Forecasting the benefits from integrating cycling and public transport

Beca

Matthew Ensor
General Manager of Transportation
Auckland

Jonathan Slason
Transportation Engineer
Auckland

What is Cycle PT

The more cycling is integrated with public transport services, the easier it becomes for people to combine cycling and public transport on a single trip. This in turn increases the use of both cycling as a mode of travel as well as increasing patronage on public transport.

Common means of better integrating cycling and public transport are allowing the carriage of bicycles on public transport (bus, rail, ferry), and/or providing secure bicycle storage at points on public transport routes. In this paper this is referred to as 'Cycle-PT'.

Currently the implementation of Cycle-PT in New Zealand is limited with only sporadic examples of Cycle-PT across the country and no examples of network-wide implementation.

The research outlined in this paper has assessed international experience in providing Cycle-PT and based on this has developed a model for the New Zealand context to forecast demand for Cycle-PT and evaluate the economics of Cycle-PT initiatives.

When a forecast of demand for Cycle-PT on public transport routes is available, the NZ Transport Agency's Economic Evaluation framework can be used to estimate the economic benefits of implementing Cycle-PT. This paper concludes with an estimation of the benefit to cost ratios for network-wide adoption of Cycle-PT in some of the larger urban areas in New Zealand.

Using North American Cycle-PT Data

Although some level of bike and bus integration is common throughout Europe, it is a relatively new development in North America. Federal legislative changes starting in the early 1990s provided specific bicycle funding collected through petrol usage tax to local and state government authorities for the purposes of implementing cycle facilities and BoB programmes. The success of BoB programmes has meant that, since 1991, more than 80 urban areas, including all of the USA's 15 largest cities, across the United States have adopted a BoB programme, with more than 15.5 million BOB trips per year.

PT services consider the provision of Cycle-PT as a value added service that enhances their core product.

This in turn has led to a body of research that is valuable in a New Zealand context, as it describes the results of cycle planning in highly motorised cities with historically low cycle mode share and cycling facilities.

The following table identifies the percentage of total PT patronage that is BoB across a range of North American transit authorities

Mode Share for BoB Cycle-PT in North America (Bus Only)

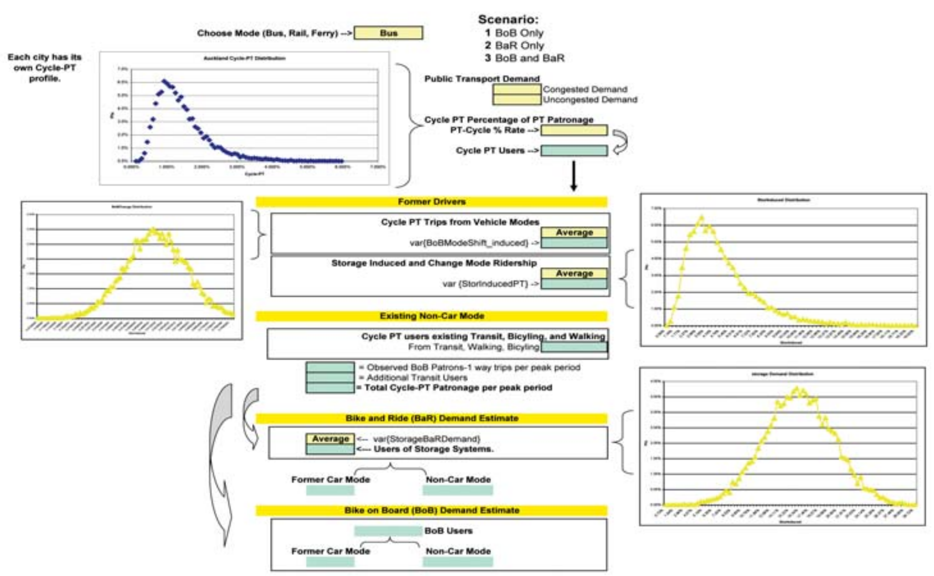
Number of Transit Authorities with data	Range of Annual Patronage	Average % of Patronage that is BoB	Maximum % of Patronage that is BoB	Some similar cities in New Zealand
22	Less than 4 million	1%	5%	Tauranga, Dunedin, Hamilton
19	6 to 20 million.	1%	4%	Christchurch
11	30 to 60 million	1%	2%	Wellington, Auckland
10	60 to 350 million	0.5%	0.8%	-

Mode Share for BoB Cycle-PT in North America (rail only)

Number of Transit Authorities with data	Range of Annual Patronage	Average % of Patronage that is BoB	Maximum % of Patronage that is BoB	Some similar Cities in New Zealand
6	Less than 10 million	3%	6%	Wellington, Auckland
11	10 to 250 million	<0.1%	0.5%	-

Bike on Board Percentages relevant to New Zealand

Mode	Average Bike on Board %	Typical Range of Bike on Board%	Relevant Cities
Bus	1%	0.5% - 3%	All
Train, Ferry	3%	1.5% - 6%	Wellington, Auckland



System Wide Cycle-PT Demand Model

The figure on the left shows a flow chart for the Macro Model with the variable distributions used in the Monte-Carlo simulation. A Monte Carlo simulation[2] was developed to create a range of potential values and a 95th percentile confidence interval for the Cycle-PT demands. The distributions of the four variables were based on the values obtained from the international literature review.

The flow chart demonstrates the steps used in the assessment of the Bike on Board (BoB) and the Bike and Ride (BaR) and the estimation of those users shifting from car modes to Cycle-PT. The process provides the distribution pattern of the four variables involved in the demand assessment of Cycle-PT. The variables are all multiplied by the existing overall PT patronage to obtain estimates of Cycle-PT users, Bike on Board users, Bike and Ride users, and those users shifting from private cars.

The Monte-Carlo simulation carried through the analysis equation for Cycle-PT but accounted for the unique distribution of the variables included in the analysis. In this manner the study attempted to reflect the range and likely values of Cycle-PT based on the range of conditions amongst New Zealand cities.

Benefits of Cycling (avg. 5km trip)	Benefits of Removing Car Trips from Road (avg. 5km trip)
Health and Safety	Environmental
	Vehicle Operating Costs (VOC)
	Traffic Reduction Benefits (Decongestion)

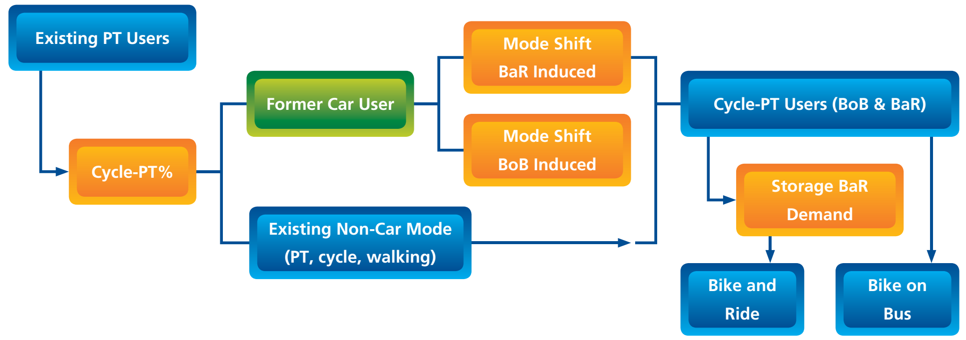
[2] Monte Carlo simulation based on 10,000 iterations of the ranges of variables described above. Cycle-PT and StorInducedPT based on Log-Normal distributions, BoBModeShift, and StorageBaRDemand based on normal distributions.

Macro Model Equation for Cycle-PT Demand

Cycle-PT = Existing PT Patronage (x) Cycle-PT Rate (x) BoBModeShift_induced (x) StorInducedPT (x) StorageBaRDemand

The process is summarised below.

Macro Model Form



Forecasting Cycle-PT Demand in New Zealand Centres

Likely Annual Cycle-PT Trips based on approximate annual patronage per region

Location	Mode	Current PT Patronage (approximate per annum)	Likely Annual Cycle-PT Trips: Goal	Likely Annual Cycle-PT Trips: Stretch Goal
Auckland	Bus	45 million	479,000	1,350,000
Auckland	Train & Ferry	7 million	422,000	520,000
Wellington	Bus	25 million	253,000	750,000
Wellington	Train & Ferry	10 million	534,000	684,000
Tauranga	Bus	0.5 million	13,000	15,000
Rotorua	Bus	0.5 million	-	-
Dunedin	Bus	2 million	22,000	60,000
Christchurch	Bus	15 million	161,000	450,000
Hamilton	Bus	2 million	20,000	60,000
Invercargill	Bus	0.5 million	-	-
		Total	1,904,000	3,909,000

Economic Evaluation of Cycle-PT

Demand and Economics of the Introduction of Cycle-PT into New Zealand (Bikes on Board & Bike and Ride)

	Auckland	Wellington	Christchurch	Hamilton	Tauranga	Dunedin
Annual Cycle-PT Trips	478,520	252,156	160,709	19,136	12,450	21,258
Annual Cycle-PT Trips from cars	250,080	131,760	84,180	10,004	6,490	11,060
Secure Locker Supply	378	200	127	17	10	22
Benefit to Cost Ratio	3.0	2.8	2.2	1.2	1.3	1.6

Conclusions

Cycle-PT can provide additional transport modal choice and flexibility in the utilisation of existing public transport. For low cost, it can realise an increase in public transport patronage and can encourage an increase in sustainable non-car travel. It also provides options for cyclists who at times may wish to use PT for part of their journey.

The network-wide provision of Bike-on-Board on public transport services in New Zealand's cities will carry around 5,800 cyclist-trips on board public transport each weekday. Analysis shows that this will provide a good economic return on the initial investment required and there are a number of additional benefits that occur in addition to those identified in the economic evaluation.

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