Auckland Cycling & Micromobility Programme Business Case

Cycling Demand and Economic Assessment

February 2022

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TRANSPORTATION SPECIALISTS

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EXECUTIVE SUMMARY

Flow Transportation Specialists (Flow) has been commissioned by Auckland Transport to assess the predicted cycling outcomes from the Auckland Cycling Programme Business Case (the Cycling PBC). We present results for

- 4 short list investment strategies
- the emerging preferred investment scenario (plus several “stretch” investment scenarios).

This report presents forecast outcomes in terms of

- predicted cycling demands and mode shares for each investment strategy/scenario
- the economic costs and benefits of each investment strategy/scenario.

Short list investment strategies

Four short list investment strategies have been assessed, including

- Strategy 1: regional route focus
- Strategy 2: Rapid Transit Network (RTN) focus
- Strategy 3: focus on school clusters
- Strategy 4: focus on centres.

Flow was responsible for assessing cycling outcomes for strategies 1 and 4, using the Auckland Cycle Model (ACM) developed and maintained by Flow. WSP assessed strategies 2 and 3, due to the focus of these strategies being about public transport and school nodes, rather than longer cycling trips. Flow was also responsible for the economic evaluation of all 4 strategies.

Key outcomes for each investment strategy are summarised below.

Table ES1: Short List assessment – Estimated annual cycle-km travelled (million cycle-km)

	Existing	2028 predicted	2038 predicted
Base case	56	n/a	n/a
Future without PBC investment	n/a	95	120
Strategy 1 – regional focus	n/a	140	180
Strategy 2 – RTN focus	n/a	105	130
Strategy 3 – school clusters	n/a	105	130
Strategy 4 – centres focus	n/a	230	160

The benefit cost ratio (BCR) of each investment strategy is summarised below.

Table ES2: Short list cycling benefit cost ratios

	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Discounted benefits (NPV)	$1,910 m	$566 m	$290 m	$1,351 m
Discounted costs (NPV)	$1,443 m	$753 m	$322 m	$803 m
Benefit cost ratio	**1.3**	**0.75**	**0.90**	**1.7**

It is important to recognise that the assessment of each investment strategy (eg school clusters) considered the effects of that strategy only in terms of the corresponding trip types (ie cycle trips to/from schools). In practice, each investment strategy would also result in co-benefits related to the other 3 investment strategies, which are combined through the preferred investment scenario. As a result, the assessment of each individual strategy is considered conservative.

Emerging preferred investment scenarios

Our assessment considered the following cycle investment scenarios, which includes not only an Emerging Preferred network, but also several "stretch" scenarios.

- Future Reference Case: all existing infrastructure, plus investment in cycling funded within the RLTP (but excluding the existing Cycling PBC investment)
- RLTP: as above, but including the existing $306 million funding allocation for the Cycling PBC
- RLTP+: as above plus other planned, but unfunded, investment in cycling
- RLTP++: as above but with an extended $600 million Cycling PBC investment. The first of several "stretch" investment scenarios
- RLTP+++: as above but with an extended $900 million Cycling PBC investment. The second "stretch" investment scenario
- Future Connect: completion of the strategic cycling network defined in Auckland Transport's Future Connect
- "Cycletopia": a "complete network" scenario where every origin and destination is connected by best practice cycle infrastructure.

Estimated cycle mode shares (for all trip types, by distance) for each scenario are shown below. These should be viewed in light of the 7% cycle mode share target by 2030 set by Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan.

Table ES3: Emerging Preferred assessment – Estimated cycling mode share (all trip types, by distance)

	Existing	2028 predicted	2038 predicted
Base case	0.4%	n/a	n/a
Future reference case	n/a	1.0%	1.2%
RLTP (as above + $306m Cycling PBC)	n/a	1.3%	1.5%
RLTP+ (as above + planned routes)	n/a	2.1%	2.3%

Table ES3: Emerging Preferred assessment – Estimated cycling mode share (all trip types, by distance)

	Existing	2028 predicted	2038 predicted
RLTP++ (as above with $600m Cycling PBC)	n/a	2.3%	2.6%
RLTP+++ (as above with $900m Cycling PBC)	n/a	2.6%	2.9%
Future Connect	n/a	3.7%	4.2%
Cycletopia	n/a	5.8%	6.6%

Our assessment indicates that investment in cycling infrastructure alone will not be sufficient to meet the cycling mode share targets of Auckland's Climate Plan. Further investment in non-infrastructure elements will be required, such as cycling education and promotion. In addition, interventions that discourage car use such as congestion charging and car parking restrictions will be required.

We have additionally assessed the BCRs for 3 of the investment scenarios, and sensitivity tested 2 of these ranges for each investment scenario. The BCR assessed and range include:

- 2.9 for the $306 million investment scenario (with a range of 2.2 to 3.7)
- 2.8 for the $900 million investment scenario (with a range of 2.0 to 3.4)
- 1.2 for the Future Connect investment scenario (sensitivity test ranges not assessed).

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APPENDICES

1 INTRODUCTION

1.1 What this report is about

Flow Transportation Specialists (Flow) has been commissioned by Auckland Transport to assess the predicted cycling outcomes from the Auckland Cycling Programme Business Case (the Cycling PBC). We present results for

- 4 short list investment strategies
- the emerging preferred investment scenario (plus several "stretch" investment scenarios).

This report presents forecast outcomes in terms of

- predicted cycling demands and mode shares for each investment strategy/scenario
- the economic costs and benefits of each investment strategy/scenario.

2 SHORT LIST ASSESSMENT

2.1 The strategies assessed

The short list assessment considered the following cycle investment strategies.

Table 1: Short list strategies considered

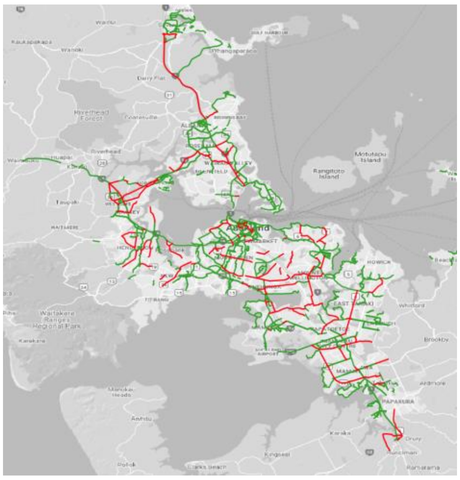
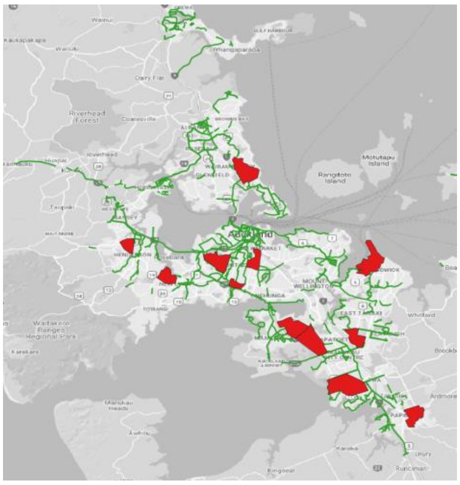
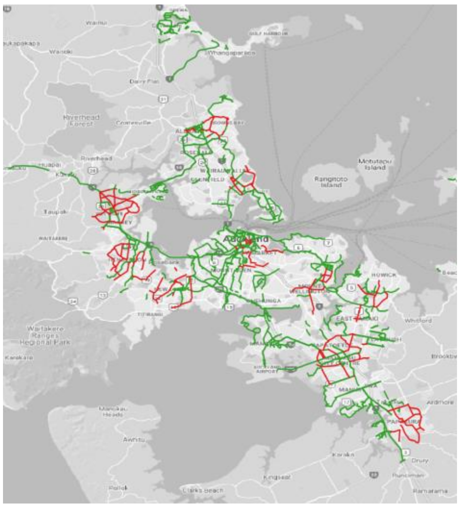
Extent of Investment	Strategy Description
	**Strategy 1: regional focus** Focuses investment on filling gaps in the regional cycle network (from Future Connect), plus key major route connections to regional routes. Shown in red in the figure to the left.
(Not mapped)	**Strategy 2: Rapid Transit Network (RTN) focus** Focus investment on short connecting links to key RTN stations (rail, ferry and Northern Busway stations), with a focus on trips within a 15-minute cycle trip of the stations. Cycle demands for Strategy 2 were assessed by WSP. Refer to WSP's reporting for the methodology applied.

Table 1: Short list strategies considered

Extent of Investment	Strategy Description
	**Strategy 3: school focus** Focuses investment on clusters of schools, enabling short trips to schools within each cluster from the surrounding residential catchment. School clusters are shown in red in the figure to the left. Cycle demands for Strategy 3 were assessed by WSP. Refer to WSP's reporting for the methodology applied.
	**Strategy 4: focus on centres** Focuses investment on Metro Centres and Town Centres, enabling short trips to each centre from the surrounding residential areas. Shown in red in the figure to the left.

2.2 Cycle demand assessment

Flow was responsible for developing cycle demand estimates for strategies 1 and 4, with WSP responsible for cycle demand estimates for strategies 2 and 3. Accordingly, this report summarises the methodology used for strategies 1 and 4. However, we provide predicted cycle demand estimates for all 4 strategies in this document where available, for completeness.

2.2.1 Methodology

We have used the Auckland Cycle Model (ACM) to assess cycling and e-bike demands in the first instance. The ACM estimates future cycling and e-bike demands, and responds to anticipated future changes in

- Infrastructure – the ACM recognises that people are more likely to ride bikes and e-bikes if quality cycle infrastructure is provided along their route
- Future e-bike uptake – the ACM assumes that over time, the accessibility of e-bikes will increase, giving more people the option to cycle more often, and greater distances

- Trip characteristics – the ACM recognises that shorter trips are more likely to be carried out on a bike, as are trips to work and school, and trips without steep gradients
- The underlying demand for travel – the ACM is informed by the regional transport model, being Auckland's Macro Strategic Model (MSM)
- Land use growth – the ACM is informed by Auckland Council's land use forecasts

The ACM uses outputs from the MSM and as a result often omits shorter trips under 1-2 km (which don't necessarily feature in the MSM). Strategy 3 however has an investment focus on cycling trips to schools, and these trips are often short trips of 1-2 km in length. Similarly, Strategy 2 has a focus on cycling components of public transport trips, and the ACM is unable to represent these cycling legs. Recognising this, WSP has developed demand estimates for strategies 2 and 3 using a first principles approach.

The ACM has been independently peer reviewed, with this process summarised in Appendix A.

2.2.2 Predicted cycling outcomes

The following table presents modelled cycling statistics for the Auckland region. Data presented reflects predicted annual totals, which average out variations between days and seasons. The data presented is for

- the estimated annual km cycled across the network
- estimated mode shares (for trips to work, by trip numbers).

Outcomes for each investment strategy have been benchmarked against existing cycling outcomes for the Auckland region, and predicted future outcomes without the PBC investment.

Table 2: Estimated annual cycle-km travelled (million cycle-km)

	Existing	2028 predicted	2038 predicted
Base case	56	n/a	n/a
Future without PBC investment	n/a	95	120
Strategy 1 – regional focus	n/a	140	180
Strategy 2 – RTN focus	n/a	105	130
Strategy 3 – school clusters	n/a	105	130
Strategy 4 – centres focus	n/a	230	160

Table 3: Estimated cycling mode share (commute to work trips, by trip number)

	Existing	2028 predicted	2038 predicted
Base case	1.1%	n/a	n/a
Future without PBC investment	n/a	2.7%	2.8%
Strategy 1 – regional focus	n/a	4.3%	4.5%
Strategy 2 – RTN focus	n/a	Not assessed	

Table 3: Estimated cycling mode share (commute to work trips, by trip number)

	Existing	2028 predicted	2038 predicted
Strategy 3 – school clusters	n/a	Not assessed	
Strategy 4 – centres focus	n/a	4.0%	4.1%

It is important to recognise the limitations of the cycle demand assessment applied to each strategy. Strategies 1 and 4 were assessed using the ACM. The ACM is able to represent "complete trips", such as cycle commute trips from home to work. It is however unable to represent very short cycle trips such as trips to schools, or cycling components of multimodal trips such as cycle trips to an RTN station.

Conversely, the first principles approach used to assess Strategy 2 includes only trips to RTN stations, and omits any trips to other destinations that may be enabled by the investment around RTN stations (such as a commute to work trip that passes close to an RTN station). Similarly, the Strategy 3 assessment considers only trips to schools, and omits any other trip types that may benefit by investment in cycle infrastructure around school clusters.

In practice, investment in any one of the 4 investment strategies (work trips, RTN trips, school trips or centre trips) will result in co-benefits related to the other 3 investment strategies. The co-benefits are not included in the tables presented above.

2.3 Economic evaluation

2.3.1 Economic benefits of the investment

The economic evaluation has been carried out in accordance to Waka Kotahi's Monetised Benefits and Costs Manual (MBCM).

The following benefit streams have been assessed for each short list strategy

- health benefits for cyclists – the public health benefits associated with increased physical activity. These have been assessed by comparing the forecast annual km cycled with and without investment and applying benefit rates from the MBCM to the increase in distance (km) cycled.
- health benefits for pedestrians – the public health benefits associated with increased physical activity. These have been assessed only for strategies that provide new walking facilities, such as new shared paths along State Highway corridors. As above, standard benefit rates from the MBCM have been applied to the estimated increase in distance (km) walked
- general traffic reduction benefits – the travel time and vehicle operating cost benefits to general traffic that remains on the road network, when some users shift from driving to cycling. Emissions and crash benefits of removing those vehicle trips from the network are also captured. The method involves comparing the annual distance (km) cycled with and without investment, applying diversion factors to account for the proportion of car-km removed from the network, and applying standard MBCM benefit rates to these car-km removed
- perceived travel time benefits for cyclists – travel time savings, weighted by the MBCM's Relative Attractiveness scale, which accounts for cyclist perceptions of comfort/time on cycle

infrastructure. This relatively minor benefit stream typically accounts for 10% of cycling project benefits. As a result, we have not calculated this directly, but estimated it based on 10% of the cycling health and general traffic reductions calculated above

- crash reduction benefits – the economic benefits of reductions in crashes following road safety improvements delivered by the project. This benefit stream typically accounts for approximately 5% of cycling project benefits, and we have estimated it based on this proportion.

The economic evaluation methodology is documented more fully in Appendix B.

Table 4 presents a summary of the discounted benefits for each short list strategy.

Table 4: Discounted economic benefits, short list strategies (Net Present Value – NPV)

Benefit stream		Discounted benefit			
		Strategy 1	**Strategy 2**	**Strategy 3**	**Strategy 4**
Cycling	Health benefits	$789 m	$194 m	$100 m	$558 m
	Perceived travel time benefits	$154 m	$47 m	$23 m	$112 m
	Safety benefits	$77 m	$24 m	$12 m	$56 m
Pedestrians	Health benefits	$136 m	$21 m	$21m	$64 m
General traffic	General traffic reduction benefits	$754 m	$279 m	$134 m	$561 m
Total benefits		**$1,910 m**	**$566 m**	**$290 m**	**$1,351 m**

We note that the estimation of economic benefits for each strategy is approximate, in that some benefit streams are estimated. Other, relatively minor, benefit streams have been omitted, such as general traffic and pedestrian safety benefits from investment in cycling infrastructure. We consider this level of detail appropriate for the short listing process.

2.3.2 Economic costs of the investment

Project capital costs have been supplied by the project team and include implementation costs of

- $1,850 million for Strategy 1
- $965 million for Strategy 2
- $413 million for Strategy 3
- $1,029 million for Strategy 4

These capital costs have been assumed to accrue evenly over a 10-year period, from 2022 to 2031. Ongoing maintenance and operational costs have been excluded from the short list assessment.

Discounted over the 40-year evaluation period, the above costs sum to a Net Present Values of

- $1,443 million for Strategy 1
- $753 million for Strategy 2
- $322 million for Strategy 3
- $803 million for Strategy 4.

2.3.3 Benefit cost ratios

Based on the discounted benefits and costs presented above, the project is estimated to have the following benefit cost ratio (BCR).

Table 5: Short list cycling benefit cost ratios

	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Discounted benefits (NPV)	$1,910 m	$566 m	$290 m	$1,351 m
Discounted costs (NPV)	$1,443 m	$753 m	$322 m	$803 m
Benefit cost ratio	**1.3**	**0.75**	**0.90**	**1.7**

All four short list strategies have BCRs close to 1. Strategies 1 (regional network) and 4 (centres) have the highest estimated BCRs however.

3 EMERGING PREFERRED ASSESSMENT

3.1 The investment programmes assessed

Our assessment considers the following cycle investment scenarios, which includes not only an Emerging Preferred network, but also several "stretch" scenarios.

Table 6: Investment scenarios considered

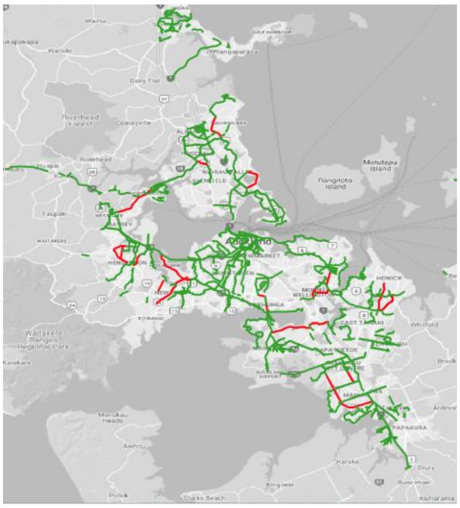
Investment scenario	Description
	**The Future Reference Case** All existing cycle infrastructure, plus future cycling projects already funded within the Regional Land Transport Plan (RLTP) excluding the PBC. The RLTP investment notably includes ◆ Auckland Transport's Pop-Up Protection programme of improvements to existing painted cycle lanes ◆ completion of the Urban Cycleways Programme ◆ priority routes within the Connected Communities programme ◆ funded sections of Te Whau pathway ◆ the Lake Road and Māngere West cycling improvements projects ◆ cycling components of the Penlink, AMETI, Lincoln Road and Papakura to Drury projects Note that the Future Reference Case scenario differed slightly from the Future Without PBC Investment scenario used in the long list assessment. The Reference Case was refined between the 2 processes to better reflect funded background investment.
	**The RLTP scenario** The same as the Future Reference Case scenario, plus the $306 million investment for the Cycling PBC already within the RLTP (red links in image to the left). Notable investment includes ◆ Kitchener Road ◆ Hobsonville Road ◆ Rosebank Road ◆ Favona Road ◆ Roscommon Road/Mahia Road

Table 6: Investment scenarios considered

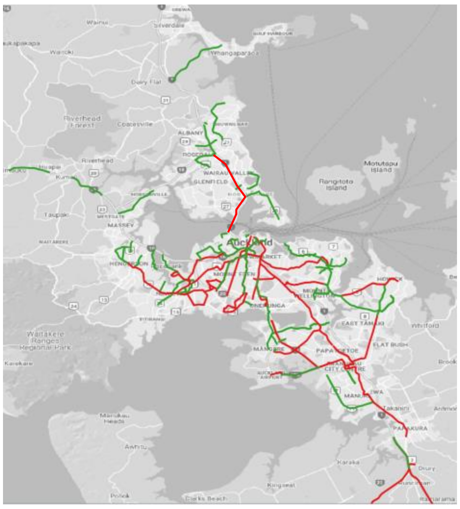
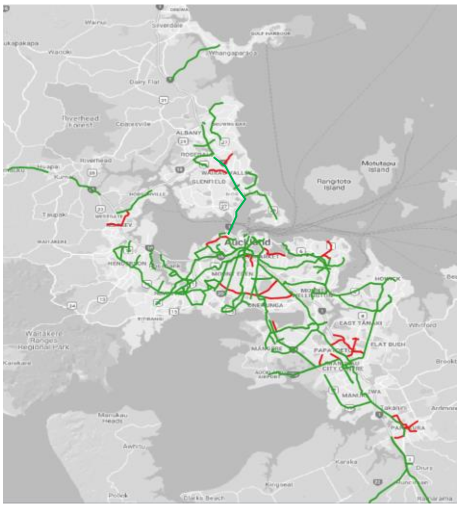
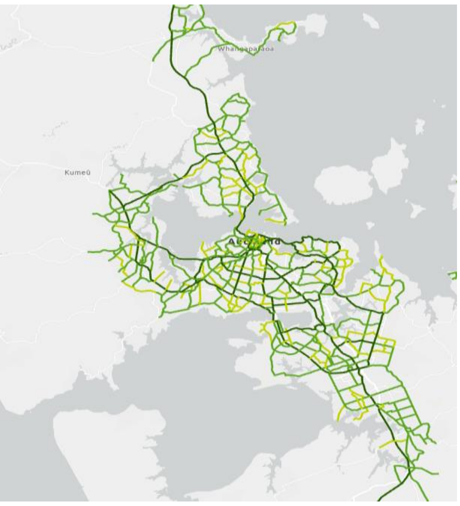
Investment scenario	Description
	**The RLTP+ scenario** The same as the RLTP scenario, in addition to all other proposed cycle projects that are not currently funded within the RLTP. This list notably includes (shown red to the left): ◆ the remainder of the Connected Communities programme ◆ cycling components of the Airport to Botany and 20Connect projects ◆ cycling components of the Drury to Bombay, Pukekohe expressway and Dominion Road light rail projects ◆ completion of the Northern Pathway project This scenario represents the Cycling PBC's default level of investment
	**The RLTP++ scenario** The first of several "stretch" investment scenarios. The same as the RLTP+ scenario, in addition to a further investment in the Cycling PBC ($600 million total investment, additional investment shown in red to the left)
	**The RLTP+++ scenario** The second of several "stretch" investment scenarios. The same as the RLTP++ scenario, in addition to a further investment in the Cycling PBC ($900 million total investment, additional investment shown in red to the left)

Table 6: Investment scenarios considered

Investment scenario	Description
	**Future Connect scenario** The third of several "stretch" investment scenarios. The same as the RLTP+++ scenario, in addition to all other strategic cycling routes identified by Auckland Transport's Future Connect network (including Regional, Major and Connector route types)
(Not mapped)	**Cycletopia scenario** A "complete network" where every origin and destination is connected by best-practice cycle infrastructure and where every city street is cyclable by people with a range of abilities. Not necessarily a realistic investment scenario, but used as a benchmark to consider what's theoretically achievable within Auckland.

3.2 Cycle demand assessment

3.2.1 Methodology

We have used the ACM to assess cycling and e-bike demands in the first instance. As set out in Section 2.2.1 above, the ACM uses outputs from the regional transport model (MSM) and as a result often omits shorter trips under 1-2 km. Recognising this, we have developed estimates of cycling trips to school and to Rapid Transit Network (RTN) stations using a first principles approach.

The methodology is documented more fully in Appendix A.

3.2.2 Predicted cycling outcomes

The following table presents modelled cycling statistics for the Auckland region. Data presented reflects predicted annual totals, which average out variations between days and seasons. The data presented is for

- the estimated annual distance (km) cycled across the network
- the estimated annual reductions in emissions (as a result of predicted reductions in private car travel)
- estimated cycling mode share (for all trip types, by distance travelled).

Table 7: Estimated annual cycle-km travelled (million cycle-km. Values in brackets relative to future reference case)

	Existing	2028 predicted	2038 predicted
Base case	56	n/a	n/a
Future reference case	n/a	180	220
RLTP (as above + $306m Cycling PBC)	n/a	230 (+50)	285 +(65)
RLTP+ (as above + planned routes)	n/a	370 (+190)	460 (+240)
RLTP++ (as above with $600m Cycling PBC)	n/a	420 (+240)	520 (+300)
RLTP+++ (as above with $900m Cycling PBC)	n/a	470 (+290)	580 (+360)
Future Connect	n/a	670 (+490)	830 (+610)
Cycletopia	n/a	1,040 (+860)	1,290 (+1,060)

Table 8: Estimated annual emissions reductions (tonnes of CO_2e)

	2028 predicted	2038 predicted
Future reference case	n/a – the below are measured relative to this scenario	
RLTP (as above + $306m Cycling PBC)	3,200	3,000
RLTP+ (as above + planned routes)	13,000	12,000
RLTP++ (as above with $600m Cycling PBC)	18,000	16,000
RLTP+++ (as above with $900m Cycling PBC)	22,000	20,000
Future Connect	44,000	41,000
Cycletopia	97,000	89,000

Table 9: Estimated cycling mode share (all trip types, by distance)

	Existing	2028 predicted	2038 predicted
Base case	0.4%	n/a	n/a
Future reference case	n/a	1.0%	1.2%
RLTP (as above + $306m Cycling PBC)	n/a	1.3%	1.5%
RLTP+ (as above + planned routes)	n/a	2.1%	2.3%
RLTP++ (as above with $600m Cycling PBC)	n/a	2.3%	2.6%
RLTP+++ (as above with $900m Cycling PBC)	n/a	2.6%	2.9%
Future Connect	n/a	3.7%	4.2%
Cycletopia	n/a	5.8%	6.6%

Improvements in cycling outcomes between today and the future Reference Case are predicted due to background investment in cycling. This background investment includes all cycling projects with committed funding identified in the Auckland RLTP 2021-31, including

- completion of the Auckland Urban Cycleways programme
- priority routes within the Connected Communities programme
- funded sections of Te Whau pathway
- cycling components of the Penlink, AMETI, Lincoln Road and Papakura to Drury projects
- Auckland Transport's pop-up protection programme.

Each of the 6 investment scenarios is predicted to result in an increase in cycling demand and positive cycling outcomes. These increases are relative to their respective level of investment.

The forecast cycle mode shares fall below the targets set by Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan. Those regional targets are (for all trips, by distance)

- 7% bike and e-bike mode share by 2030
- 9% bike and e-bike mode share by 2050.

Similarly, the forecast cycle mode shares fall below the e-bike mode share potential estimated by Waka Kotahi's Research Report 674, of

- 8% e-bike mode share for urban areas within 5 km of the city centre
- 5% e-bike mode share for suburban Auckland locations.

These comparisons provide some level of confidence that the model is not predicting unrealistically inflated cycle mode shares, relative to Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan, or Waka Kotahi research. Conversely, our modelling suggests that infrastructure improvements alone will not be sufficient to achieve the outcomes anticipated by our Climate Plan. Further investment in measures that encourage mode shift will be necessary, including for example congestion charging.

It should be recognised that the ACM has been calibrated based on the observed response in Auckland to recent cycling investment. That level of investment, and the associated demand response were very small relative to the levels of investment assessed above, particularly compared to the more extreme investment scenarios. In effect, the ACM is being used to test scenarios far beyond its calibrated parameters, and there is a risk in doing so. The actual cycling outcomes, should for example Auckland Transport complete the Future Connect cycle network, may be significantly different to the modelled forecast.

3.2.3 Cyclable catchments

The ACM has also been used to quantify the proportion of Auckland's population predicted to live within a 15-minute safe cycle trip of at least 1 key social destination. We have used the following definitions in this process

- a 15 km/h average cycle speed has been assumed, meaning a 15-minute catchment includes trips within 3.75 km

- key social opportunities have been assumed to include any MSM zone with 1,000 jobs or more, the city centre, Metro Centres and Town Centres
- Population forecasts are from Auckland Council's scenario I11.6 forecasts
- Safe cycle infrastructure has been assumed to include all protected cycle lanes, off road cycleways and quality shared paths.

The results are presented in Table 10.

Table 10: Auckland's population living within a 15-minute, safe cycle ride of key social opportunities

	2018	2028	Proportion of regional total
Base case	192,000	n/a	12%
Future reference case	n/a	452,000	24%
RLTP (as above + $306m Cycling PBC)	n/a	635,000	34%
RLTP+ (as above + planned routes)	n/a	863,000	47%
RLTP++ (as above with $600m Cycling PBC)	n/a	953,000	52%
RLTP+++ (as above with $900m Cycling PBC)	n/a	1,023,000	55%
Future Connect	n/a	1,357,000	73%
Cycletopia	n/a	1,594,000	86%

Note that even with the "Cycletopia" investment scenario, less than 100% of Auckland's population is predicted to fall within a 15-minute, safe cycle ride of key social opportunities. This is because some of Auckland's future population falls outside the boundary of the ACM. As a result, actual population proportions may be slightly higher than those reported above.

3.3 Economic evaluation

3.3.1 Economic Do Minimums

We have assessed the economic impact of 3 investment scenarios:

- The $306 million investment scenario
- The $900 million investment scenario
- Future Connect

Two different "Do Minimum" scenarios have been used to assess the economic benefits of the investment scenarios:

- The $306 million investment scenario has been assessed by comparing it to the future Reference Case that includes all other cycling investment with committed funding in the RLTP (refer Table 6, page 11). This has allowed us to isolate the predicted benefits of the $306 million investment from the background investment in cycling

- The $900 million and Future Connect investment scenarios have been assessed against the RLTP+ scenario (refer Table 6, page 11). This has allowed us to isolate the predicted benefits of these 2 investment scenarios from the additional planned but unfunded background investment in cycling, such as the cycling components of the A2B project.

3.3.2 Economic benefits of the investment

The economic evaluation has been carried out in accordance to Waka Kotahi's Monetised Benefits and Costs Manual (MBCM).

The following benefit streams have been assessed for the project

- perceived travel time benefits for cyclists – travel time savings, weighted by the MBCM's Relative Attractiveness scale, which accounts for cyclist perceptions of comfort/time on cycle infrastructure
- health benefits for pedestrians and cyclists – the public health benefits associated with increased physical activity
- general traffic reduction benefits – the travel time and vehicle operating cost benefits to general traffic that remains on the road network, when some users shift from driving to cycling. Emissions and crash benefits of removing those vehicle trips from the network are also captured
- crash reduction benefits – the economic benefits of reductions in crashes following road safety improvements delivered by the project

Table 11 presents a summary of the discounted benefits. Further detail of how these have been developed is included in Appendix B.

Table 11: Discounted economic benefits (Net Present Value – NPV)

Benefit stream		RLTP ($306m investment)	RLTP+++ ($900m investment)	Future Connect
Cycling	Health benefits	$439 m	$1,252 m	$3,005 m
	Perceived travel time benefits	$38 m	$111 m	$251 m
	Safety benefits	$15 m	$47 m	$142 m
Pedestrians	Health benefits	-	-	$13 m
General traffic	General traffic reduction benefits	$268 m	$797 m	$1,836 m
	Emissions reduction benefits[1]	$8 - $12 m	$23 - $36 m	$53 - $84 m
Total benefits		**$768 - $772 m**	**$2,230 - $2,243 m**	**$5,300 - $5,331 m**

[1] The MBCM requires a low and high range to be given for emissions benefits, reflecting low and high shadow costs for CO_2 emissions

3.3.3 Economic costs of the investment

Project capital costs have been supplied by Auckland Transport and include $306 and $900 million for those respective investment scenarios, and $5 billion for Future Connect. Capital costs have been assumed to accrue linearly over a 10-year period, from 2022 to 2031.

Ongoing maintenance and operational costs have been assumed to be 0.5% of the implementation costs (ie $1.5 million per year for the $306 million investment scenario).

Discounted over the 40-year evaluation period, the above costs sum to Net Present Values of

- $269 million for the $306 million investment scenario
- $792 million for the $900 million investment scenario
- $4,399 million for Future Connect.

3.3.4 Benefit cost ratios

Based on the discounted benefits and costs presented above, the investment scenarios are estimated to have the following benefit cost ratios (BCR).

Table 12: Estimated benefit cost ratios

	RLTP ($306m investment)	RLTP+++ ($900m investment)	Future Connect
Discounted benefits (NPV)	$768 - $772 m	$2,230 - $2,243 m	$5,300 - $5,331 m
Discounted costs (NPV)	$269 m	$792 m	$4,399 m
Benefit cost ratio	**2.9**	**2.8**	**1.2**

3.3.5 Benefit cost ratio ranges

The BCRs calculated above include only benefits due to investment in separated cycle facilities. They omit any additional benefits associated with Local Area Network (LAN) components of each investment scenario. The LANs include comprehensive traffic calming within targeted communities, to ensure local streets are cyclable. LANs typically result in benefits for cyclists and pedestrians, as well as road safety benefits for general traffic. While a proportion of the estimated costs have been set aside for the LANs, these have not been included in the estimated project benefits, as the location and scope of the LANs have not yet been determined.

This section considers the effects that including the LANs in the benefits calculation may have on the overall BCRs. The LAN components make up 23% of the estimated costs for the $306 million programme, and 17% of the costs for the $900 million programme. As a result, we have estimated the effect of the LANs on the BCR by factoring up the estimated benefits by these proportions.

Following our economic evaluation, Auckland Transport also advised that the estimated costs of each investment scenario were expected to increase by 35% to 40%. This section also considers the effects this cost increase would have on the BCR, by factoring down the benefit component of the BCR accordingly (ie maintaining the same overall programme budgets, but delivering less km of infrastructure).

The results of these tests are summarised in Table 13 below.

Table 13: Estimated benefit cost ratio ranges

Costs	LAN benefits	RLTP ($306m investment)	RLTP+++ ($900m investment)
Low (original cost estimate)	Excluded (default)	2.9	2.8
	Included	3.7	3.4
High (updated cost estimate)	Excluded	2.2	2.0
	Included	2.6	2.2

The BCR ranges for each investment scenario include

- 2.2 to 3.7 for the $306 million investment scenario
- 2.0 to 3.4 for the $900 million investment scenario.

APPENDIX A demand estimates

Methodology

The Auckland Cycle Model (ACM) has been used to develop estimates of average weekday peak period cyclist trips with and without the project. The ACM estimates future cycling demand and

- reflects predicted land use (according to Auckland Council's scenario I11.5 land use forecasts)
- reflects cyclists' route choice – with cyclists generally opting to travel via a slightly longer route if it provides a higher standard of infrastructure, or less adverse gradients
- reflects realistic cycling trip lengths – with longer trips less likely to be undertaken by bicycle than shorter trips, with a probability distribution applied that is based on the existing Auckland cycle trip length distribution
- reflects realistic cycle trip types – with trip types such as home-to-work and home-to-education more likely to be undertaken by bicycle than trip types such as trips for employer's business
- reflects anticipated future growth in e-bike availability
- is responsive to changes in cycle infrastructure (in terms of both demands and trip assignment), in that high quality cycle infrastructure between any two nodes will result in more trips between those nodes being undertaken by bicycle, than a scenario with poorer quality cycle infrastructure
- reflects both utility and recreational cyclist components.

The ACM is informed by the Auckland Macro Strategic Model (MSM), and its development is documented more fully in a Model Development Report[2].

For the economic evaluation of the project, 2028 and 2038 forecast models have been used.

The model represents morning and evening peak period (two hour) cyclist demands for each forecast year. Estimates of daily cyclist demands have been derived by factoring the morning and evening peak period forecasts. A factor of 2.0 has been used in this process. This factor reflects the level of off-peak and weekend profiles currently observed on a range of routes across Auckland. We note that higher factors tend to apply to cycle routes that have a higher proportion of recreational trips, such as Tamaki Drive, while lower factors apply on routes with more commuter focus such as the Northwestern Cycleway.

Peer review of cycle model

The ACM was independently peer reviewed[3] by QTP for the SeaPath DBC in 2018. That review focused on the model's ability to predict future cycling trips across the Waitemata Harbour, but also scrutinised the model's general construction and appropriateness to assess cycle infrastructure in general. Key findings of the peer review included:

[2] Flow Transportation Specialists. September 2018. Auckland Cycle Model – Model Development Report
[3] QTP. September 2018. SeaPath DBC – Economics and Modelling Peer Review

- that the ACM has been built using unconventional methods, but that it has demonstrated powerful ability to accurately predict forecast cycle demands in the short term. We note that there is no established convention on cycle demand forecasting, however
- that the model is limited by its coarse zone size, with this being based on the MSM zones. This issue is addressed by disaggregating the MSM's 550 zones into over 800 smaller zones, with this process focusing on areas of particular interest to Auckland Transport projects, such as the city centre and Metropolitan Centres. In the case of the PBC, the zone structure is considered less critical, as the PBC's focus is on strategic, regional investment at the MSM zone level
- that the model does not well reflect education trips, due to the short length of these trips. Recognising this, the model has not been used to assess trips to schools for the PBC (or for other short trip types)
- that the model uses a "network effects" module, which results in an S-shaped response to cycling network investment (with predicted demands increasing exponentially at lower levels of investment, before plateauing). The peer reviewer noted that there is no evidence to support this non-linear trend

The peer review concluded that the ACM provides a much-improved ability to forecast future cycle demands, relative to the previous methods of the MBCM's Simplified Procedures 11 and Waka Kotahi's Research Report 340.

Subsequent to the peer review, the ACM has been used to evaluate a number of Auckland Transport, Waka Kotahi and Auckland Council projects, including

- Waka Kotahi's Northern Pathway project
- cycling components of Auckland Transport's Connected Communities programme
- Auckland Council's te Whau Pathway
- Auckland Transport's Glen Innes to Tamaki Drive shared path, Pt Chevalier to Herne Bay cycleway, Avondale to New Lynn shared path, and other components of the Auckland Urban Cycleways programme

Finally, we note that the ACM was referenced extensively in Waka Kotahi Research Report 676 (Latent demand for walking and cycling, March 2021). That report recommended a range of cycle demand estimation tools be used in the future, with urban area cycle models being recommended for projects that are expected to result in fundamental changes in travel behaviours and that cost in excess of $20 million. The Auckland Cycling PBC falls within this category.

Future micro-mobility impacts

The cycle demand component was based on outputs from the ACM, calibrated based on observed cycle data from 2016. In the period since, e-bikes have gained in popularity significantly. Evidence to support this includes

- Waka Kotahi's Research Report 674 "*Mode shift to micromobility*" (February 2021), which concluded that if appropriate infrastructure is provided, e-bike trips could account for up to 8% of all trips within a 5 km radius of Auckland's City Centre, and 5% in more suburban areas of the city

- 2018 data collected by the University of Auckland[4], which observed that 31% of peak period trips on the Northwestern Cycleway were by e-bike (but only 15% on Tamaki Drive, which did not have safe cycle infrastructure at that time)
- Waka Kotahi's research[5] indicating that 11% of bikes sold in New Zealand in 2019 were e-bikes
- Data collected by Auckland Transport[6] indicating that in 2020, 25% of regular bike riders in Auckland used e-bikes
- Most micro-mobility hire companies have e-bikes and e-scooters, rather than pedal bikes/scooters.

The evidence points to a rapidly increasing rate of e-bike ownership and use, from near-zero in 2016 when the ACM was calibrated, to the observed rates above. Reflecting this, we have made the following assumptions in our demand assessment

- 40% of cycle trips in Auckland will be by e-bike (or similar micro mobility device) in 2028
- 60% of cycle trips in Auckland will be by e-bike (or similar micro mobility device) in 2038

Waka Kotahi's Research Report 674 reviewed both New Zealand and international literature to consider the effect of e-bikes on trip lengths. Waka Kotahi's conclusion was that e-bikes enable trip lengths two to three times longer than traditional pedal bikes. We have taken the low end of this range, and assumed that e-bikes enable trips that are double (two times) the length of traditional pedal bike trips.

Similar trends have been observed for e-scooters and other "wheeled pedestrian modes", however there is less data available to support this. Data collected by Flow on Tamaki Drive in 2018 found that approximately 20% of pedestrian trips on this route during the peak periods were by "wheeled pedestrians". Waka Kotahi's Research Report 674 concluded that given appropriate infrastructure, e-scooters could account for 1% to 3% of all trips outside of Auckland's City Centre (and approximately double that within the City Centre).

E-scooters also differ from bikes and e-bikes, in that they are often used for the first/last mile of public transport trips. Given these differences, and the uncertainty around e-scooters, we have not modified the ACM to incorporate e-scooter trips.

School trips

While we have used the Auckland Cycle Model (ACM) to assess cycling and e-bike demands in the first instance, the ACM is based on car and public transport trips from the regional MSM model. As a result, it generally omits shorter trips under 1-2 km, particularly effecting school trip estimates. Recognising this, we have developed estimates of cycling trips to schools using a first principles approach.

School trips have been estimated according to the following process:

[4] Wild, K. & Woodward, A. (2018). *Electric city: E-bikes and the future of cycling in New Zealand*. University of Auckland Medical and Health Sciences
[5] Khoo, J. (March 2021). Can active modes supercharge our health outcomes?
[6] TRA for Auckland Transport. (June 2021). *Measuring and growing active modes of transport in Auckland*

- the 2018 census indicates that there were 386,000 school students across Auckland in 2018. 2028 and 2038 student numbers have been derived by applying predicted population growth, from Auckland Council's I11.6 land use forecasts
- the existing cycle to school mode share in Auckland is approximately 1% (from census data). At the upper end of the spectrum (the "cycletopia" scenario), a 40% mode share has been assumed. In supporting this figure, we note that several Auckland schools already achieve a 20%-30% cycle mode share[7], without safe infrastructure. Internationally, higher mode shares have been achieved where best practice infrastructure is provided[8]. Mode shares for intermediate investment scenarios have been linearly interpolated between these 1% and 40% figures, relative to their modelled cycle trips from the ACM
- an average cycle trip length to school of 1 km has been assumed.

For the $306 million investment scenario, this process has resulted in 64,800 daily cycle-km to/from schools in 2028: 386,000 students x 117% population growth x 7.2% mode share x 1 km x 2 trips (ie return).

RTN trips

The ACM considers "complete trips" from origins to destinations (such as home to work). It is unable however to consider cycling legs of multimodal trips, such as a short cycle trip to an RTN station that is part of a longer RTN trip. Recognising this, we have developed estimates of cycling trips to RTN stations using a first principles approach.

Trips to RTN stations have been estimated according to the following process:

- the existing cycle mode share to Auckland RTN stations (1st mile trip) is approximately 1%, from Auckland Transport data. The existing cycle from RTN station mode share is 0% (the last mile trip)
- for the "cycletopia" scenario, a 1st mile mode share of 20% has been applied, and a last mile mode share of 5%. This is on the basis of
    - existing cycle mode shares to Devonport ferry terminal of between 7% (2013) to 16% (2015)
    - first and last mile mode shares to train stations in Copenhagen of 27% and 10%, respectively[9]
    - first and last mile mode shares to train stations across the Netherlands of 43% and 14%, respectively[10]
- these mode shares have been applied to the forecast 2028 and 2038 annual RTN boardings across the Auckland network, from Auckland Transport data

[7] 34% recorded at Pasadena Intermediate 2017, 24%-29% at Belmont Intermediate 2011-2017

[8] For trips of 5km or less, 46% of primary school and 84% of secondary school trips in the Netherlands are by bike. Hoe gaan kinderen naar school? (How do Children travel to school?); van Goeverden and de Boer; Technische Universiteit Delft; November 2008

[9] https://cyclingsolutions.info/bike-plus-train-an-attractive-model/

[10] https://link.springer.com/article/10.1007/s11116-019-10061-3

- an average cycle trip length to/from RTN of 2 km has been assumed.

For the $306 million investment scenario, this process has resulted in 16,000 daily 1st-mile cycle-km to RTN stations in 2028: 99,600 morning period boardings x 4.0% 1st-mile mode share x 2 km x 2 trips (ie return).

Pedestrian demand estimates

Pedestrian demand estimates have been developed for the Future Connect investment scenario, which proposes new walking and cycling facilities along a significant section of SH20. Average demands of 160 pedestrians per day have been applied to this route, based on average recorded pedestrian counts on existing Auckland State Highway shared paths within similar environments as SH20, and accounting for projected population growth within the Māngere area.

APPENDIX B economic evaluation methodology

General methodology

This section quantifies the transportation economic benefits of each investment option.

The economic evaluation has been based on procedures from Waka Kotahi's Monetised Benefits and Costs Manual (MBCM). It has used predicted forecast 2028 and 2038 cycle demands from the ACM. ACM outputs from modelled scenarios both with and without the investment have been compared to isolate predicted benefits. Benefits for intermediate years have been interpolated and extrapolated from the two forecast years.

The project has been assessed with a standard 40-year evaluation period, and a 4% annual discount rate.

The evaluation applies a 10-year construction period beginning in January 2022 and ending December 2031. During this construction period, we have assumed that 10% of the programme will be completed each year, so that benefits accrue at that 10% rate per year. Ie

- no benefits in the first year of implementation, 2022
- 10% of benefits in 2023
- 20% of benefits in 2024
- through to 90% of benefits in 2031
- 100% of benefits from 2032 onward

The economic evaluation has been carried out using the MBCM's update factors relevant at the time of the assessment (November 2021), including

- 1.57 for travel time benefits
- 1.04 for walking and cycling benefits
- 1.14 for safety benefits
- 1.26 for road traffic reduction benefits
- 1.15 for emissions reduction benefits.

We note that Waka Kotahi released revised updated factors on 15 December 2021. The revised factors will not have a material effect on the BCRs, increasing them by approximately 2%.

Benefit streams

The following benefit streams have been assessed for the project

- perceived travel time benefits for cyclists – calculated using ACM outputs and applying MBCM travel time cost rates
- health benefits for cyclists – calculated using outputs from the ACM, and applying MBCM health benefit rates
- health benefits for pedestrians – calculated using estimated pedestrian demands on new pedestrian routes, and applying MBCM health benefit rates

- safety benefits for cyclists – calculated using outputs from the ACM, and applying MBCM cycling safety benefit rates
- general traffic reduction benefits – calculated using outputs from the ACM, and applying a composite road traffic reduction benefit rate from the MBCM to account for vehicle travel time, operating cost, crash cost and emissions benefits

Further detail on each of the above benefit streams is provided in the following sections.

Cyclist perceived travel time cost savings

Perceived cyclist travel time cost savings associated with the project have been evaluated, based on outputs from the ACM. The evaluation has applied the MBCM's Relative Attractiveness rating to weight travel time by the perceived cost on each route according to that route's infrastructure standard. The travel time costs on each modelled link included in the ACM have been aggregated across the Reference Case and Option networks, using fixed trip matrices, and compared to determine user cost savings for existing users. These have then been applied to predicted new users on the network, using the rule of half.

We have applied average cycle speeds of 17 km/hr across the network, based on the existing average cycle speed recorded in the NZ Household Travel Survey.

In 2028 for example, for the $306 million investment scenario

- The ACM predicts cyclists will travel 239,482 daily cyclist-km across the 2028 Reference Case network. When adjusting this for Relative Attractiveness on each link and the average speed above, the daily perceived travel time is 9,543 cyclist-hr
- With the project, and with fixed Do Minimum cycle demands, the perceived daily travel time reduces to 9,265 cyclist-hr, a saving of 278 daily cyclist-hr, shared by 6,741 existing daily trips that are predicted to use the project links
- A further 9,586 new daily trips are predicted to use the project links in 2028, in response to the investment. To these users, half of the above perceived travel time cost savings, per user, have been applied. Ie: 278 / 9,265 x 9,586 x 0.5 = 198 cyclist-hr per day
- The total perceived travel time saving is 278 + 198 = 476 cyclist-hr per day
- The above 476 daily cyclist-hr has been monetised, by applying a weighted travel time cost of $7.44/hour[11], the relevant MBCM update factor of 1.57, and multiplying by 365 days per year: 476 x $7.44 x 1.57 x 365 = $2,027,871 per year in 2028.

When also applied to the 2038 model outputs and discounted, the net discounted travel time cost savings are $38 million for the $306 million investment scenario, or approximately 5% of the overall project benefits.

[11] $7.80/hr for cycle commuting purposes and $6.90 for other cycling purposes, applying a 60%/40% utility/recreational split

Health benefits for people on bikes and e-bikes

This benefit stream calculates the health benefits gained from additional cycling activity. Cyclist health benefits have been calculated for the full length of each new cyclist trip. This quantity has been obtained directly from the model, with the total length of cyclist-km travelled under the Reference Case and Option scenarios compared, and the difference being the total distance of new cyclist-km trips. The estimated increase in school and RTN cycle-km has also been added to this figure.

The MBCM applies cycling health rates of

- $2.20 per cycle-km, for traditional pedal bicycles
- $1.00 per e-bike-km

The economic evaluation has applied a composite value of the above, based on the following estimated e-bike proportions

- 40% of bike trips estimated to be by e-bike (or similar device) by 2028
- 60% of bike trips estimated to be by e-bike (or similar device) by 2038

The MBCM requires cycling health benefits to be capped, with maximum annual benefits of $2,500 per year for pedal bike riders. This cap was developed on the basis that 50% of New Zealanders already achieve Ministry of Health physical exercise guidelines, so this 50% would not gain additional health benefits from cycling more. The cap is accordingly equal to 50% of the estimated $5,000 benefit of making an inactive person active. A lower cap of $2,000 per e-bike riders is given by the MBCM.

The above caps are not practical to apply however, as they apply to *people*, from a public health perspective. Transport planning generally however deals with *trips*, and the two (people versus trips) do not necessarily align. In the case of a street with on average of 100 daily cycle trips, these may be undertaken by several hundred individual people, some cycling twice a day and others only very occasionally.

Instead, we have capped the cycling health benefits by simply factoring these down by 40% (ie capping them at 60%), reflecting the 40% of Aucklanders who already meet the Ministry of Health's daily exercise guidelines. The assumption here is that 40% of new cycle trips will be undertaken by the 40% of Auckland's population that already meet daily exercise guidelines, and who therefore gain no personal health benefit from the new cycle trip.

Discounted over the 40-year evaluation period of the project, this benefit stream equates to $439 million for the $306 million investment scenario, or approximately 57% of the overall benefits.

Health benefits for pedestrians and wheeled pedestrians

The MBCM also allows health benefits to be calculated for new pedestrian trips, at a rate of $4.40 per new pedestrian-km travelled. As with the cycling health benefits above, this benefit stream reflects the health benefit gained by increased walking activity.

The MBCM does not however provide a health benefit rate for wheeled pedestrian trips, such as e-scooter trips. In lieu of this, we have applied the e-bike health benefit rate of $1.00 per km. We have weighted the two benefit rates assuming 20% of pedestrian trips will be via wheeled modes in 2028, and 40% in 2038. This assumption is on the basis of 20% of pedestrian trips on Tāmaki Drive being via wheeled modes when surveyed in 2018, and the expectation that access and availability of e-scooters and other wheeled pedestrian devices will increase over the coming years. Conversely however, we are aware that e-scooter use on Tāmaki Drive is likely higher than on other Auckland routes.

The MBCM also applies a cap to pedestrian benefits, of $1,250 per person per year. We have again applied this by capping pedestrian health benefits by 60%.

Pedestrian benefits have only been calculated for investment scenarios that include new pedestrian links, and only for that length of new pedestrian link. For the Future Connect scenario for example, this included significant lengths of new walking routes along SH20.

In total, discounted pedestrian health benefits are estimated to be $13 million for the Future Connect investment scenario, or approximately 0.2% of the overall project benefits.

Safety benefits for cyclists

The MBCM allows cycle safety benefits to be calculated for both new and existing cycle trips, where an improved cycling facility is provided. These may be calculated either per cyclist-km travelled on new facilities, or alternatively per cyclist in the case of "hazardous sites". The project does not specifically address hazardous sites, so the per cyclist-km method has been applied.

The calculation of this benefit stream follows the MBCM process, and applies the rate of $0.05 per cyclist-km travelled on improved routes. Forecast estimates of cyclists on each of the improved routes have been obtained directly from the ACM.

Over the 40-year evaluation period, the cycling crash cost savings discount to $15 million for the $306 million investment scenario, or approximately 2% of the project benefits.

The method above is based on MBCM Simplified Procedures 11 (SP11), which is intended for investment programmes of under $15 million. The Auckland Cycling PBC significantly exceeds this. In our experience however, carrying out a site-specific cycling crash analysis for an area-wide cycling investment programme is likely to result in comparable crash reduction benefits.

General traffic reduction benefits

Decongestion benefits are expected to be a significant portion of the overall project benefits, as the proposed investment scenarios would each provide alternatives to private car travel on currently congested Auckland road corridors. As a result, any mode shift in favour of active modes will reduce existing (or forecast future) congestion on the road network.

The MBCM decongestion value for Auckland is $1.94 per vehicle-km removed from the network during the commuter peak periods (Table 42, updated to current values). This region-wide value was developed in 2008 and does not necessarily recognise the levels of congestion currently experienced on central Auckland streets affected by the project, nor does it reflect how this congestion is expected to change over time. Nonetheless, without the benefit of a local traffic model to develop area specific decongestion values, we have applied the MBCM default value to the commuter peak periods, and omitted any inter peak decongestion benefits.

We note that where local traffic models have been available to assess specific projects elsewhere in Auckland, the resulting commuter peak period decongestion values have ranged up to $5 per vehicle-km in 2028 and $7 per vehicle-km in 2038. Interpeak values of approximately $1.50 per vehicle-km have also been developed. As a result, we consider our assessment to be conservative.

Forecasts of new commuter peak cycle trips have been obtained directly from the ACM, with additions made to account for school and RTN trips. It is important to recognise that not every new cycle trip on the network would otherwise have taken place by private car. Some cycle trips would instead replace a public transport, walking trip or car passenger trip, while others may be new trips entirely. Recognising this, the number of new cycle trips has been factored down by diversion rates. We have applied the following rates to each type of new cycle trip:

- a 2028 diversion rate of 0.47 has been applied to new cycle trips forecast by the ACM. This reflects future car mode share of trips across Auckland, expected car occupancy, and accounts for some new recreational cycle trips
- a diversion rate of 0.15 have been applied to new cycle trips to RTN stations, reflecting the existing 15% car mode share to existing Auckland RTN stations supplied by Auckland Transport
- a diversion rate of 0.91 for new RTN trips (ie a new train trip from Henderson to Britomart, replacing a car trip). This diversion factor accounts for a car occupancy of 1.1
- a diversion rate of 0.93 for school trips. This accounts for the existing average car mode share for trips to school within Auckland of 62% (from census data), and assumes that 50% of school trips are return trips by a parent or caregiver (ie home-school-home)
- the above diversion rates have been assumed to reduce over time, reflecting a falling car mode share across Auckland in the future.

We note that the MBCM does not provide diversion rates for cycling trips, but provides a rate of 0.725 for public transport trips in Auckland. The weighted average of the rates developed is 0.58, and this is appropriately lower than the MBCM's public transport diversion rate.

We have applied the diversion rate above to the respective commuter peak period cycle trip forecasts, and to the $1.94 benefit per car-km removed from the road network. We have annualised this assuming 245 weekdays per year. The resulting general traffic reduction benefits have been estimated to be $268 million for the $306 million investment scenario, discounted over the 40-year evaluation period. This accounts for approximately 35% of the overall project benefits.