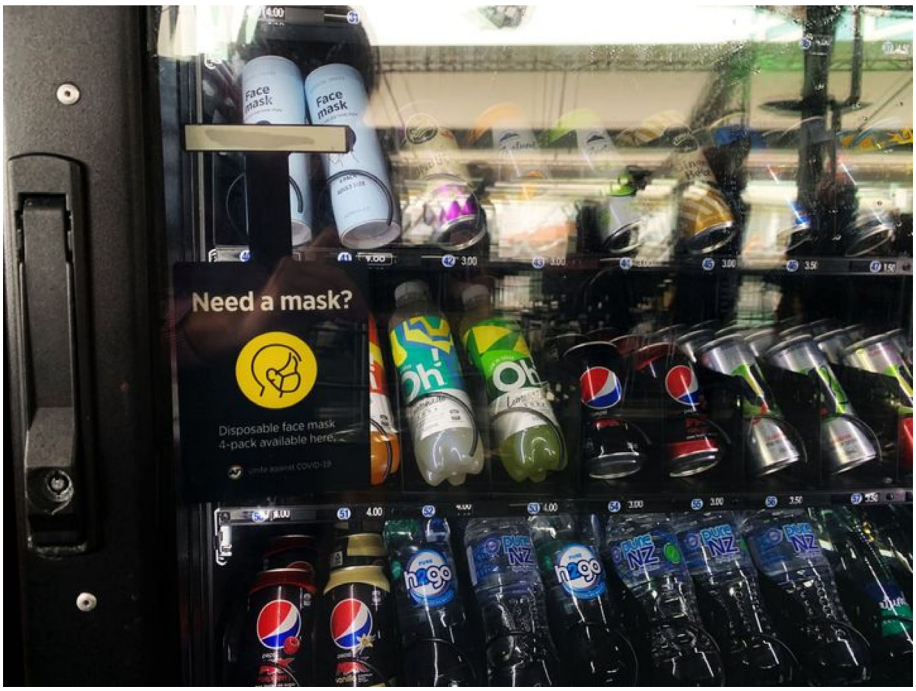


**FIGURE 2** Masks available in vending machines in Auckland.

**TABLE 1** Categories of measures implemented by the three transport agencies.

| PT services responses to COVID-19 | | PT infrastructure responses to COVID-19 | |
|---|---|---|---|
| **Measures** | **Implementing agencies** | **Measures** | **Implementing agencies** |
| 1. Service changes | | 1. Onboard infection mitigation measures | |
| Modified schedule | 3 | Enhance vehicle cleaning | 3 |
| Reduced schedule | 3 | Social distancing measures | 3 |
| Replacement services | 1 | Vehicle capacity limits | 2 |
| Additional services | 3 | Rear door boarding and exiting | 3 |
| Route changes | 1 | | |
| Saturday timetables | 3 | | |
| Sunday timetables | 2 | | |
| 2. System changes | | 2. Facility changes | |
| Discounted fares | 3 | Enhanced facility cleaning | 3 |
| Masks for users | 3 | Implemented facility closure for customers | 2 |
| Masks for operators | 3 | Implemented physical distancing markers | 2 |
| QR scanning and encouragement of use | 3 | | |
| Contactless payment encouragement | 3 | | |
| Vaccine pass | 3 | | |

changes to facilities in Auckland, Christchurch and Wellington. Onboard mitigation measures include enhanced vehicle cleaning, social distancing measures, vehicle capacity limits, and rear door boarding and exiting. Facility changes included enhanced facility cleaning, closing facilities and physical distancing markers.

### *Onboard mitigation of infection*

AT implemented all four onboard mitigation measures. The AT website mentioned several times that all public transport vehicles were cleaned thoroughly and regularly to reassure users that it was safe (Auckland Transport, 2021). AT implemented both social distancing measures and vehicle capacity limits (Figure 3). The AT website


**FIGURE 3** Social distancing markers used across New Zealand.

informed users numerous times that they must maintain social distancing (Auckland Transport, 2021). AT used the word 'must' to reinforce the rule. Vehicle capacity limits were also introduced. AT encouraged people to use its app to check the capacity of a bus or a train at any given time, and to commute outside the usual peak hours. In 2021, AT applied rear door boarding and exiting; this was only mentioned once on their website.

ECan implemented all four onboard mitigation measures. Enhanced vehicle cleaning was implemented by ECan, along with hand sanitiser being introduced into MyWay vehicles as well. ECan implemented social distancing measures and communicated these through their COVID-19 updates page. The early stages of the pandemic saw ECan apply social distancing on all forms of public transport, with this being slowly phased out over time as the alert levels changed. ECan implemented vehicle capacity limits across the public transport system. In the early stages of the pandemic, most public transport operated at a limited capacity to enable social distancing. Rear door boarding and exiting was implemented by ECan to protect drivers. Only those with accessibility issues (i.e., those needing to use the ramp) were able to enter by the front door. In August 2020, front door boarding was allowed once again. Fares were required once more, with contactless payments being encouraged. As of 2022, rear door exiting was the only measure still active.

GW implemented three of the four onboard mitigation measures. The only measure not implemented (according to the GW and Metlink websites) was vehicle capacity limits. One article discussed vehicle capacity limits but there was no actual mention of the measures implemented to enforce this, or which public transport routes were affected. In most of their online updates, enhanced cleaning measures were mentioned and used by GW across all public transport services at all alert levels. In 2022, GW continued their cleaning regime to reduce transmission and give passengers extra peace of mind. Physical distancing was implemented and encouraged by GW. Depending on the government's regulations and alert levels, GW implemented either mandatory or encourage 2m physical distancing on public transport. Even though there was no specific statement that 'rear door boarding and exiting is compulsory', there was enough evidence to suggest that this was implemented. The Metlink website mentioned that rear door boarding would continue and that buses could no longer be boarded via the front door, implying that compulsory rear door boarding was implemented at some point.

### *Facility-related changes*

AT implemented two of the three facility-related changes. The two that were implemented were enhanced facility cleaning and physical distancing markers. Although information on facility closures was not found on the website, the information might have been deleted or removed, as it was irrelevant in 2022.

ECan implemented all three facility-related changes. The bus interchange was closed on 26 March 2020 and reopened on 11 May 2020. ECan also implemented enhanced facility cleaning and physical distancing markers in public transport facilities.

GW implemented two of the three facility-related changes, namely enhanced facility cleaning and closures. There was no mention on either of the websites about implementing physical distancing markers.

### 4.1.3 | Communication

This section includes the results on the communication of information regarding public transport, especially social media interactions and website accessibility.

*Social media*

AT posted on Facebook 951 times from January 2020 to July 2022 to communicate their strategies and measures for dealing with COVID-19. Facemask-related posts were the most common (55), followed by changing alert level rules (49), social distancing (45), timetable changes (31) and COVID-19 (29). There were several posts about service cancellations, and route and timetable changes in general; however, these were not COVID-19 related.

ECan and Metro have different Facebook pages, with Metro only providing information on public transport. From January 2020 to July 2022, Metro posted 264 times and ECan posted 1478 times. The ECan website noticeably had a lack of posts about public transport related to COVID-19. 'Alert level' was the most common phrase (12), which was used almost twice as often as the second-ranked phrase, namely 'distancing' (7). The reason why 'route' and 'cancel' had no mentions is because Metro updated public transport users about routes and cancellations. Metro's Facebook page showed that 'COVID-19' was the most common used phrase (42), with 'cancel' being the least used (8). 'Face mask/covering', 'timetable' and 'alert level' (30) were used approximately equally, indicating they were the most important measures for public transport users to understand.

GW and Metlink run two different Facebook pages, with Metlink being specifically for providing information on public transport. From January 2020 to July 2022, Metlink posted 316 times, whereas GW posted 1399 times. However, GW's posts mainly focused on

**TABLE 2** Access to information.

| | Auckland | Wellington | Christchurch | Average |
|---|---|---|---|---|
| PT services responses to COVID-19 | | | | |
| 1. Service changes | | | | |
| General service changes | 2 | 2 | 2 | 2 |
| Journey planner | 1 | 1 | 1 | 1 |
| Supplemental services | 2 | 1 | | 1.5 |
| Updated timetable | 1 | 3 | 2 | 2 |
| 2. System changes | | | | |
| Discounted fares information | 4 | 1 | 3 | 2.7 |
| Masks for users | 1 | 1 | 1 | 1 |
| Masks for operators | 1 | 1 | 1 | 1 |
| QR scanning information | 1 | | 1 | 1 |
| Contactless payment information | | | 1 | 1 |
| PT Infrastructure responses to COVID-19 | | | | |
| 1. Vehicle safety | | | | |
| Enhances vehicle cleaning | 1 | | | 1 |
| Social distancing information | 1 | | | 1 |
| Vehicle capacity limits | | | | |
| Rear door boarding and exiting information | | | 1 | 1 |
| 2. Facility changes | | | | |
| Enhanced facility cleaning information | | | | |
| Facility closure information | 2 | | 1 | 1.5 |
| Other factors | | | | |
| COVID-19 FAQ | | | | |
| Employee health | | 1 | | 1 |
| Average | 1.45 | 1.37 | 1.4 | 1.35 |

*Source*: Authors.

'alert levels' and their changes over time. 'COVID-19' was more prominent on Metlink's Facebook page. 'Alert level', 'face mask/covering' and 'distancing' were used relatively equally (around 40 times), indicating they were the most important types of information for the users.

*Website accessibility*

The websites of AT, ECan and GW were analysed to understand the accessibility of the information. Accessibility was determined by the average number of clicks it took to get to the information from the home page. Table 2 shows the results, where the green represents high accessibility (0–1 clicks from home page), yellow represents medium accessibility (2–3 clicks), and red represents low accessibility (4+ clicks). Grey represents either a lack of information, or that the information was outdated or no longer on the website.

Table 2 shows that Metlink had the highest accessibility out of the three agencies, with an average of 1.37 clicks to reach the information. Metro was ranked second highest, with an average of 1.4 clicks, and AT had the lowest accessibility out of the three, with an average of 1.45 clicks. The overall accessibility of the three public transport agencies was very close, with only a 0.08 difference in the average number of clicks. AT, even though they had the lowest average accessibility, had the most information about response measures on their website, with information on 11 out of the 17 measures, whereas Metro and Metlink had information on 10 and 8 respectively.

The most accessible information across the websites was found to be the journey planner and information on masks (one click each on average). The journey planner was the most accessible and useable information because of its presence on all three pages. It was clearly labelled and easy to spot. Mask information was also highly accessible; however, it was within each website's COVID-19 information page, so even though it took one click to get to the information, a user had to read through the page to find it. Several other measures had one click on average but were not found on all websites. The information that was the least accessible on all three websites related to general service changes (two clicks), updated timetables (two clicks), and discounted fares (2.7 clicks).

Note that the category of onboard infection mitigation measures had only three results. This information was probably not available because of the alert level when the research was conducted. Central government no longer required social distancing; therefore, capacity limits were no longer needed, and rear door boarding and exiting were not compulsory. If this review had been conducted in mid-2021 or 2020, there would have been updates about this in the general COVID-19 information. The information can still be found on the websites; however, it needs to be searched for rather than found by clicking from the home page.

## 5 | DISCUSSION AND CONCLUSION

This study aimed to understand New Zealand public transport agencies' response to the COVID-19 pandemic by analysing measures related to public transport services, infrastructure and communication. The research also focused on the accessibility of all agencies' websites and how well the agencies communicated the response measures through social media.

First, we explored how public transport services and systems were changed in response to COVID-19 in Auckland, Christchurch and Wellington. Of the 13 possible measures, AT implemented 12, whereas ECan and GW implemented 11 of the 13 measures. In the category of service changes, the least frequently implemented responses were route changes and Auckland and Wellington replacement services. In Hungary, they used replacement bus services throughout numerous cities to replace withdrawn trains (Oszter, 2020) to keep public transport operating, whereas only one of the three public transport agencies did so in New Zealand. All six system-related response measures were implemented by all three public transport agencies. Discounted fares were used many times throughout the 2.5-year period. However, in the early stages of the pandemic, discounts were provided for essential workers to encourage their continued use of public transport. This was similar to many cities around the world. In Toulouse and Grenoble, they adopted a fare-free public transport scheme (The International Association of Public Transport, 2020b). This was an incentive to encourage those using public transport to continue to use it, as well protecting users, as it limited contact and cash handling. Mask for users and drivers were mandatory on public transport in New Zealand cities. However, it was reported that ~10% of passengers did not wear masks on Auckland buses (Hancock, 2022). This rate of non-compliance is much lower than that reported for Russia (37%), Saudi Arabia (27%), and the United Kingdom (20%–27%) (Armitage et al., 2022; Shashina et al., 2022).

Second, we explored the responses related to public transport infrastructure, including vehicle safety and facility changes in Auckland, Christchurch and Wellington. ECan led in this category, implementing all seven response measures, whereas AT implemented six

and GW only implemented five. Similar to other cities around the world, New Zealand implemented capacity limits. In Denver, the Regional Transportation District limited ridership to 15 passengers per bus and 30 per rail car (Gkiotsalitis & Cats, 2021). Pennsylvania's Port Authority recommended and implemented reduced capacity, with no more than 10 passengers on a 35-ft bus, no more than 25 on a 45-ft bus, and no more than 25 on a 60-ft bus (Kamga et al., 2021). In the United Kingdom, public transport services ran at reduced capacity because of a 2 m social distancing rule implemented when services were restored after the lockdown. This meant that only 10% of the usual passengers travelled by public transport (Gkiotsalitis & Cats, 2021). Cumming (2021) argues that New Zealand is 'nowhere near as crowded public transport systems as many other countries, making physical distancing easier' (p. 10). Despite the capacity limits and a 1–2 m social distancing rule on buses, their implementation was challenging. Buses had reminders on the backs of seats to leave every second seat empty, but implementation was left to the passengers. Moreover, a 2 m distance does not eliminate the risk of transmitting COVID-19.

Improving the indoor air quality on buses has been used to reduce the risk of transmitting COVID-19. Most buses in New Zealand do not have opening windows or air filters (Hancock, 2022). Wilson et al. (2023) found that in 94% of buses and 77% of trains in New Zealand, there is a higher level of carbon dioxide in the indoor air compared to outside. The quality of air can get worse when public transport fills up and passengers are standing. However, the commitment to improve the indoor air quality was linked to the costs of the existing fleet (Hancock, 2022), putting vulnerable passengers at risk, given the continuing circulation of COVID-19 in the country. There was no information available on the websites of AT, ECan and GW about protected areas for drivers during the pandemic. In Krakow, Poland, separate safety zones for drivers were implemented, providing physical protection of the part of the vehicle adjacent to the driver's cabin, which was inaccessible to passengers (Bauer, Dźwigoń, & Richter, 2021).

Within the category of facility changes, AT and GW implemented only a few responses. AT did not mention that they had closed any facilities for customers. This was probably because of the amount of people not using the transport network during the pandemic, as Auckland's public transport usage was likely to have decreased the most because of its population and ridership rates. GW did communicate the information that physical distancing markers were being implemented. There were many signs and images throughout New Zealand informing the public about physical distancing; therefore, GW may have assumed the population already understood their intended usage on bus stops and train stations. It is likely that at the time of this research, the information had been removed from the website, as it is no longer valid. If we compare New Zealand with other countries, Bangkok implemented various physical distancing markers. At some train stations, there were black 'plus' markers, whereas other stations used yellow line markers with a 'stand here' message on them (Siewwuttanagul et al., 2020). This shows that New Zealand was consistent with other cities around the world in implementing physical distancing markers, with only one of the public transport agencies in the study not having communicated information about these markers. However, New Zealand did not enlarge bus stops, which was observed in case of London (Wild et al., 2020). AT encouraged people to consider biking and walking to address the limited capacity of public transport. Waka Kotahi funded Streets for People and Innovating Streets for People projects across the country to change the streets temporarily in favour of walking and cycling. Similar projects were used in Australian and European cities, where temporary cycle lanes were implemented on strategic routes (Buehler & Pucher, 2023; Wild et al., 2020) and cycling for recreation, exercise and stress relief has increased significantly (Buehler & Pucher, 2023). In comparison with international cities, Waka Kotahi's funding for walking and cycling is very limited, both before and after the COVID-19 era, as the focus is genearlly on large roading projects to improve economic growth and productivity instead of wellbeing.

Early in the pandemic, there was uncertainty about how COVID-19 was transmitted. The WHO recommended that buses should be clean and that operators should disinfect surfaces, as they are frequently touched by passengers. Therefore, enhanced vehicle cleaning was used by AT, ECan and GW to reduce the risk of transmitting COVID-19. However, over the course of the pandemic, scientific understanding about the spread of the virus changed and surface transmission was not determined to be a significant risk (Lewis, 2021). In spite of this knowledge, public transport agencies throughout the world, including in New Zealand, continued deep cleaning vehicles and infrastructure. It is important for future pandemic that agencies avoid 'health washing' because it is easy for them to implement.

Finally, we explored how public transport agencies in Auckland, Christchurch and Wellington communicated with passengers in terms of their social media

interactions and website accessibility. The Facebook pages were searched for posts containing key phrases. We found that AT used one of these phrases in 22.6% of their posts from 2020 to mid-2022, ECan's Metro website used these phrases in 60.2% of its posts, and GW's Metlink used them in 82.2% of its posts. From this, it is possible conclude that GW used social media the most to communicate its responses to COVID-19, followed by ECan, then AT. AT's website primarily relates to transport and deals with all matters of public transport in the region, so it is fair to compare it with Metro and Metlink, which both deal with the same matters.

GW's Metlink was the most accessible website, with an average accessibility of 1.37 clicks. ECan's Metro was the second most accessible website at 1.4 clicks, followed by AT's website at 1.45 clicks. However, this is only at face value. The Metlink website had the least information on it, with 8 out of 17 types of information. Metro had the second most information, with 10 out of 17 types, and AT had 11 out of 17. Although Metlink had the least information available, they still had the most accessible website. If we compare this with a similar study conducted by Diaz et al. (2021) on Canadian public transport agencies, the most accessible website had 14 out of 24 types, with an average accessibility of 0.8 clicks, and the least accessible website had 17 out of 24 information types and an average of 1.7 clicks. The highest number of measures found on a website was 20 out of 24 types and these had an average of 1.2 clicks, whereas the fewest types found was 8 out of 24, with an average of 0.9 clicks (Diaz et al., 2021). The most accessible website in New Zealand had 1.35 clicks, whereas the most accessible website in Canada had 0.9 clicks. New Zealand's most accessible website had 47% of the information types and Canada's most accessible website had 58.3% of the information types. This proves that, when compared with other countries, New Zealand's public transport agencies website accessibility and information were inadequate. Moreover, the average accessibility of Canada's 24 public transport agencies was 1.2 clicks, whereas those in New Zealand averaged 1.4 clicks, again showing a lack of website accessibility in New Zealand.

Out of the 60 response measures (20 measures × three agencies) that were assessed across the three public transport agencies, 52 were implemented (86.6%). By comparison, Diaz et al. (2021) found that Canadian public transport agencies implemented only 260 out of 525 response measures (21 measures × 25 agencies), or 49.5%. There are two important things to consider when making this comparison; firstly, the sample size was much larger than the one used in this research. Secondly, the response measures assessed in the case of Canada were fairly similar to the measures used in this research; however, they were in the Canadian context. For example, they did not have vaccine passes or QR codes, as in New Zealand. However, through this comparison, it is clear to see that public transport agencies in New Zealand performed well.

In conclusion, all public transport agencies in New Zealand performed reasonably well in implementing their responses to COVID-19. Some public transport agencies excelled in some areas more than others; however, there was no single public transport agency that stood out negatively. AT implemented the most service-related response measures. ECan implemented the most infrastructure-related response measures. GW showed their strengths in communication, as they had the most accessible website and communicated information on the most responses. Our conclusion was based on the top-down measures (masks, half fares, social distancing, etc.) that central government adopted in response to COVID-19 in a particular time period, which helped keep public transport operational while supporting active transport wherever possible. However, this research did not cover bottom-up (or people's) perspectives of the adopted measures. Therefore, we consider that the COVID-19 response was good enough in the sense that it was oriented around keeping the networks open and available to those who needed them, while keeping the networks relatively low-risk for those still using them. There was a strong platform and vertical alignment for metropolitan transport agencies to provide short-term, effective response measures to keep the networks operational. The management of COVID-19 is an ongoing issue, as 200–800 cases were reported in Auckland, Wellington and Christchurch in a single week of March 2024. The issue of long COVID has also emerged and therefore public transport agencies' work related to COVID-19 has not ended. AT, ECan and GW should particularly focus on the wellbeing of vulnerable groups who use public transport as their only choice for mobility.

It is also important to understand what success looks like in the long term for metropolitan public transport agencies. Future research should explore how public transport has bounced back from this interruption. According to 2024 data from AT, Auckland achieved nearly 90% of the pre-COVID-19 boarding rate of 2019. This demonstrates that patronage has not returned to normal yet, and could still take some time. In contrast, data from ECan in late 2023 showed higher than pre-COVID ridership in Christchurch. This might be because of the discounted and flat fares policy adopted by ECan. Therefore, future research should explore new factors, including the ability to work from home, and government policies on fares and investments into the future of public transport usage in New Zealand.

This study suggests possible avenues for future research. First, it would be valuable to explore how well the responses of AT, GW and ECan were received by the public and what lessons these agencies learned during the COVID-19 pandemic. Second, in-depth work is required to understand the relationship of central and local governments regarding public transport policies, planning and funding in normal and disrupted situations. This study briefly touched on these issues, but its scope was limited to exploring what AT, GW and ECan did in response to COVID-19.

## ACKNOWLEDGEMENTS

An earlier version of this paper was presented at the 16th World Conference on Transport Research, 17–21 July 2023, Montreal, Canada. The author would like to thank the Editors and the two anonymous referees for providing very constructive comments on the initial version of this article. Open access publishing facilitated by Massey University, as part of the Wiley - Massey University agreement via the Council of Australian University Librarians.

## ORCID

*Muhammad Imran* https://orcid.org/0000-0002-1421-1576

## ENDNOTE

[1] https://www.stuff.co.nz/the-press/news/127158474/christchurch-bus-services-to-be-scaled-back-during-weekdays-due-to-driver-shortage.

## REFERENCES

Armitage, C., Keyworth, C., Gartland, N., Coleman, A., Fishwick, D., Johnson, S., & van Tongeren, M. (2022). Identifying targets for interventions to support public use of face coverings. *British Journal of Health Psychology*, *28*, 208–220.

Ball, J., Ward, M., Thornley, L., & Quigley, R. (2009). Applying health impact assessment to land transport planning. *NZ Transport Agency Research Report RR*, *375*, 146.

Bauer, M., Dźwigoń, W., & Richter, M. (2021). Personal safety of passengers during the first phase Covid-19 pandemic in the opinion of public transport drivers in Krakow. *Archives of Transport*, *59*, 41–55.

Beehive. (2020). Use of face coverings on public transport outlined. https://www.beehive.govt.nz/release/use-face-coverings-public-transp

Beehive. (2021). *Vaccine pass ready for a kiwi summer*. https://www.beehive.govt.nz/release/vaccine-pass-ready-kiwi-summer

Bromfield, N., & McConnell, A. (2020). Two routes to precarious success: Australia, New Zealand, COVID-19 and the politics of crisis governance. *International Review of Administrative Sciences*, *87*(3), 518–535.

Buehler, R., & Pucher, J. (2023). COVID-19 and cycling: A review of the literature on changes in cycling levels and government policies from 2019 to 2022. *Transport Reviews*, *44*(2), 299–344.

Conrow, L., Campbell, M., & Kingham, S. (2021). Transport changes and COVID-19: From present impacts to future possibilities. *New Zealand Geographer*, *77*(3), 185–190.

Cumming, J. (2021). *Going hard and early: Aotearoa New Zealand's response to Covid-19* (pp. 1–13). Health Economics, Policy and Law.

Currie, G., & Gook, M. (2009). Measuring the performance of transit passenger informationwebsites. *Transportation Research Record*, *2110*(1), 137–148.

Department for Transport, UK. (2020). £2 billion package to create new era for cycling and walking. https://www.gov.uk/government/news

Diaz, F., Abbasi, S. J., Fuller, D., & Diab, E. (2021). Canadian transit agencies response to COVID-19: Understanding strategies, information accessibility and the use of social media. *Transportation Research Interdisciplinary Perspectives*, *12*, 100465.

Gkiotsalitis, K., & Cats, O. (2021). Public transport planning adaption under the COVID-19 pandemic crisis: Literature review of research needs and directions. *Transport Reviews*, *41*(3), 374–392.

Gray, L., Rose, S. B., Stanley, J., Zhang, J., Tassell-Matamua, N., Puloka, V., & Baker, M. G. (2021). Factors influencing individual ability to follow physical distancing recommendations in Aotearoa New Zealand during the COVID-19 pandemic: A population survey. *Journal of the Royal Society of New Zealand*, *51*(Suppl 1), S107–S126.

Green, N., Tappin, D., & Bentley, T. (2020). Working from home before, during and after the Covid-19 pandemic: Implications for workers and organisations. *New Zealand Journal of Employment Relations*, *45*(2), 5–16.

Hancock, F. (2022). Cost concerns scupper fresh air plans for Auckland buses. *RNZ*, 12 July.

Hirschhorn, F., Veeneman, W., & van de Velde, D. (2019). Organisation and performance of public transport: A systematic cross-case comparison of metropolitan areas in Europe, Australia, and Canada. *Transportation Research Part A*, *124*, 419–432.

Hofmann, S., Beverungen, D., Rackers, M., & Becker, J. (2013). What makes local governments' online communications successful? *Government Information Quarterly*, *30*, 387–396.

Imran, M., & Pearce, J. (2015). Discursive barriers to sustainable transport in New Zealand cities. *Urban Policy and Research*, *33*(4), 392–415.

Inayatullah, S., & Milojevic, I. (2021). *Mauri Ora ki Mua: Visions for wellbeing for Aotearoa New Zealand 2050–2070*. A report prepared for the Infrastructure Commission and the Ministry of Transport. https://www.transport.govt.nz/assets/Uploads/Futures-report-Oct-11th-.pdf

Jarman, H. (2021). State responses to the COVID-19 pandemic: Governance, surveillance, coercion and social policy. In G. Scott, K. Elizabeth, F. Elize, & P.-S. Andre (Eds.), *Coronavirus politics: The comparative politics and policy of COVID-19* (pp. 51–66). University of Michigan Press.

Kamga, C., Tchamna, R., Vicuna, P., Mudigonda, S., & Moghimi, B. (2021). An estimation of the effects of social distancing measures on transit vehicle capacity and operations. *Transportation Research Interdisciplinary Perspectives*, *10*, 100398.

Legacy, C., Curtis, C., & Scheurer, J. (2017). Planning transport infrastructure: Examining the politics of transport planning in Melbourne, Sydney and Perth. *Urban Policy and Research*, *35*(1), 44–60.

Lewis, D. (2021). COVID-19 rarely spreads through surfaces. So why are we still deep cleaning? *Nature*, *590*, 26–28.

Oszter, V. (2020). COVID-19 impacts on passenger rail transport in Hungary, Slovenia, Croatia, Serbia and Romania. *Transport Geography Papers of Polish Geographical Society*, *23*(2), 7–13.

Özçürümez, S. (2021). COVID-19 in Turkey public health centralism. In G. Scott, K. Elizabeth, F. Elize, & P.-S. Andre (Eds.), *Coronavirus politics: The comparative politics and policy of COVID-19* (pp. 393–413). University of Michigan Press.

Ridango. (2022). Contain & control: What can public transport learn from Hong Kong? http://ridango.com

Shammut, M., Imran, M., & Hasan, S. (2023). Automated mobilities and society: Why do social meanings matter? *Cities*, 104110.

Shashina, E. A., Sannikova, E. A., Shcherbakov, D. V., Zhernov, Y. V., Makarova, V. V., Isiutina-Fedotkova, T. S., Zabroda, N. N., Belova, E. V., Ermakova, N. A., Khodykina, T. M., Skopin, A. Y., Sukhov, V. A., Klimova, A. A., Turnic, T. N., Yakushina, I. I., Manerova, O. A., Reshetnikov, V. A., & Mitrokhin, O. V. (2022). Analysis of the face mask use by public transport passengers and workers during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, *19*, 14285.

Sheller, M., & Urry, J. (2006). The new mobilities paradigm. *Environment and Planning A Economy and Space*, *38*(2), 207–226.

Siewwuttanagul, S., Kamkliang, S., & Prapaporn, W. (2020). Investigation on physical distancing measures for COVID-19 mitigation of rail operation in Bangkok, Thailand. *International Journal of Building, Urban, Interior and Landscape Technology*, *15*, 93–102.

Siu, A., & Wong, R. (2004). Economic impact of SARS: The case of Hong Kong. *Asian Economic Papers*, *3*(1), 62–83.

Statista. (2022). *New Zealand: Most popular social media networks 2021*. Statista Research Department. https://www.statista.com/statistics/681840/new-zealandmost-popular-social-media-networks/

Stoney, C., Asquith, A., Kipper, K., McNeill, J., Martin, J., & Spano, A. (2023). Policy-making, policy-taking, and policy-shaping: Local government responses to the COVID-19 pandemic. *Australian Journal of Public Administration*, *82*, 1–22.

The International Association of Public Transport (UITP). (2020a). Management of COVID-19 guidelines for public transport operators. (Factsheet).

The International Association of Public Transport (UITP). (2020b). Full free fare public transport; objectives and alternatives. https://cms.uitp.org/wp/wp-content/uploads/2020/09/Policy-Brief-FullFreeFarePT-DEF-web.pdf

Thomas, M., Charlton, G., Lewis, I., & Nandavar, S. (2021). Commuting before and after COVID-19. *Transportation Research Interdisciplinary Perspectives*, *11*, 100423.

Wang, K.-Y. (2014). How change of public transportation usage reveals fear of the SARS virus in a City. *PLoS One*, *9*(3), e89405.

Wild, K., Hawley, G., Woodward, A., Thorne, R., & Mackie, H. (2020). *Street space reallocation to fight COVID-19*. Mackie Research and The University of Auckland.

Wilson, N., Barnard, L., Bennett, J., Kvalsvig, A., Halley, C., Kerr, J., & Jarman, J. (2023). Poor ventilation in public transport settings in Aotearoa NZ: New data for buses and trains. *The Briefing*, Public Health Communication Centre Aotearoa, 10 July.

Yin, K. (1994). Discovering the future of the case study, *method in evaluation research*. *Evaluation Practice*, *15*(3), 283–290.

Zayet, T., Ismail, M., Varathan, K., Noor, R., Chua, H., Lee, A., Low, Y., & Singh, S. (2021). Investigating transportation research based on social media analysis: A systematic mapping review. *Scientometrics*, *126*, 6383–6421.

Zhang, J., & Hayashi, Y. (2022). Research frontier of COVID-19 and passenger transport: A focus on policymaking. *Transport Policy*, *119*, 78–88.

**How to cite this article:** Whale, J., & Imran, M. (2024). New Zealand public transport agencies' responses to COVID-19: Understanding public transport services, infrastructure and communication measures. *New Zealand Geographer*, 1–16. https://doi.org/10.1111/nzg.12388

## APPENDIX

### WEBSITES VISITED

#### Auckland Transport

(2021). *COVID-19 update: Transport in Auckland under Alert Level 3*. https://at.govt.nz/about-us/news-events/covid-19-update-transport-in-auckland-under-alert-level-3/

(2021). *COVID-19 update 18 August; Transport in Auckland under Alert Level 4*. https://at.govt.nz/about-us/news-events/covid-19-update-18-august-transport-in-auckland-under-alert-level-4/

(2021). *Statement of Intent*. https://at.govt.nz/media/1986660/at-statement-of-intent-2021-2024.pdf

(2022). *COVID-19 update: reduced public transport services*. https://at.govt.nz/about-us/news-events/covid-19-update-reduced-public-transport-services/

(2022). *Fare zones & calculating how much you pay*. https://at.govt.nz/bus-train-ferry/fares-discounts/fare-zones-calculating-how-much-you-pay/

(2022). *Half Price Discount on Public Transport Fares*. https://at.govt.nz/bus-train-ferry/fares-discounts/half-price-discount-on-public-transport-fares/?utm_source=faresanddiscounts

(2022). *Reduced services on some East and Central bus routes*. https://at.govt.nz/bus-train-ferry/service-announcements/reduced-services-on-some-east-and-central-bus-routes/

(2022). *Our role & Organisation*. https://at.govt.nz/about-us/our-role-organisation/#:~:text=Auckland%20Transport%20(AT)%20is%20responsible,cycling%2C%20parking%20and%20public%20transport

(2023). *AT Metro patronage report*. https://at.govt.nz/about-us/reports-publications/at-metro-patronage-report/

**Environment Canterbury**

(2020). *A lower price for Metrocards*. https://www.ecan.govt.nz/get-involved/news-and-events/2020/a-lower-price-for-metrocards/

(2020). *Timaru public transport under Alert Level 2*. https://www.ecan.govt.nz/get-involved/news-and-events/2020/timaru-public-transport-under-alert-level-2/

(2021). *Environment Canterbury approves on-demand public transport after trial's success*. https://www.ecan.govt.nz/get-involved/news-and-events/2021/environment-canterbury-approves-on-demand-public-transport-after-trials-success/

(2022). *COVID-19 key updates from Environment Canterbury*.https://www.ecan.govt.nz/get-involved/news-and-events/2021/
covid-19-key-updates-from-environment-canterbury/

(2022). *Councils in Canterbury*. https://www.ecan.govt.nz/about/your-council/our-team/councils-in-canterbury/

**Greater Wellington**

(2020). *COVID-19; Metlink removes cash sales from buses, trains, and stations*.https://www.gw.govt.nz/your-region/news/covid-19-metlink-removes-cash-sales-from-buses-trains-and-stations/

(2020). *COVID-19: Metlink rolls out precautionary cleaning measures across rail, bus, and ferry*. https://www.gw.govt.nz/your-region/news/covid-19-metlink-rolls-out-precautionary-cleaning-measures-across-rail-bus-and-ferry/

(2021). *Te Mahere Waka Whenua Tūmatanui o te Rohe o Pōneke Wellington Regional Public Transport Plan*. https://www.gw.govt.nz/assets/Documents/2021/10/J001366-Public-Transport-Plan-v5-web.pdf

(2022). *COVID-19 important information*. https://www.gw.govt.nz/your-region/emergency-and-hazard-management/covid-19-important-information/

**Metlink**

(2021). *A more assured network with redesigned Metlink bus timetables*. https://www.metlink.org.nz/news-and-updates/news/a-more-assured-network-with-redesigned-metlink-bus-timetables/

(2021). *Mandatory face coverings and full timetables on Metlink services during alert level 2*. https://www.metlink.org.nz/news-and-updates/news/mandatory-face-coverings-and-full-timetables-on-metlink-services-during-alert-level-2/

**Metro**

(2022). COVID-19 Service updates. *Canterbury moves to the Orange traffic light setting*. https://www.metroinfo.co.nz/news/covid-19-service-updates/

**Waka Kotahi New Zealand Transport Agency**

(2021). *COVID-19—implications for land transport*. https://www.nzta.govt.nz/assets/planning-and-investment/arataki/docs/Arataki-potential-impacts-of-COVID-19-summary-July-2020.pdf

(2021). *COVID-19 transport impact on New Zealand*. https://www.nzta.govt.nz/assets/resources/covid-19-impacts-on-transport/nz-covid-transport-impact-presentation-march-2021.pdf

(2022). *Land transport issues*. https://nzta.govt.nz/planning-and-investment/national-land-transport-programme/previous-nltps/2018-21-nltp/the-investment-framework/land-transport-issues/

(2022). Waka Kotahi COVID-19 transport impact, Fieldwork waves 1-29 core report. 18 November. https://www.nzta.govt.nz/assets/resources/covid-19-impacts-on-transport/waka-kotahi-nzta-covid-19-transport-impact-wave-29-20221118.pdf

(2020). *COVID-19 transport behaviour change* (research note 002). https://nzta.govt.nz/assets/resources/research/research-notes/002/002-Covid-19-behaviour-change-update-2.pdf

(2023). *Working with partners and stakeholders*. https://www.nzta.govt.nz/about-us/about-waka-kotahi-nz-transport-agency/working-with-partners-and-stakeholders/#:~:text=Waka%20Kotahi%20NZ%20Transport%20Agency%20is%20one%20of%20a%20number,operation%20of%20the%20transport%20sector

(2023). *About the NLTP*. https://www.nzta.govt.nz/planning-and-investment/national-land-transport-programme/about-the-nltp/

**Ministry of Transport**

(2023). *Our story*. https://www.transport.govt.nz/about-us/what-we-do/our-functions/our-story/#:~:text=We%20

work%20closely%20with%20other,and%20data%20to%20support%20collaboration

(2023). *Our functions*. https://www.transport.govt.nz/about-us/what-we-do/our-functions/

(2023). *Our government transport partners*. https://www.transport.govt.nz/about-us/what-we-do/our-government-transport-partners/#:~:text=Local%20government%20authorities,planning%20and%20land%2Duse%20planning