Auckland's road to electric public transport – why so bumpy?

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Auckland’s road to electric public transport – why so bumpy?

Why we’re electrifying Auckland’s public transport fleet

Why it’s hard to know the full cost of this, and what we are doing to find out

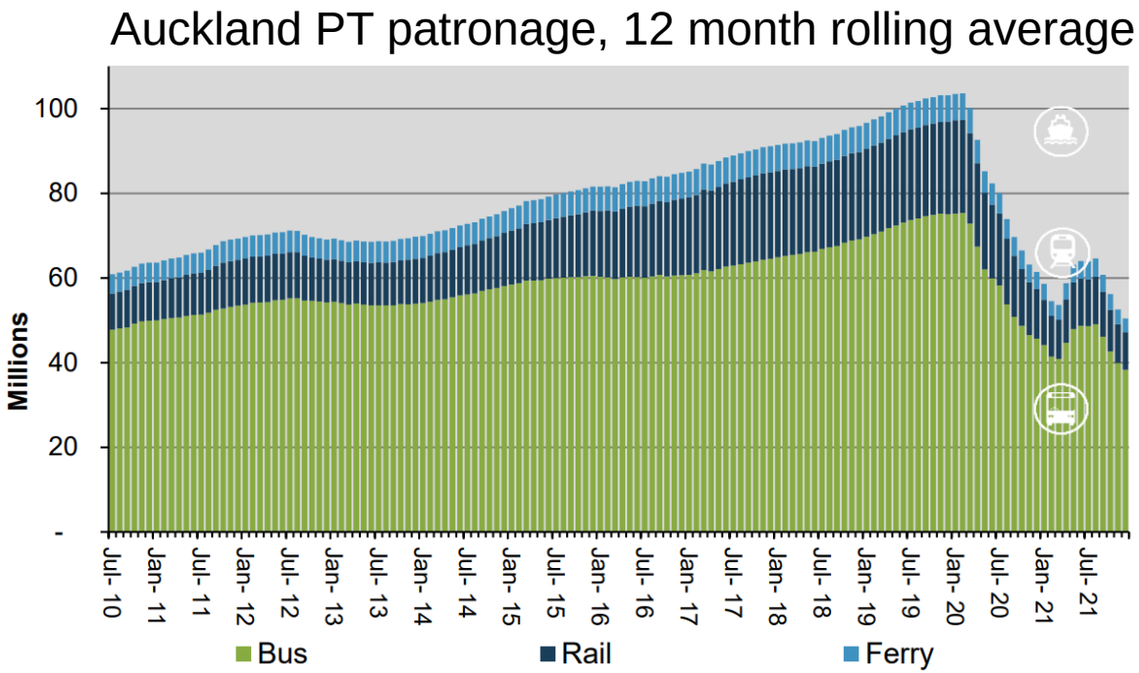
Promote the framework across Asset Management team and beyond

Introducing AT

- Tāmaki Makaurau has 1.7 million residents, forecast to grow past 2 million by 2036
- AT was established in 2010. We are kaitiaki (guardians) of transport assets with a replacement value of over $22 billion
- We are the only road controlling authority in NZ that also controls bus services
- Currently around 1,700 people work directly for AT (T4NSW employs 25,000)
- 60 percent of NZ's public transport trips are on our buses, trains and ferries
  – 100 million trips/year pre-Covid

Adjusting to Covid

- Covid has reduced vehicle traffic as well as public transport patronage
- Services continued to run in lockdown, but customers were restricted to essential travel only
- Outside of lockdowns, patronage is still down especially on peak services and City Centre-focused services
- Patronage reached 85% of pre-covid levels in early 2021. We are confident of the role of PT in Auckland's future.

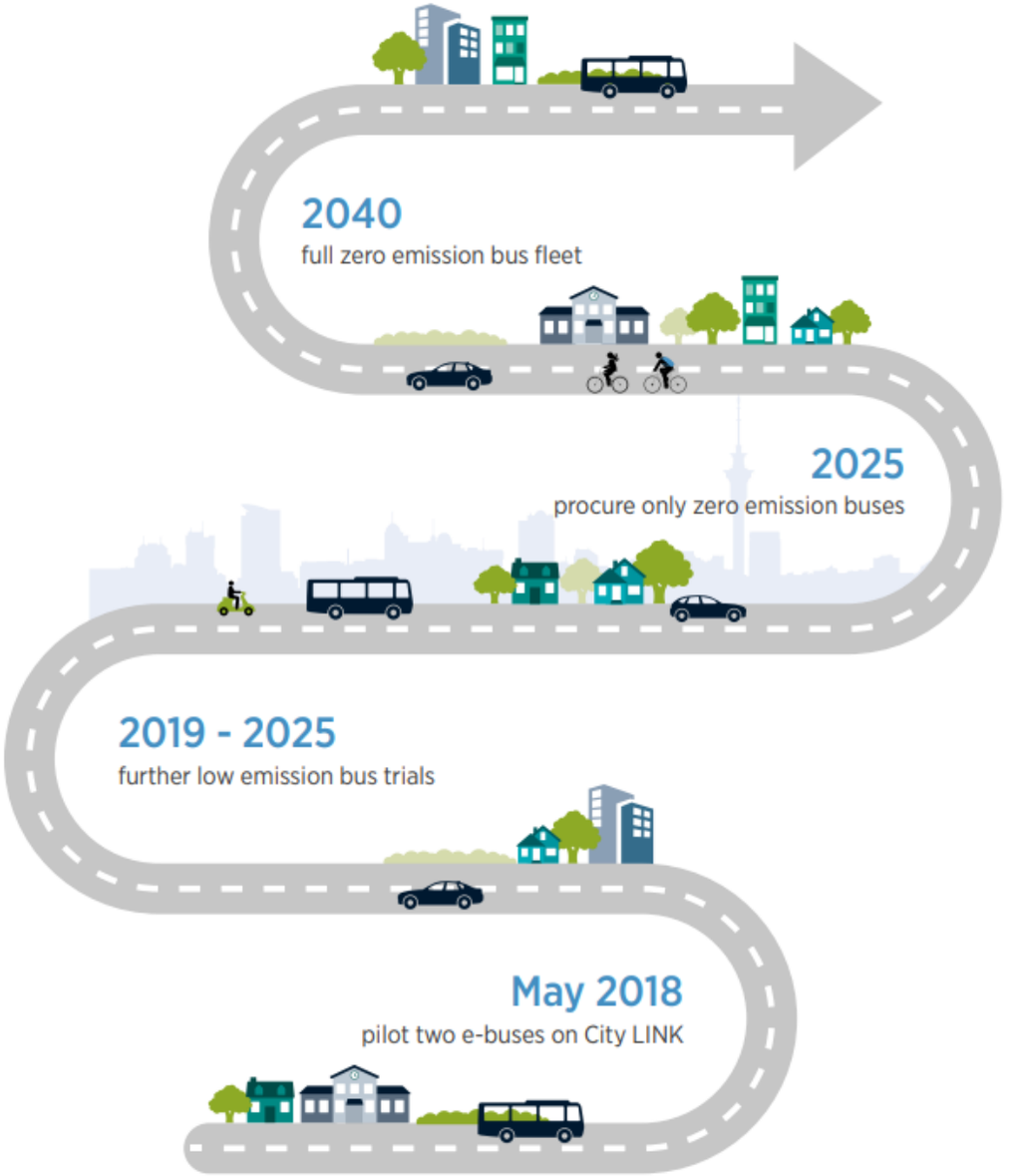


Why we need a low emission PT fleet

- The climate emergency and the Climate Change Response (Zero Carbon) Amendment Act
- Te-Tāruke-ā-Tāwhiri: Auckland's Climate Plan
- AT introduced an all-electric fleet on urban rail services in 2015. Since this change:
  - Patronage almost doubled (11.4 in 2014 to 21.4 million in 2019)
  - Operating costs reduced relative to diesel trains
  - Trains are less noisy and local air quality is better at stations and on board
  - Land use change around stations has accelerated

The next step – electric buses

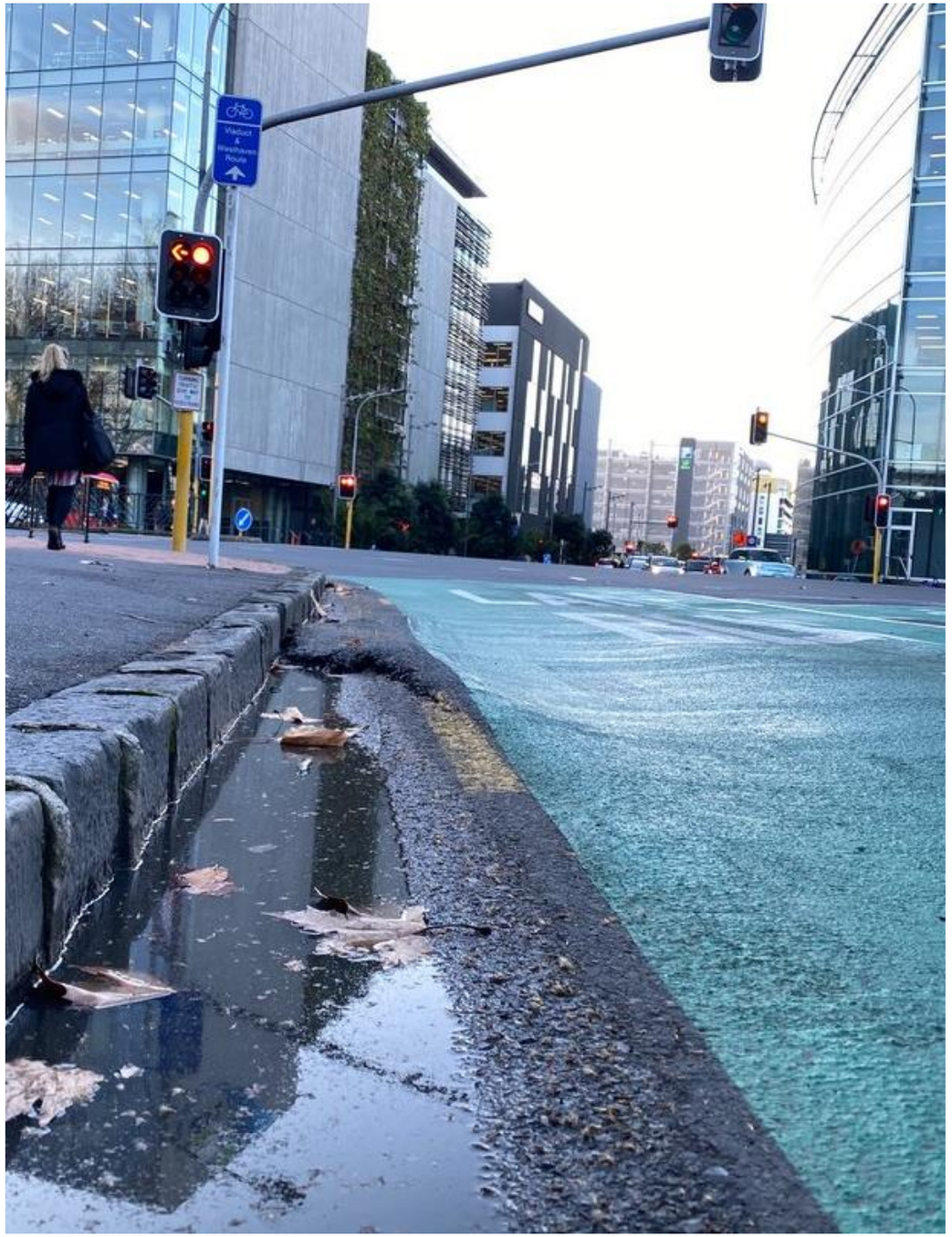
- Operation of the bus fleet accounted for 93,200 tonnes of CO2e in 2018/2019
- AT now has 32 electric buses in service, along with charging infrastructure
- We are forecasting a 72% reduction of life cycle greenhouse emissions vs diesel buses
- Our electric buses operate mainly on:
  - Waiheke Island, mix of rural and coastal settlements
  - Manukau to Airport service via Puhinui, a crosstown service through city and suburban environments
  - The City Link service in the central city



Impacts of electric buses

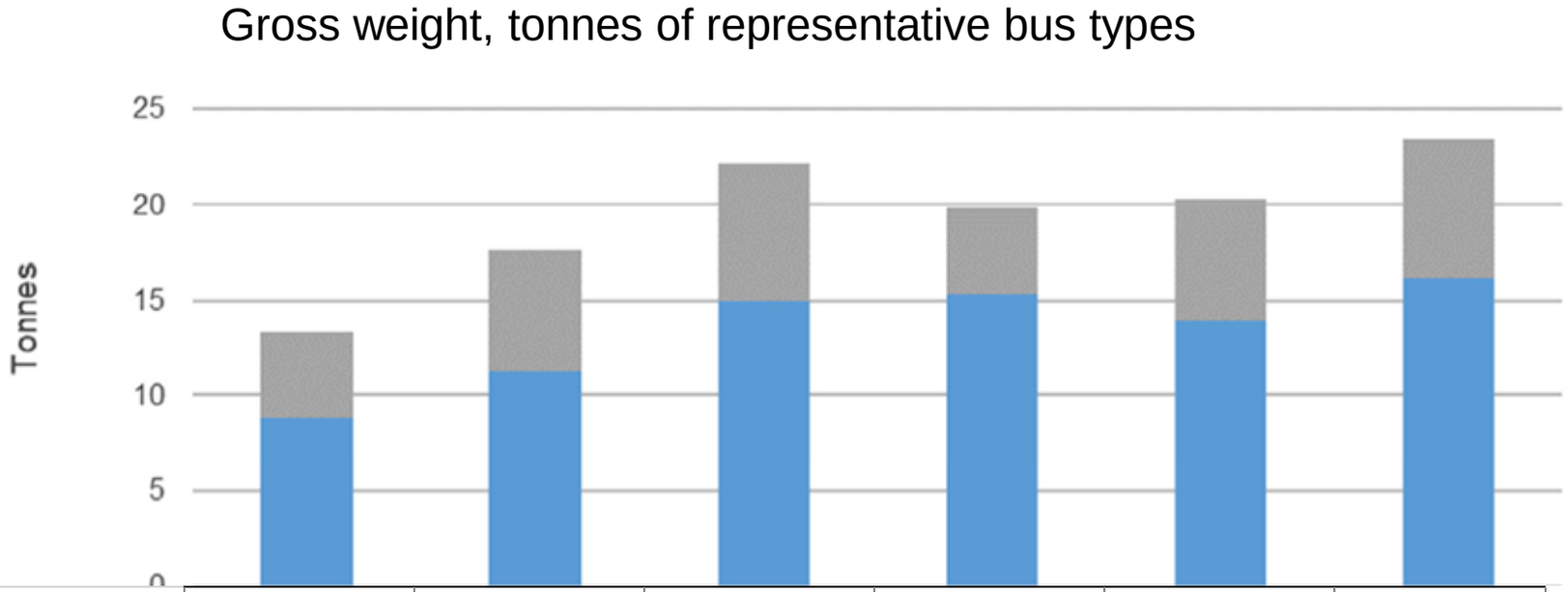
- Battery operated electric buses are heavy and the extra weight will cause extra damage to road pavements
- AT worked with WSP on a desktop study to forecast the impact of electric buses on:
  - Isthmus routes - Mt Eden Rd, Onewa Rd bus lanes and the City Link route
  - Waiheke routes
- We modelled 6 types of buses

Diesel single deck 2 axle	Diesel single deck 3 axle	Diesel double deck 3 axle
Electric single deck 2 axle	Electric single deck 3 axle	Electric double deck 3 axle



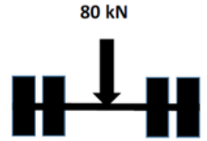
Weight of diesel vs electric buses

- All the electric buses in the study are heavier than their diesel equivalents



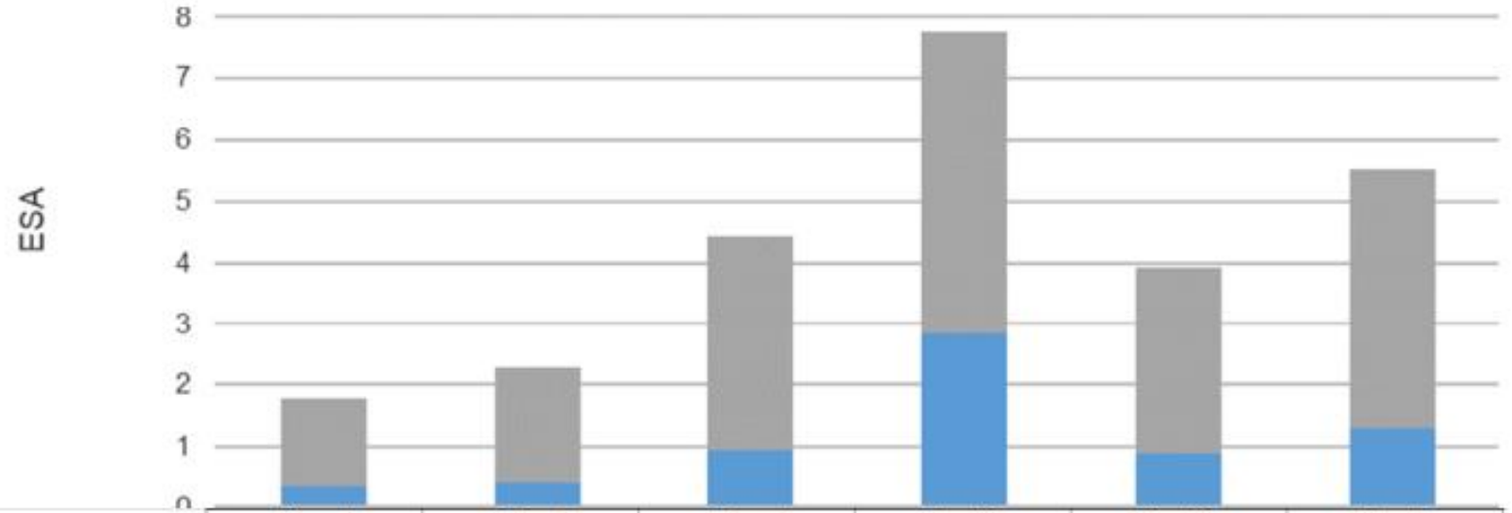
	Diesel single deck 2 axle	Diesel single deck 3 axle	Diesel double deck 3 axle	Electric single deck 2 axle	Electric single deck 3 axle	Electric double deck 3 axle
Total mass	13.3	17.6	22.2	19.8	20.3	23.4
Passenger mass	4.5	6.3	7.2	4.5	6.3	7.2
Empty bus mass	8.8	11.3	15	15.3	14	16.2
% heavier				49%	15%	5%

Axle weight of diesel vs electric buses



- The impact of a bus on the pavement is calculated using the fourth power law.
- The Equivalent Standard Axles (ESA) of a fully loaded two axle single deck electric bus is four times the equivalent diesel bus

Equivalent Standard Axle weights of representative bus types



	Diesel single deck 2 axle	Diesel single deck 3 axle	Diesel double deck 3 axle	Electric single deck 2 axle	Electric single deck 3 axle	Electric double deck 3 axle
Total max ESA	1.8	2.3	4.5	7.8	3.9	5.5
Additional ESA, passenger mass	1.4	1.9	3.5	4.9	3.1	4.2
Empty bus ESA	0.4	0.4	0.9	2.8	0.9	1.3

Impacts on pavement life

- The quality of the road construction makes a difference that is hard to quantify
- Isthmus bus routes have frequent buses on roads built to modern standards
- Waiheke bus routes run hourly and share the road with general traffic, but road construction quality is poor

Potential reduction in pavement life due to electric buses

		Increase in wear	Potential reduction in life
Combined isthmus routes	Lower prediction	44%	31%
	Probable	70%	41%
	Upper prediction	250%	71%
Combined Waiheke routes	Lower prediction	43%	30%
	Probable	70%	41%
	Upper prediction	74%	43%

Financial impacts

- It is probable that road renewal costs will almost double due to electric buses
- By coincidence, the impact is similar for frequent buses on well formed city roads, and less frequent buses on poor quality Waiheke roads.
- There are many uncertainties in this calculation but the scale of the impact is significant

Potential increase in pavement renewals cost due to electric buses

		Current annual renewals	Additional renewals due to electric buses	Total forecast renewals
			$/ year/ lane km	
Combined isthmus routes	Lower prediction	$46,500	$20,700	$67,200
	Probable		$32,600	$79,100
	Upper prediction		$116,300	$162,800
Combined Waiheke routes	Lower prediction	$46,990	$19,990	$66,980
	Probable		$32,900	$79,890
	Upper prediction		$34,900	$81,890

Next steps on our roadmap

- As a result of this work, AT bus contract specifications require 3-axle electric buses
- We will closely monitor road pavement condition on the e-bus routes

We are doing further work to:

- Better understand the embedded carbon impact of road construction and road renewals
- Trial NZ’s first hydrogen bus
- Develop a business case for electric ferries

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