QTP
Quality Transport Planning

SeaPath DBC

Economics & Modelling Peer Review

September 2018

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Appendices

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1 Executive Summary

1.1 QTP were appointed by the New Zealand Transport Agency (**the Agency**) in October 2017 to undertake a Peer Review of the SeaPath Detailed Business Case (**DBC**) modelling and economic assessment. The modelling and economic benefit assessment has been undertaken by consultants Flow Transportation Specialists (**Flow**) as sub-consultants to AECOM who are understood to be preparing the complete Economic Assessment for the project.

1.2 The Peer Review has been an ongoing progress, with three working notes providing interim feedback on the initial modelling methodology, a draft Demand Assessment and Economic Benefit Evaluation report (the **Evaluation Report**) and the requested preparation of the Auckland Cycle Model Development Report (**ACM MDR**) upon which the modelling of the benefits is based.

1.3 This report summarises the entire peer review (to date). To avoid repetition, each of the three QTP working notes are included in **Appendix A**, with Flow's documented responses and actions also included.

1.4 The development and application of a cycle model offers the potential to meet, and improve upon, the key aspects of the EEM full procedures in the following ways:

- Demands can be estimated for multiple future years, allowing a stream of benefits to be estimated during the appraisal period, in accordance with the full procedures; and
- Cycle demands can be estimated that reflect the specific nature of the proposal, in particular, with regard to a facility's potential to attract cyclists as part a longer-distance network of planned cycleways, such as the Auckland Cycle Programme[1], rather than just as a function of the immediately surrounding population.

1.5 The main text of this Peer Review report does not seek to repeat the detail of the stages of review provided within Appendix A. Its key purpose is to identify the limitations and risks of the appraisal. In order to provide context to such comments, a high-level summary of the Peer Reviewer's understanding of the appraisal process if first provided. Finally, comment is provided on each of the Peer Review matters listed in the Agency's Planning and Investment Knowledge Base (**PIKB**).

1.6 The available budget and scope for the model build agreed with the commissioning agency is a material consideration in critiquing practices employed. This is particularly relevant to cycle modelling where the desirable model features to capture a range of model responses can be equally, if not more so, challenging than for a traditional traffic model, yet cycle infrastructure funding is very small compared to that of general traffic[2], which does tend to affect the available budget for cycle modelling.

1.7 For these reasons, it is considered that cycle modelling should prioritise the aspects that

[1] The Auckland Cycling Programme Business Case recommends an investment of $635m over the period 2018-2028.

[2] The 2018 NLTP budget for walking and cycling improvements is 4% of that for road and PT improvements.

are most critical to accurately estimating cycle demands.

1.8 A number of potential issues with different aspects of the ACM have been raised during the review process where practices are considered unconventional or sub-optimal. However, as noted at section 5.4 of Working Note 3, section 5.4 of the ACM MDR provides some powerful illustrations of the model's ability to accurately forecast cycle demands on new and improved routes based on before and after surveys. Notably, the ACM provides much improved accuracy over the application of the alternative approaches of applying the EEM simplified procedures or NZTA Research Report 340.

1.9 Notwithstanding the above important points in relation to model scope and the successful demonstration of the model's predictive capability in the short-term, a number of key limitations of the ACM have been identified. These relate to the relatively coarse nature of the model, the modelling of education and recreational trip types, the unconventional nature of the future demand forecasting and the lack of modelling of cycle travel times.

1.10 Whilst the coarse zone and link structure is considered to limit the accuracy to which modelled cycle demands on a given section of road or cycleway may be modelled, the limitation is not considered to have a significant impact on the purpose of the model for the SeaPath economic evaluation. For SeaPath, the potential under-estimation of recreational trip types is considered conservative in terms of estimating scheme benefits and the limitations with regards to educational related trips are not anticipated to significantly affect the assessed benefits.

1.11 The ACM uses a 'Network Effects' module to further increase cycle demands for zones that are 'well connected' to other zones, beyond the modal-shift effects applied through inter-zonal improvements in cycle infrastructure. Whilst I understand the potential effects attempted to be captured by this methodology, I am not able to conclude that the implementation of 'Network Effects' does improve the model accuracy and therefore don't consider the additional complexity is justified. I am advised that for SeaPath, the 'Network Effects' module has around a 5% impact on the modelled scheme benefits.

1.12 Notwithstanding this relatively small component of the assessed economic benefits (which I recommend be discounted) the assessed benefits are considered reasonable.

1.13 The economic peer review cannot be considered complete until costs have been calculated and both the costs and benefits are profiled and discounted across the appraisal period and the economic case is documented.

1.14 In consideration of the Agency's PIKB (2018-21 NLTP Assessment Framework) guidance on the Peer Review of Proposals, the sensitivity analysis testing undertaken is considered appropriate and some relatively minor additional modelling is anticipated for the purpose of incremental assessment of the options. It is beyond the scope of this Peer Review to provide a review of matters relating to the wider Detailed Business Case anticipated to be prepared under the PIKB Investment Assessment Framework, or to review the basis of the parallel cost estimate process anticipated for infrastructure costing more than $20 million (if applicable).

2 Overview

2.1 Scope of Review

2.1.1 The scope of QTP's Peer Review of the SeaPath Detailed Business Case Modelling and Economics is to undertake the Peer Review in accordance with the NZ Transport Agency's (**Agency**) Planning and Investment Knowledge Base (**PIKB**) requirements and includes the following components:

i. A context and background information review;
ii. Provision of feedback on the proposed approach to option evaluation;
iii. An initial review of the modelling and economic evaluation;
iv. A review of the consultant responses to the initial review; and
v. Prepare a Peer Review document (this report).

2.1.2 The modelling and economic benefits have been prepared by consultants Flow Transportation Specialists (**Flow**).

2.2 Peer Review Process

2.2.1 The Peer Review process commenced during the period from October 2017 to December 2017, recommencing in August 2018 following receipt of an updated Economic Appraisal Report (dated July 2018) relating to modified options and a modified modelling process. Thus the key components of the review are summarised as follows:

- A review of the Draft methodology proposed (17th October 2017) reported in a Draft QTP Working Note 1 (dated 3rd November 2017);
- Subsequent discussion and agreement on issues and actions, as captured in the Flow Technical Note of 9th November 2017, and reflected in an updated QTP Working Note 1 (dated 9 h November 2017);
- QTP's preliminary review, by way of emailed comments on 14th December 2017, of version A of the Demand Assessment and Economic Benefit Evaluation report (the '**Evaluation Report'**) of the same date;
- QTP's Working Note 2 (dated Friday 17th August 2018) providing initial feedback on the updated Evaluation Report and spreadsheet analysis (dated 27 July 2018);
- QTP's Working Note 3 (dated Friday 28th August 2018) providing initial feedback on the submitted Auckland Cycle Model Development Report (**ACMDR**);

2.2.2 Each of the three QTP working notes are included in **Appendix A**, with Flow's documented responses and actions also included. In addition there has been correspondence on points of detail and clarification.

2.2.3 The 'final' versions of the ACMDR (dated 6th September 2018) and the Evaluation Report (dated 10th September 2018) have been prepared to address the comments made within the peer review working notes, in accordance with Flow's documented responses and actions.

2.2.4 The main text of this Peer Review report does not seek to repeat the detail of the stages of review provided within Appendix A. Its key purpose is to identify the limitations and risks of the appraisal. In order to provide context to such comments, a high-level summary of the

Peer Reviewer's understanding of the appraisal process if first provided. Finally, comment is provided on each of the Peer Review matters listed in the Agency's PIKB.

3 Summary of Appraisal Process

3.1 Overview

3.1.1 The Agency's Economic Evaluation Manual (**EEM**) sets out the procedures for evaluation of the economic efficiency of investment proposals in accordance with the Agency's Assessment Framework.

3.1.2 The EEM provides simplified and full procedures, the former being for low-cost, low-risk activities. The simplified procedures for evaluating cycling facilities are well defined and relatively straightforward, but are only applicable for proposals estimated to cost $5 Million or less.

3.1.3 The simplified procedures include assessment of the following:

- Scheme costs (including maintenance costs for the Options and Do-Minimum);
- Travel time costs (including the concept of cycle facility attractiveness);
- Health and Environmental benefits for cyclists and walkers;
- Safety benefits; and
- Incremental benefits (as scheme costs increase).

3.1.4 The procedures use a relatively simple spreadsheet approach (SP11), including for the critical aspect of the estimation of demands attributed to a new facility which is simply based on factors applied to the population within three 'buffer' distances from the scheme.

3.1.5 The EEM requirements for cycling and walking facilities under the full procedures[3] are a little ambiguous in that the guidance on calculation of costs and benefits refers back to the conceptual level advice of Chapter 2. This would however suggest that full procedures should include (beyond the simplified procedures) assessment of vehicle operating costs savings (i.e. due to mode shift), 'other external benefits', 'mode change benefits', and journey time reliability benefits.

3.1.6 A key difference to note between the simplified and full procedures is that the former estimates benefits (and costs) at a single year and assumes a constant stream of benefits over the appraisal period. Typical transport scheme evaluation under the full procedures requires an estimate of the benefits for at least two horizon years so that the annual benefits can be appropriately profiled (and subsequently discounted).

3.1.7 We note also that typically the key source of assessed benefits for cycle infrastructure relates to the health (and environmental) benefits, which for SeaPath comprise around 60% of the total assessed benefits. Further significant components of cycle infrastructure benefits are the decongestion benefits (or travel time and operating cost benefits) for motor vehicles due to modal shift and the travel time savings for cyclists, which combined represent around 20% of the assessed benefits (for SeaPath). Because these benefits (together around 80% of the total assessed benefits) are based directly on forecasts of **new** users that a facility will attract (rather than simply cyclists that re-route to use a new facility), it is considered that this should be the focus of effort in appraising cycle facility benefits.

[3] Refer EEM Section 4.5.2 'Evaluating of walking and cycling – Stages of analysis'

3.1.8 In this regard, the EEM full procedures are of limited accuracy as they refer to the same (simple) process[4] adopted within the simplified procedures that relates new use of a facility directly to the population within three distance catchments (or buffers) of a facility.

3.1.9 Thus the development and application of a cycle model offers the potential to meet, and improve upon, the key aspects of the EEM full procedures in the following ways:

- Demands can be estimated for future years allowing a stream of benefits to be estimated during the 40-year appraisal period, in accordance with the full procedures; and
- Cycle demands can be estimated that reflect the specific nature of the proposals, in particular, with regard to a facility's potential to attract cyclists as part a longer-distance network of planned cycleways, such as the Auckland Cycle Programme[5], rather than just as a function of the immediately surrounding population.

3.1.10 In this regard, I am supportive of the overall approach taken to this appraisal to develop and apply the Auckland Cycle Model (**ACM**), in order for the appraisal effort to focus on cycle demand estimation, being the key determinant of the assessed scheme benefits.

3.1.11 As noted in Working Note 2 (and 3) of Appendix A, following submission of the draft Evaluation Report (dated 27 July 2018), it was requested that a separate report be prepared by Flow, as the developers of the ACM, documenting the development of the updated ACM. Section 2.2 of the EEM requires that where transport models are used to generate demand forecasts that documentation should be provided to demonstrate the models have been correctly specified and produce realistic results. To that end, the ACMDR was provided by Flow on Thursday 16th August.

3.1.12 Working Note 3 provides a more detailed record of the Peer Review of the ACM, an overview of the model being provided below and comment on limitations provided in the following chapter.

3.2 Auckland Cycle Model

3.2.1 The ACM has been subject to major changes since its initial (high-level) reporting for the SeaPath IBC stage in December 2014. In essence, the original model employed exogenous mode-share aspirations as the basis of future cycle demand assumptions, whereas the updated model provides a demand response to proposed new infrastructure and demographic growth.

3.2.2 The following bullet points provide a summary of the key aspects of the ACM based on the MDR of September 2018:

a. The model is implemented in the SATURN software, the network coded at the 'buffer' level, which excludes modelling of intersections.

b. Roads, on-road cycle lanes and off-road cycle paths are represented as links with a 'relative attractive index', which works in the same way as fixed-speeds on links, ranging from 11 for intimidating on-road cycle environments, to 15 for high standard

[4] EEM section 4.5.3.3 Cycle demand analysis refers to Worksheet 20.1 of Appendix A20, which is the same process applied within the SP11 simplified procedures.

[5] The Auckland Cycling Programme Business Case recommends an investment of $635m over the period 2018-2028.

cycle paths (and 19 for 'iconic' facilities that are highly attractive such as 'LightPath' and 'SkyPath').

c. Thus assignment of cycle demands to links is based on the least 'cost' route between model zones (using an 'equilibrium' assignment), based on a combination of time (which is based on the coded speed or 'attractiveness') and the coded link distance.

d. Demands (between zones representing discrete geographical areas of Auckland) in the base year (2013 model) are estimated from 2013 Census Journey to Work (**J2W**) data, but 'expanded' to estimate total cycle trips. Note that the J2W cycle trips include cross-harbour cycle trips that are taken in part by ferry (or bus).

   1. First, the estimates of ***daily*** J2W trips are factored to the model AM and PM peak two-hour periods, that are coincidental with the Auckland Regional Transport (**ART**) model, using UK Department of Transport-based factors of 0.6 and 0.49 respectively.
   2. The peak period JTW trips are then expanded to total peak period cycle trips using the Ministry of Transport's Household Travel Survey-derived factors of 1.25 / 1.43 for the AM / PM periods.

e. Under-representation of morning peak school-related cycling trips are addressed by the manual addition of trips within the catchment zones of 9 schools with over 50 cycle trips per day (based on 2013 Auckland Transport cycle surveys).

f. Under-representation of recreational cyclists using Auckland's Waterfront have been added to the model as 'fixed' routes.

g. The initial estimates of demand in 2013 are adjusted to better reflect 2013 count data using SATURN's Matrix Estimation process (with intersection turning counts summed to intersection link approach counts in many instances).

h. Validation of modelled flows has been presented based on counts that in most instances are the intersection turn counts summed to link exit flows.

i. Future year changes in demand relating to changes in landuse have been based on the average of the forecast population and employment growth between each origin and destination zone.

j. Mode shift has been reflected by identifying a matrix of 'Potential Cycle Trips' for the future years, factoring these based on a J2W-based trip-length probability and with further factoring based on improvements to distance and attractiveness between model zones, between the base year and future year networks as follows:

   1. Potential cycle trips are identified based on ART model trip types (for 2026 and 2046) and factoring these for their relative probability as cycling trips. 100% of home-based work and home-based education trips are included, whereas no employer's business, home-based other or commercial vehicle trips are included, and only 25% of home-based shopping and home-based other trips are included.
   2. A trip-length probability function, based on the J2W data, has been used to increasingly reduce the trips with distance (noting a sharp linear decline from 100% to 20% of potential cycle trips between 0 and 10kms and less than 10% of potential trips greater than 15kms).
   3. The components of the further 'improvement' factor applied are based on 0.35 x the change in distance (between the base and future networks) + 0.65 x the change in

attractiveness (implemented as a speed).

k. Finally, A further factoring of demands has been applied, termed 'Network Effects' which factors a zone's cycle demands between 1 and 2 based on the average attractiveness (implemented as speed) to/from all other zones within 5km, for attractiveness values between 12 and 15. The Network Effects module is intended to reflect the step-change in cycling demand that could occur for tours of trips (e.g. home to work to gym to home) once an impediment to cycling any one leg is removed.

l. The distance and attractiveness-related improvement factors have been calibrated using a 2016 model forecast of demands on improved and unimproved routes in Auckland for which traffic counts are available for both 2013 and 2016 (pre and post-implementation).

3.2.3 A fundamental point to understand with the ACM is that the coded link speed is actually a measure of 'attractiveness' (rather than speed) and is used in both the assignment of cycle trips to appropriate routes (refer c above) and the cycle demand response to new infrastructure (refer j above). As such the model does not provide an accurate indication of actual cycle travel times and this is accounted for in the methodology used in the economic appraisal (summarise next).

3.3 SeaPath Economic Appraisal

3.3.1 The economic appraisal uses a spreadsheet approach to assess the benefits associated with the two SeaPath options. It is based on that of the EEM simplified procedures (SP11), but the demands (and travel distances) used in the calculations are based on the ACM outputs for two horizon years, rather than the highly simplified procedure adopted in SP11 that provides a single estimate of cycle demands for new or improved cycle infrastructure. Furthermore, (general traffic) decongestion benefits are estimated (these are not estimated as part of the standard SP11 process), being a key component of the vehicle operating cost savings, mode change benefits and journey time reliability benefits anticipated under the EEM full procedures (refer 3.1.5 above).

3.3.2 The process is summarised as follows:

a. Travel time benefits to cyclists are estimated based on the 'without scheme' cycle demands, assigned to the option network. The average assigned cycle volume on the route is then used in the calculation of the travel time savings (in veh.hrs), based on the scheme length and an estimate of the average speed with and without the scheme (based on first-principles assumptions of cycle speeds and intersection delays with and without the scheme, the without-scheme route being via the existing transport network).

b. Health and environmental benefits are calculated using the standard SP11 value per kilometre ($1.40 plus the appropriate update factor) applied to the number of modelled additional trips due to the scheme. SP11 crudely applies this value to the length of the scheme, whereas this analysis appropriately applies the $/km value to the (entire) modelled average trip length for new cyclists. This is a further key advantage of a model-based approach that the total trip length for new users can be derived.

c. Health and environmental benefits for pedestrians are calculated in a similar manner to those of cyclists. The number of pedestrians for the reference-case and the option is estimated by simply applying a factor (70%) to the modelled number of cyclists, based

on data of this mode-share on existing shared-use paths. The benefits for pedestrians use only the length of the proposed new sections of facility.

d. Safety benefits for cyclists use the SP11 value per kilometre ($0.05 plus appropriate update factor) applied to the scheme length.
e. Decongestion benefits have been estimated through application of the traffic model covering the study area (the Northern Corridor improvements SATURN model). A small number of trips have been removed from the model based on the number of new cycle trips estimated, factored down in relation to assumptions around the trip purpose, the car share of vehicle trips and average occupancy. Only cross-harbour trips have been removed between Northcote/Takapuna and the CBD areas. The resulting reduction in vehicle.kms has been applied to the EEM rate provided in table SP9.1 (which is provided in relation to new public transport services, but is equally applicable to shifts to other modes).
f. The resulting annual benefits estimated for the years 2027 and 2047 have been provided to consultants AECOM for the final stage in the economic appraisal including scheme cost estimates and the profiling and discounting of the annual costs and benefits over the appraisal period.

4 ACM Limitations and Applicability

4.1 Context

4.1.1 All transport models have limitations with regard to the accuracy to which demands may be forecast. This is particularly the case in future years as there is great uncertainty as to the rate and nature of future landuses, the take-up and nature of evolving technologies such as e-bikes, e-cars and driverless cars and more general social, behavioural and economic trends.

4.1.2 It should also be recognised that transport models 'evolve', sometimes from humble beginnings for a specific purpose, and thus the methodologies employed may differ from a situation where a model were to be built from scratch for a well-defined range of applications. Related to this, the available budget and scope agreed with the commissioning agency is a material consideration in critiquing practices employed. This is particularly relevant to cycle modelling where the desirable model features to capture a range of model responses can be equally, if not more so, challenging than for a traditional traffic model, yet cycle infrastructure funding is very small compared to that of general traffic[6], which does tend to affect the available budget for cycle modelling.

4.1.3 For these reasons, cycle modelling should prioritise the aspects that are most critical to accurately estimating cycle demands.

4.1.4 A number of potential issues with different aspects of the ACM have been raised during the review process (refer Appendix A) where practices are considered unconventional or sub-optimal. However, as noted at section 5.4 of Working Note 3, section 5.4 of the ACM MDR provides some powerful illustrations of the model's ability to accurately forecast cycle demands on new and improved routes based on before and after surveys. Notably, the ACM provides much improved accuracy over the application of the alternative approaches of providing the EEM simplified procedures or NZTA Research Report 340.

4.2 Key Limitations

4.2.1 Notwithstanding the above important points in relation to model scope and the successful demonstration of the model's predictive capability, the following key points are noted for consideration in the application of the ACM:

i. The accuracy of the modelled cycle volumes is limited to some degree by the relatively coarse nature of the ACM in relation to zone size and network resolution. The zone structure has been refined to some degree in the lower North Shore for the SeaPath appraisal. Whilst the coarse zone and link structure is considered to limit the accuracy to which modelled cycle demands on a given section of road may be modelled, the limitation is not considered to have a significant impact on the purpose of the model for the SeaPath economic evaluation. However, application of the model to appraise other cycle schemes will likely require a review of the zone resolution, zone loading assumptions and the resolution of the network within the vicinity of a proposed scheme.

ii. We note the limitations of the modelling of recreational trips. The reflection of high cycle

[6] The 2018 NLTP budget for walking and cycling improvements is 4% of that for road and PT improvements.

demands on popular recreational cycle routes as fixed demands on the links is considered a pragmatic approach to reflecting these trips that do not relate to modelled origin and destination zones. It is understood that no specific estimate of recreational trips for SeaPath (or SkyPath) are implemented in the model. Whilst we are comfortable with this as the basis of a conservative appraisal of potential demands and benefits, a suitably conservative estimate of recreational trips for SeaPath (and SkyPath) applied to fixed routes could be made. Similar considerations could apply for the appraisal of other new cycle infrastructure.

iii. The ACM provides broad estimates of total cycle demands but the model architecture does not lend itself to accurate modelling of education-related cycle trips. These have a different trip length distribution to commuting trips, have different assignment characteristics (in generally being prepared to take longer, safer routes on cycle infrastructure), and the growth of such trips is not reflected well in the current demand forecasting process. This requires consideration where the modelling of new cycle infrastructure could serve a relatively high proportion of school-related trips.

iv. Whilst certainly not a flaw in the appraisal methodology, it is a significant limitation of the ACM, in terms of usefulness of the model and its interpretation, that the coded cycle speeds are not able to indicate cycle travel times. Alternative methods exist to adjust travel 'costs' to reflect the relative attractiveness of alternative cycle facilities on a link, leaving the speed to be indicative of the average cycle speed for a given standard of facility (and contributory to the overall perceived cost).

v. The future demand forecasts use some unconventional processes in estimating the potential response to new infrastructure change and future landuses that bear exploration of alternative techniques in any future comprehensive update of the ACM.

vi. The ACM uses a 'Network Effects' module to further increase cycle demands for zones that are 'well connected' to other zones, beyond the modal-shift effects applied through inter-zonal improvements in cycle infrastructure. Whilst I understand the potential effects attempting to be captured by this methodology, I am not able to conclude that the implementation of 'Network Effects' does improve the accuracy of the modelling and therefore don't consider the additional complexity justified. I am advised that for SeaPath, the 'Network Effects' module has around a 5% impact on the modelled scheme benefits.

5 Economic Appraisal Review

5.1 Working Note 2 of Appendix A set out some relatively minor queries in relation to the assessed economic benefits and these were addressed in the subsequent comments and actions prepared by Flow.

5.2 As noted throughout the review process and at 3.3.2 above, the economic peer review cannot be considered complete until costs have been calculated and both the costs and benefits profiled and discounted across the appraisal period and the economic case is documented.

5.3 As commented in Working Note 2 (parag. 1.1) we would anticipate that the incremental benefits of the improved shared path on Onewa Road, that form part of Option 1, would be assessed for Option 2 to confirm if this further improvement could be supported from an economic perspective.

6 PIKB Peer Review Matters

6.1 Introduction

6.1.1 The Agency's Planning and Investment Knowledge Base (2018-21 NLTP Assessment Framework) sets out guidance on the Peer Review of Proposals. Some aspects of the Peer Review guidance relate to the preparation of the wider business case (for this stage in the SeaPath appraisal being the Detailed Business Case (**DBC**) required under the Investment Assessment Framework (**IAF**)), whilst others do relate more to the focus of this review, being technical matters associated with the assessment of benefits.

6.1.2 Here we provide comment in relation to the aspects relating to the modelling and economic evaluation and note where aspects are beyond the scope of our review.

6.2 Conformity

6.2.1 SeaPath is eligible for funding under the Walking and Cycling Improvements activity class of the current Government Policy Statement on Land Transport. Ensuring the DBC has been prepared in conformance with all aspects of the IAF is beyond the scope of our review.

6.2.2 We note that the Agency's Cost Estimation Manual (SM014) requires external Peer Review for estimates greater than $4.5 million and for construction costs greater than $20 million a parallel estimating process is required. Whilst a review of the cost estimation process is beyond our scope (and area of expertise) we do however anticipate reviewing whether the resulting cost estimates (and assessed benefits) are appropriately profiled and discounted within the economic appraisal being completed by AECOM.

6.3 Choice of Do-Minimum

6.3.1 We note that the do-minimum for the SeaPath project is referred to as 'the future Reference Case' within the Evaluation Report. This includes all planned major infrastructure, including SkyPath, and as such provides an appropriate future 'base' network against which the relative benefits of the addition of SeaPath is based. A sensitivity test reported in the Evaluation Report indicates the benefits of SeaPath in the unlikely event that SkyPath is not constructed.

6.4 Identification and Selection of Alternatives and Options

6.4.1 QTP have not been involved in the option selection and alternative options consideration process. We simply note that the earlier December 2017 Evaluation Report included assessment of four alternative options, of which Option 4 was similar to Option 2 now assessed and reviewed.

6.4.2 The Evaluation Report considers two options. Some further slight adjustment to the modelling would be required to complete recommended incremental cost/benefit assessment. Assuming an upgrade to the Shared Use Path (**SUP**) on Esmonde Road, as per Option 1, but introduced into the Option 2 model would allow the incremental benefits of Option 2 to be assessed. Further, the incremental benefits of Option 2 with the Esmonde Road Upgrade could be assessed relative to Option 2 (as noted at 5.3 above).

6.5 Results Alignment Rating

6.5.1 The Results Alignment Rating, undertaken at the strategic business case stage, is beyond the scope of this review.

6.6 Cost Estimate

6.6.1 As noted at 6.2.2 above, a parallel cost estimate is anticipated for projects costing $20 million, though the Peer Review of the cost estimate itself is beyond the scope of this peer review.

6.7 Cost-benefit Appraisal Rating

6.7.1 Whilst we are not presently able to complete a review of the cost-benefit appraisal (as the costs and final economic appraisal are yet to be completed) we have reviewed the benefit appraisal against the requirements of the EEM (refer Chapters 3 and 5 above).

6.7.2 There is some ambiguity regarding the requirement of the EEM under the full procedures in evaluating the economic benefits of a cycling and walking project, but the process applied in developing a cycle model with estimated demands that are responsive to the proposed infrastructure is considered superior to the EEM full procedures for estimating new demands for a cycle facility, for which around 80% of the scheme benefits accrue.

6.7.3 Generally, the process applied is considered to err on the conservative side in assessing future demands and potential benefits of the scheme. However, as noted at 4.2.1 vi above, the 'Network Effects' component of the benefits is not considered sufficiently robust to be included within the assessed scheme benefits and therefore the assessed scheme benefits are considered to be around 5% greater than can be substantiated.

6.7.4 In terms of mutual-exclusivity of the options, we note the PIKB requirement for incremental assessment and this is recommended as set out at 6.4.2 above.

6.8 Risk Assessment, Analysis and Mitigation

6.8.1 This is required as part of the business case reporting and is beyond the scope of our review.

6.9 Sensitivity Analysis

6.9.1 A number of sensitivity tests were identified during the course of the evaluation and the effects of these on the assessed benefits are included within the Evaluation Report. These are considered appropriate in testing the sensitivity of the analysis to a range of key assumptions. The greatest negative impact on the assessed benefits occurred for the 'No SkyPath' sensitivity test. With the inclusion of SkyPath within the recently published National Land Transport Programme, this eventuality is very unlikely. The greatest positive impact occurs for the higher take up in e-bikes test, based on an associated assumed doubling in the number of cycle trips over 5km. This is considered a quite possible response to SkyPath and SeaPath where an e-bike would make the trip viable for a larger number of people than the central-case analysis based on current J2W trip-length trends.

Appendix A – Peer Review Working Notes & Consultant Responses and Actions

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Memorandum

To:	Section 9(2)(a) (Aecom)
From:	Section 9(2)(a)
Subject:	Seapath DBC Peer Review - Working Note 1 (Modelling and Economics Inception)
Date:	3rd November 2017
Copy:	Section 9(2)(a) (Flow), Out of scope (NZ Transport Agency)

Dear Section 9(2)(a)

1 Introduction

1.1 As you are aware, QTP Ltd. have recently been instructed to assist the NZ Transport Agency (the Agency) in development of the business case for the Seapath Shared Path, with a specific focus on a review of the supporting modelling and economics.

1.2 The overall aim of our Peer Review is to provide comfort to the Agency that the technical aspects of the Project modelling and economics will be/have been conducted in an appropriately-robust way, in accordance with the scale of the project and the requirements of the Agency's Planning and Investment Knowledge Base (2018-21 NLTP Assessment Framework).

1.3 The objective of this Working Note to form the basis of an *initial* discussion (by teleconference) with the project team, being the client (the Agency), the consultant (Aecom) and their modelling and economics specialist sub-consultants (Flow). As such, it is not intended to be fully 'refined', nor are the views expressed within intended to be either prescriptive or final, but merely serve to assist progress on the project to its intended conclusion. It will also serve as the basis for a note requested by the Agency on peer reviewer satisfaction with the proposed approach following this discussion and including any recommendations necessary to meet Agency requirements.

1.4 It is important to from the outset that the Project benefits are likely to be multi-faceted and that modelling and economics are only one part of the Agency's Business Case process. While a Project benefit-cost appraisal will be an important input to the Agency's future decision-making on potential further investment, it will not be the sole criteria. Indeed, the Assessment Framework and Business Case approach demands a wider approach to review of the option selection using MCA process, as proposed.

1.5 Please note that as a technical document, we have not attempted to explain all the terms within this Note in lay-person terms, as we trust that your expert advisors on these aspects, Flow, will readily understand these and, if required, explain them to other Project Team members.

1.6 We also consider it important for context to provide some general caveats at the outset of our Review:

- A transport model is a mathematical process which attempts to represent complex human behavior in such a way that it is possible to make reasonable and useful predictions of potential behavior in the future. All transport models are simplifications of reality.
- Existing and potential cyclists and pedestrians are diverse groups, with many individual motivators for choosing to use that mode (or not) in the first place, let alone which routes they take. Any tool or model framework which 'aggregates' such individual choices will inevitably use generalised assumptions. In many cases these assumptions are likely to be 'wrong' at an individual level. However, 'on the whole' such models seek to provide a reasonable approximation to the observed or anticipated behavior of the target population – and most pertinently for planning purposes, need to respond (sensibly) to key variables.

1.7 The specific information considered for this initial review is :

- Seapath Long List Options Information Pack (Aecom, 17 October 2017);
- Seapath Demand Assessment and Economic Evaluation (Flow, 8 December 2014) ('**the IBC Evaluation**');
- Seapath Shared Path – Economic Evaluation methodology, Draft for comment, (Flow, 17 October 2017); ('**the draft methodology**')
- ART Land Use Assumptions (spreadsheet supplied by Flow, 31/10/17);
- Forecasting Cycle Demand in Auckland[1] (presentation, Asia Pacific Cycle Conference, Section 9(2)(a) 20 October 2017) ('**the recent Presentation**'); and
- Various other supporting publicly-available information currently available via the internet (e.g. Seapath and Skypath Project websites)

1.8 Following this Introduction, our Note reviews the proposed Modelling Assessment and Economic Evaluation methods in more detail. Some (much?) of the information may be viewed merely as background by which we have used to familiarise ourselves with the context of the Project. Key aspects for potential discussion are, however, underlined thus.

1.9 Our focus will be/has been on identifying the key issues, with an expectation that through this reporting, the Client and Consultant may be provided with the opportunity to consider and potentially respond to these, before the methodology (and in time any formal review by ourselves) is 'finalised'.

[1] http://apcc2017.com/files/docs/apcc/friday/855%20micheal%20jongeneel%20-%20forecasting%20cycle%20demands%20in%20auckland%20-%20m%20jongeneel.pdf

Summary of Key Conclusions and Recommendations

1.10 *This section would be finalised within a final Inception Note.* Suffice to say for now that:

1.11 **We are, in general, comfortable with the draft methodology proposed**.

1.12 Some aspects may however bear refinement, although this is to be anticipated as any project progresses.

1.13 Our view that the Auckland Cycle Model is likely to provide a much-more appropriate and reliable basis for (cycle) demand estimation for the Project (and in its absence), compared to alternative (demand estimation) methods including EEM SP11 Simplified Procedure Methods and Research Report 340.

1.14 Initial refinements should be considered to ensure that Option selection (for which potential demand and broad benefit-cost estimates can be expected to be criteria) is not unduly biased or compromised.

1.15 It is important, as an early stage, to agree Do-Minimum (**DM**) network(s) at the principal assessment years and we would welcome more detailed and firm proposals for this aspect from the Project team. It may be that several DM scenarios may be prudent to consider (e.g. potential tolling of Skypath) - or at least (at this stage) to simply provide confidence that option selection is unlikely to be critically-influenced by the D-M adopted.

1.16 Within the economic evaluation, sensitivity-testing to important variables is important but, given the proposed (modelling and economics) methodology, is likely to be relatively expedient.

2 Modelling Assessment

2.1 The proposed DBC Demand Assessment methodology is stated to build upon that undertaken for the IBC (and also be consistent with subsequent major project assessments).

2.2 A broad outline of the process for modelling and in particular the demand estimation undertaken for the **IBC** modelling has been provided within the report supplied. Overall, the process adopted then (2014) was explained with reasonable clarity, except insofar as some matters of detail are concerned.

2.3 However, it is apparent, from both the draft DBC methodology and the recent Presentation, that further work has occurred to enhance the Auckland Cycle Model since the IBC Evaluation was conducted. It is therefore more pertinent to concentrate on this as the basis of the Seapath DBC modelling and economics. Refinements subsequent to the IBC modelling are stated (within the recent Presentation) to include:

- Calibration of forecast process
- Improved of "Quality of Service" concept
- Better agreement with observed growth (2013-2016); and
- Better confidence in future predictions

2.4 Overall and prior to commenting in more detail on potential 'deficiencies' or 'enhancements', we do feel it is important to emphasise our view that the Auckland Cycle Model is likely to provide a much-more appropriate and reliable basis for (cycle) demand estimation for the Project (and in its absence), compared to alternative (demand estimation) methods including EEM SP11 Simplified Procedure Methods and Research Report 340. It is not necessary here to go into full detail of why this is likely to be the case, but an extract from the recent Presentation (Figure 2-1) does serve to illustrate well the comparative merits of the alternative methods at key points in the existing network:

Comparison with Other Methods

- Research Report 340
- EEM Simplified Procedures 11

Route	Observed Daily Cyclists (2016)	2016 Auckland Cycle Model		Research Report 340		EEM Simplified Procedures 11	
		Cyclists	Error	Cyclists	Error	Cyclists	Error
Beach Rd	343	263	-23%	392	+14%	1,158	+237%
Carlton Gore Rd	317	410	+29%	423	+33%	1,067	+237%
Grafton Gully	344	373	+8%	465	+35%	1,660	+383%
Nelson St	340	373	+10%	64	-81%	1,535	+352%
LightPath	375	351	-6%	248	-34%	1,594	+325%
Quay Street	715	761	-6%	628	-12%	956	+34%
Average Error			± 14%		± 35%		± 261%

Figure 2-1: Comparison of Existing Auckland "Calibrated' 2016 Model Demand Estimates to Other Methods, for Selected Locations[2]

[2] Table sourced from recent Presentation.

Scope of Model

2.5 The IBC Evaluation suggested that the network model adopted had been constructed to include cycle infrastructure within a 20 km cycle trip of either end of SeaPath and all cycle trips internal to the network are intended to be captured by the methodology and included within the model. This was "considered adequate for analysis of SeaPath, as a 20 km model extent from either end of this facility was considered sufficient to capture the majority of cycle trips on the proposed infrastructure".

2.6 The model extent (Figure 2-2 below) does, however, appear to be somewhat less than stated above, with the northern extent at the SH1/Oteha Valley Road interchange, being located some 10km to the north of the Seapath (IBC route) termination.

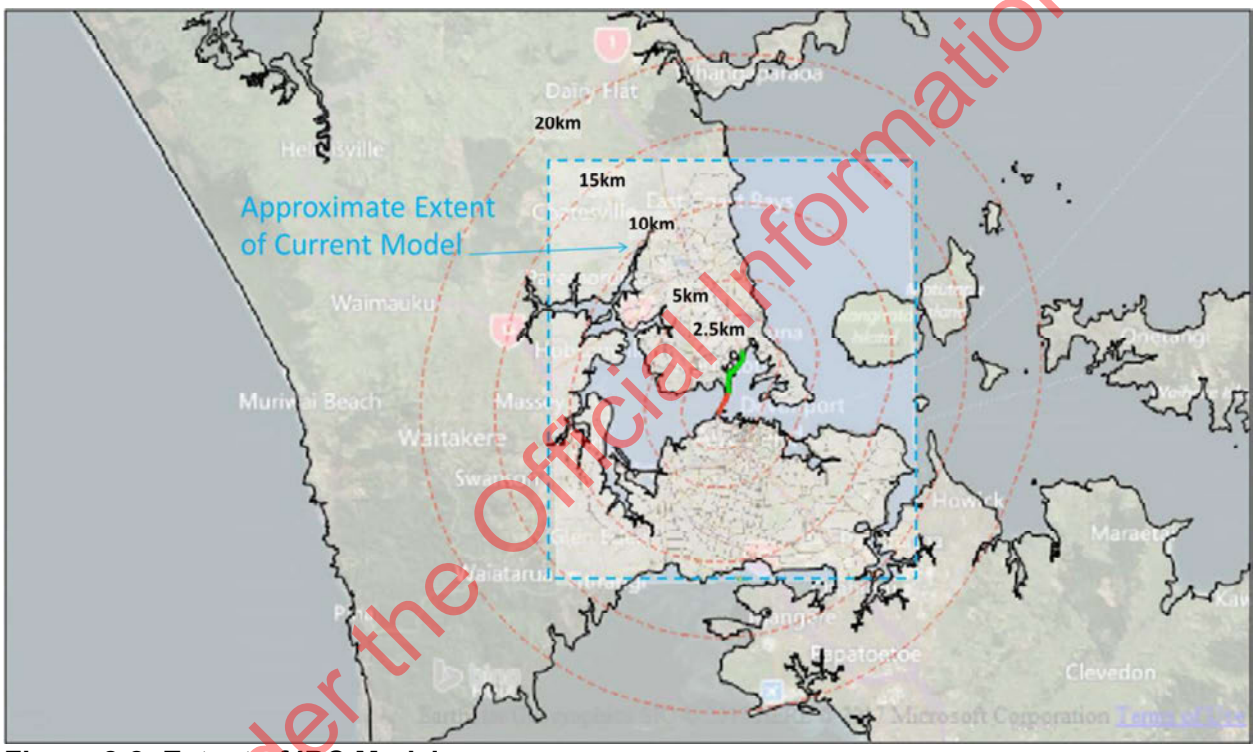


Figure 2-2: Extent of IBC Model

2.7 This is really just as a point of note for accuracy, as (including potential travel on a Seapath/Skypath route), the existing model extent *will* cover (potential) trips of up to around 20km in total and this may be expected to be (more than) adequate to capture the vast majority of potential trips.

Model Zoning

2.8 The ART zoning system, adopted as the basis for the Auckland Cycle Model (and thus the proposed Seapath DBC Cycle Model, within the latter's extent) is shown in Figure 2-3 below. In total the ART model covers the Auckland region with 557 zones and the Cycle Model appears to encompass (around) 238 of these.

2.9 Whilst, at the high-level illustrated, this may appear to be a reasonably refined system, in the context of a cycling (and pedestrian[3]) model we consider this to actually be probably rather too coarse to capture a reasonable proportion of existing and potential trips: The average diameter of the (Cycle Model area-only) zones, if all prescribed by a circle equivalent to their area, is estimated to be around 1.2km). Given that many (potential) cycle and walk trips (particularly for non-commuting purposes) may be less than this, this means that such trips may not be reflected within a demand matrix and certainly could not be within an assignment model.

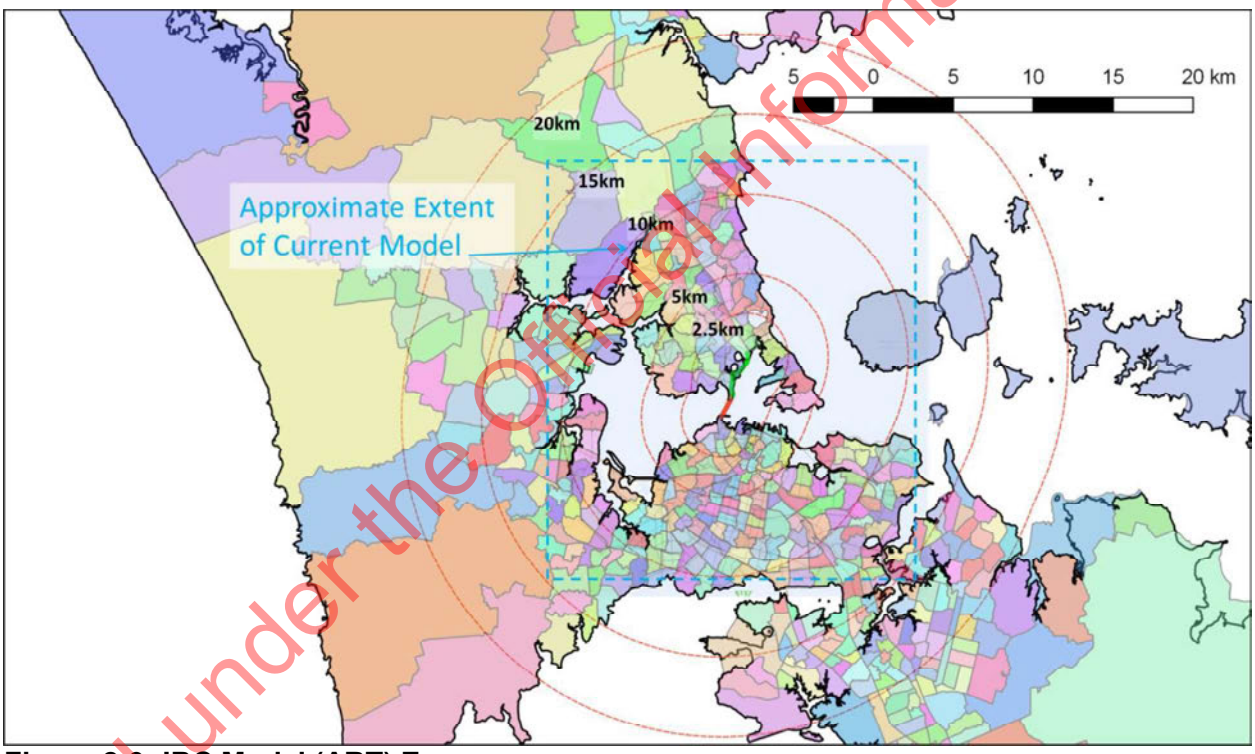


Figure 2-3: IBC Model (ART) Zones

2.10 A discussion on the pros and cons of potential refinement of the zone structure and its nature - albeit such would sensibly still be predicated on respecting ART boundaries and land use/trip forecasts - within any constraints of the Project, would be helpful.

3 While the IBC clearly attempted to model assignment (and presumably demand) of pedestrians, using a network scope and structure similar to that of the (IBC) Cycle model, it appears that the DBC evaluation proposes to use alternative methods, being essentially simplifying assumptions based on factoring ratios of predicted cycle demand. *Given appropriate parameter sensitivity-testing*, we think this is a reasonable approach and indeed, preferred over use of what would otherwise be a relatively very coarse zone and network representation to reflect pedestrian trips, many of which could be expected to be relatively short.

Land Use Forecasts

2.11 The ART land use forecasting has moved on since production of the IBC Evaluation in 2014. The future forecasts adopted then were based upon 'Scenario (modified) I8B)'. Given the passage of time and notable changes (including approval of the Auckland Unitary Plan and updated Statistics NZ sub-national population projections), it appears appropriate to use an updated land use scenario(s).

2.12 'Scenario I11' is thus now proposed to be adopted. The proposal appears sensible, subject to confirmation that this has indeed been adopted by the Auckland planning agencies as the (latest) 'default' scenario (as indicated to support the use of Scenario I8B for the IBC Evaluation).

2.13 It *may* be appropriate to consider sensitivity of the Project Option(s) demand and BCR to alternative land-use growth in due course. However, this may be most expediently achieved by a fairly simple process of factoring projected demand (and/or resulting benefits), rather than full modelling runs.

2.14 By way of indicating the potential for growth in potential demand within the wider catchment of the project, the changes by zone (for 'Scenario I11') between 2016 and 2046 are shown in Figure 2-4 below (using land use data supplied by Flow).

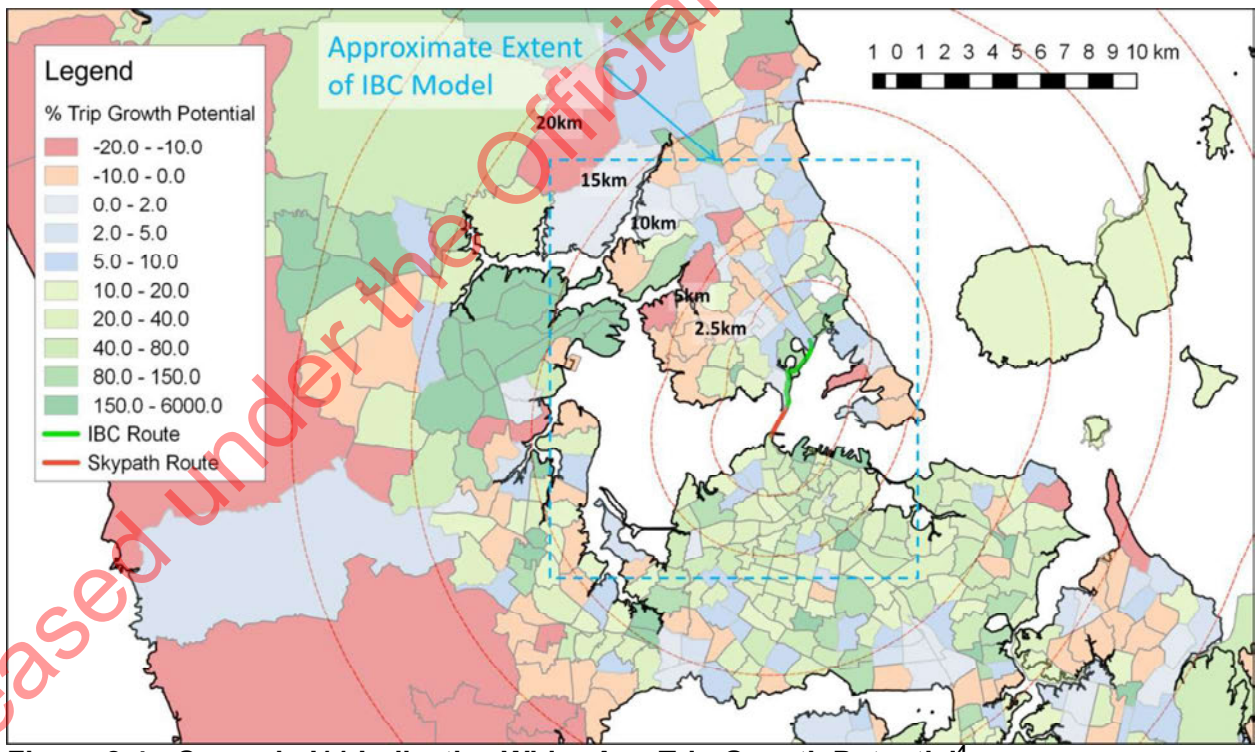


Figure 2-4: Scenario I11 Indicative Wider-AreaTrip Growth Potential[4]

2.15 Looking at this potential within the more-local catchment of the project, the changes by are shown in Figure 2-5 below.

[4] Indicative change expressed as % growth in Scenario I11 forecast (Population + Employment) by ART Zone, between 2016 and 2046

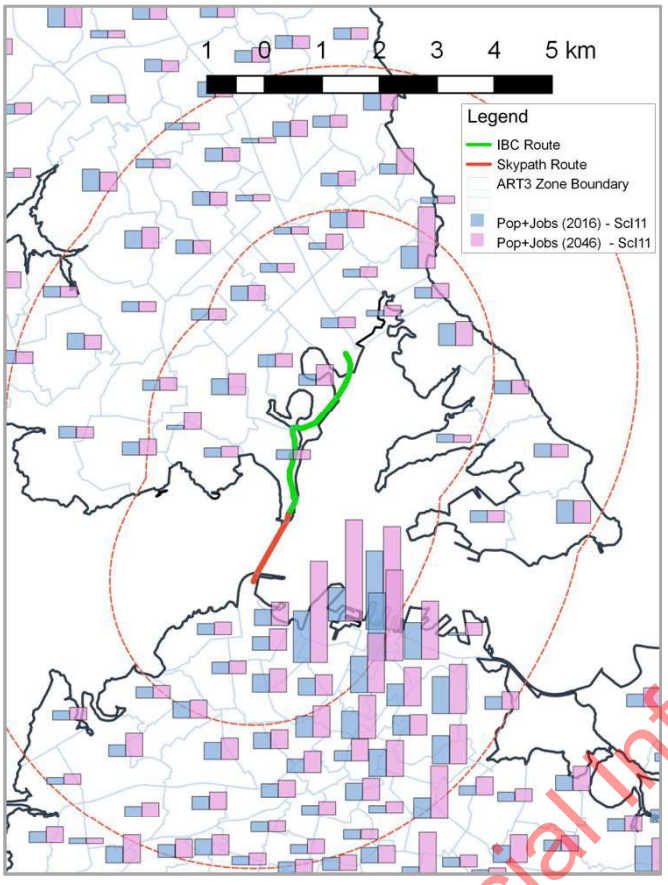


Figure 2-5: Scenario I11 Indicative Local-Area Trip Growth Potential[5]

2.16 Clearly, for this Scenario there is very significant growth (in combined residential and employment totals) anticipated within the CBD and to some extent north of the Project (particularly in Takapuna). Elsewhere within the immediate northern catchment the anticipated growth potential is, however, somewhat lower.

2.17 Growth in both demand (potential as well as actual trip forecasts) can be illustrated by ultimate assignment (as shown by Figure 2-6 extracted from the IBC below), and also, usefully, by desire-lines between areas (zones) which are aggregated to 'sectors'. Figure 2-7 indicates some potential sectors which may be used for future reporting purposes to assist model development and our Peer Review[6].

5 Indicative change expressed as % growth in Scenario I11 forecast (Population + Employment) by ART Zone, between 2016 and 2046

6 These are based around Auckland Local Board areas, although ART zones within Board areas more remote from the project have been amalgamated to reduce the number of sectors from 21 to a more-manageable 10.

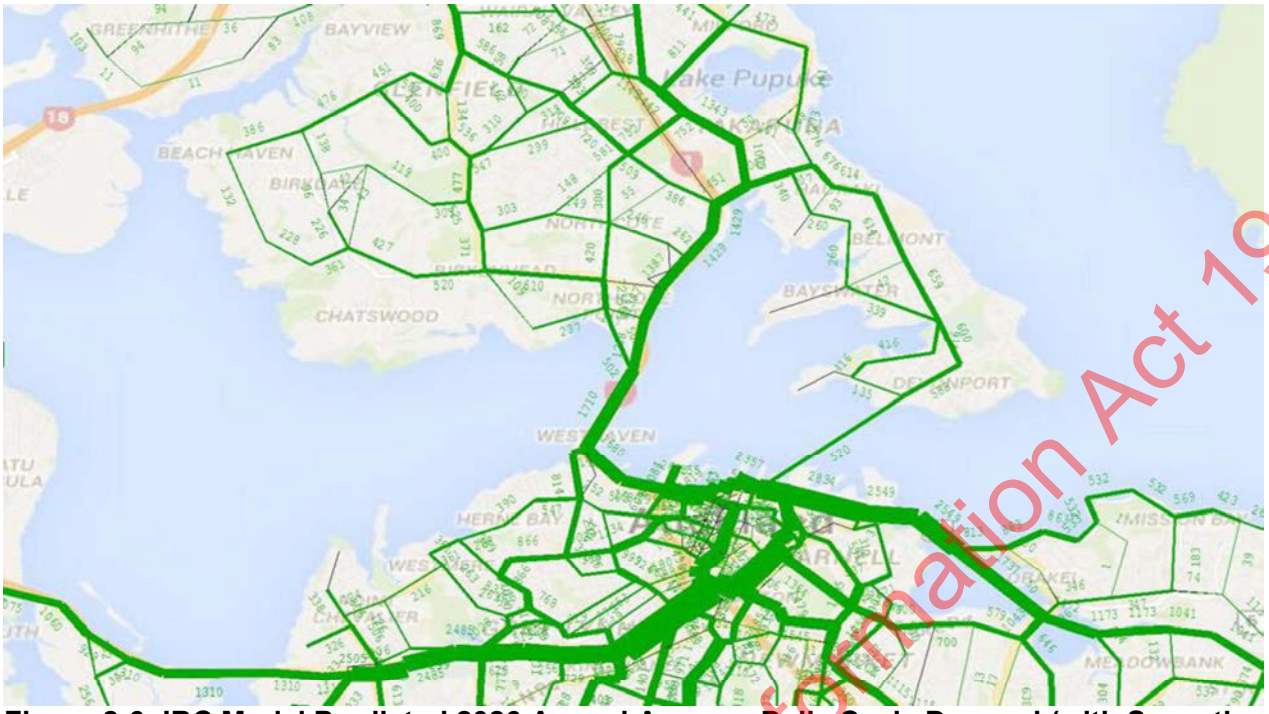


Figure 2-6: IBC Model Predicted 2026 Annual Average Daily Cycle Demand (with Seapath & Other assumed D-M schemes)

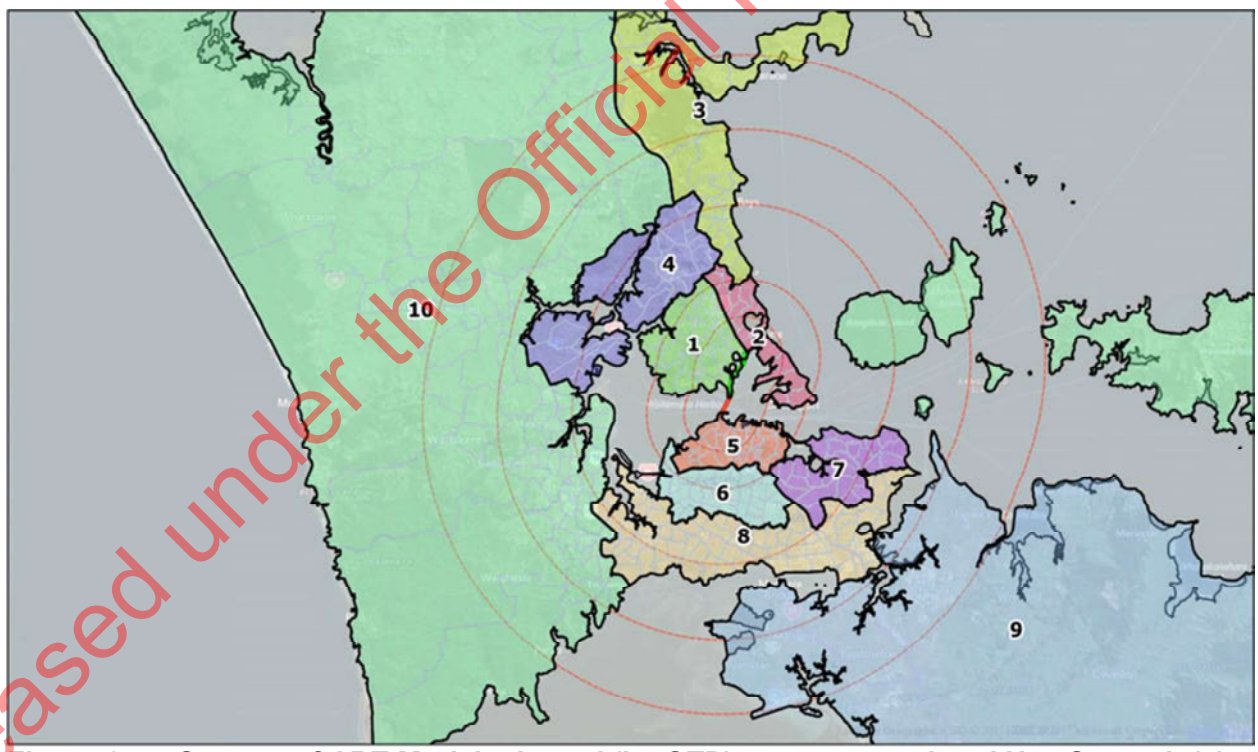


Figure 2-7: Sectors of ART Model adopted (by QTP) to aggregate Land Use Scenario(s)

QTP_Sector	Sector Name	Pop+Jobs (2016) - Scl11	Pop+Jobs (2046) - Scl11	Indicative Potential for Trip Growth
1	Kaipatiki	120632	131729	9%
2	Devonport-Takapuna	90998	121095	33%
3	Hibiscus and Bays	122450	154643	26%
4	Upper Harbour	101764	191737	88%
5	Waitemata	249195	388658	56%
6	Albert-Eden	136517	189704	39%
7	Orakei	107846	144392	34%
8	City South	335119	461817	38%
9	South	708315	990062	40%
10	North	305321	505804	66%
Total		**2278156**	**3279640**	**44%**
Change I11-I8B			1001484	
% Change			+44.0%	
Immediate Catchment Area Only		Pop+Jobs (2016) - Scl11	Pop+Jobs (2046) - Scl11	Indicative Potential for Trip Growth
North		211629	252823	19.5%
South		249195	388658	56.0%
Total		460824	641481	39.2%
Change			180657	
% Change			+39.2%	

Table 2-1: Indicative Trip-Driver Growth Potential, by Sector

2.18 Of course, these comparisons only indicate *potential* growth in the principal drivers of trip-making (for the purpose of future sensibility-checks) – and not the enhanced market-share that may generate on the Project. Other Sector-based tables/desire lines e.g. existing and forecast total and cycle trip matrices, will also be helpful for future sensibility checks by the consultants - and ourselves.

2.19 It may be that Flow already have adopted alternative sectors, and it would be helpful to agree that these are appropriate prior to reporting.

Network Detail

2.20 Looking at the (IBC) Cycle Model network, it is apparent (and acknowledged within the previous reporting) that while "the (assumed) principal cycle routes" are reflected within this and are thus available for potential assignment, a large number of more-minor potential routes are not. In some ways such a coarse network nature does carry the risk of a model simply reflecting these assumptions in both calibration and future application.

2.21 The modelled network density *does* appear to be (broadly) consistent with the zoning scale. However, as indicated above, *both* may be rather too coarse, particularly within the northern potential Project catchment. The current 'strategic' nature of the modelled network system might benefit from further refinement (along with the zone system), as this will enable assignment on more local routes (including 'quiet' streets not currently modelled), as well as ultimately more-accurately reflecting the potential for 'partial-use' of the Seapath option(s) in particular.

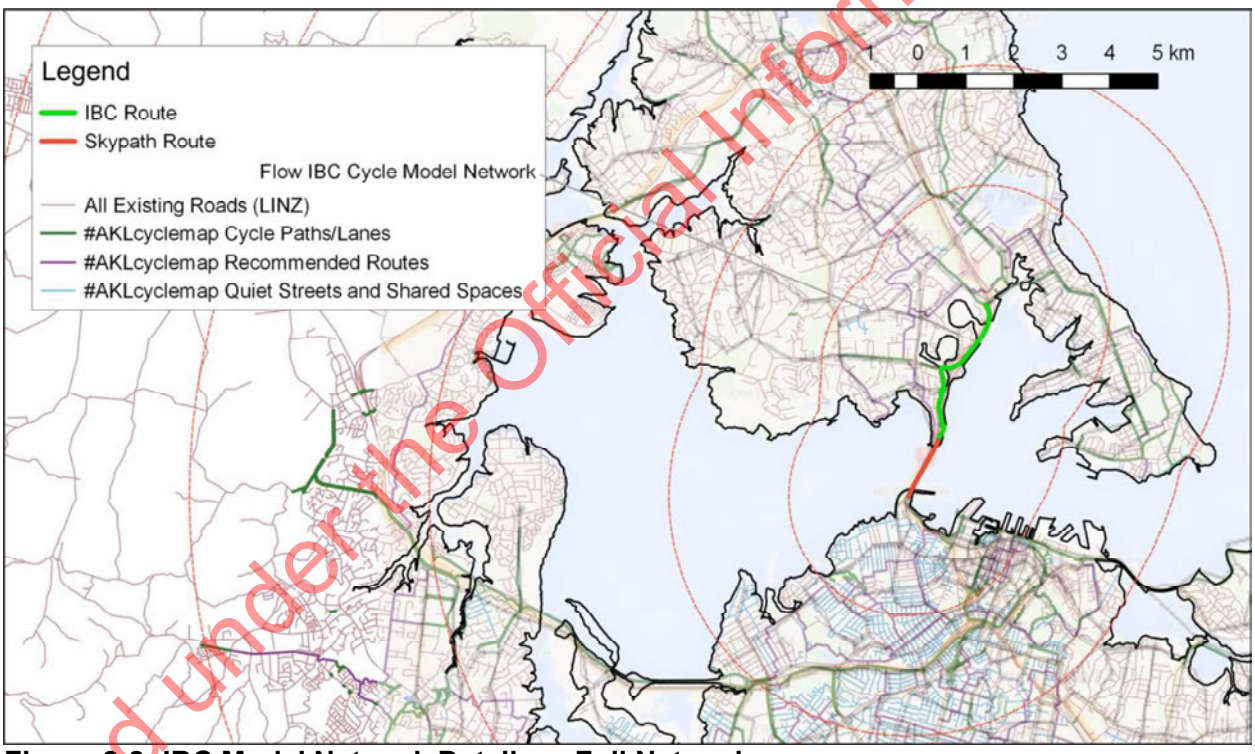


Figure 2-8: IBC Model Network Detail vs. Full Network

2.22 The simplistic network nature (adopted for the **IBC**) can be seen, with many routes also apparently coded simply as 'straight' lines or with very few intermediate points. This relative lack of accuracy can be important in the context of assignment (and particularly cycle assignment) models, given that the SATURN software (normally) uses the geographic distance[7] calculated from a more-accurate 'GIS" file input.

[7] Some networks may 'hard-wire' the deterrence, including a more-accurately-calculated distance, but the latter may (generally) be seen as poor-practice. It may be that (assignment) deterrence is expressed differently in this project model, with the actual distance forming only one component – and thus may actually be expressed with geographic 'accuracy' – tbc by Flow.

2.23 (We note that the recent Presentation does appear to indicate that (slightly) improved geographic representation of network links may have been undertaken in the interim compared to the IBC model Evaluation, refer Figure ES1 (Cycle and Pedestrian Network Model)[8]?)

2.24 Refinement may not be a particularly-onerous task in itself: The indicative SATURN buffer network framework shown below actually covers all roads within the whole of the Auckland Region and was prepared by ourselves (for the sake of illustration only) in several hours. As noted above, the current more-limited model extent (compared with ART regional representation) is, however, actually expected to be perfectly-ample for the purpose of capturing the principal benefits of this Project (and the potential future do-minimum projects within the sphere of influence). The point is to indicate that (buffer) network-coding (which accurately reflects true alignments) need not itself be particularly time-consuming.

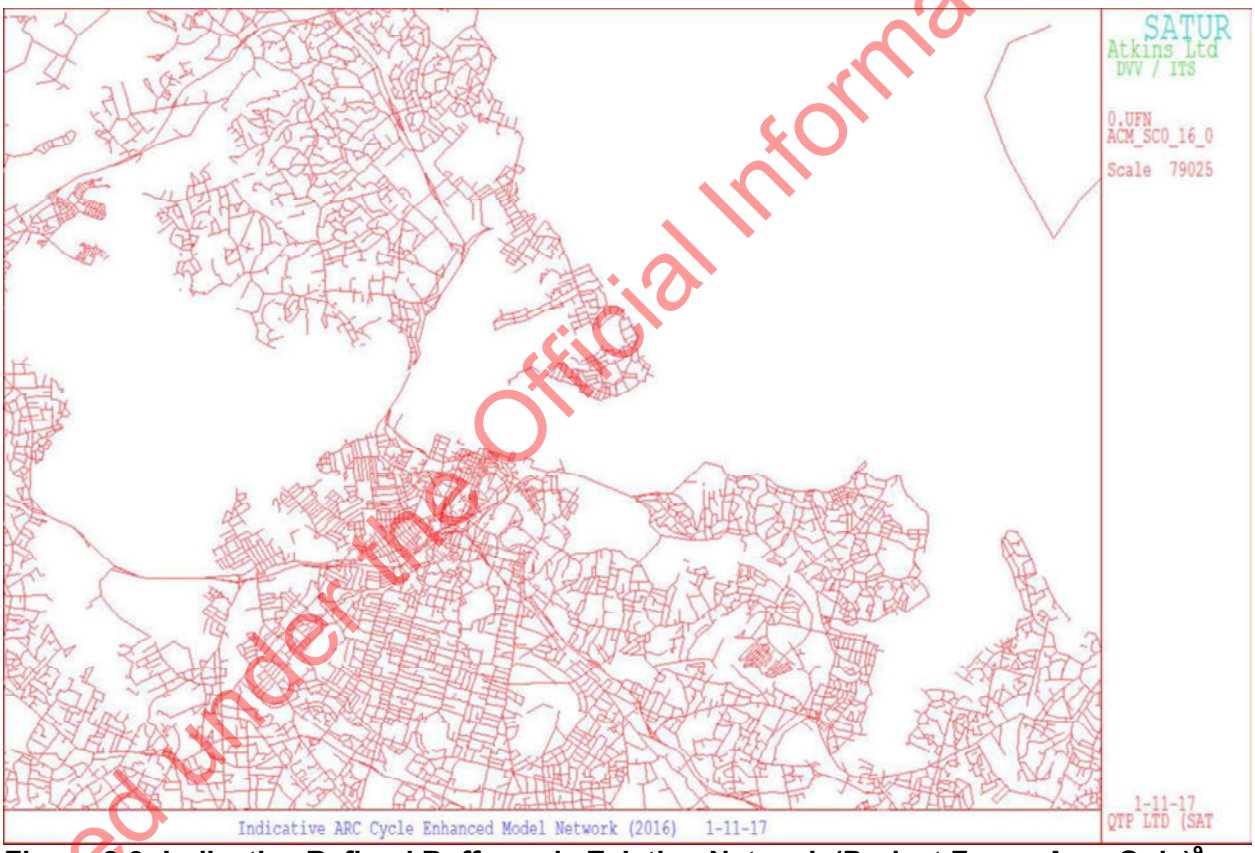


Figure 2-9: Indicative Refined Buffer-only Existing Network (Project Focus Area Only)[9]

8 This is the same as 'Figure 1: Expanded Cycle/Pedestrian Network Model' in the same report

9 Indicative network is only a 'first-pass' and reflects only (LINZ) street sections. Some links missing/unconnected and additional detail (such as local cycle-path connections) could be obtained from other sources (e.g. OSM) prior to creation, or added later. Many of the links shown (eg cul-de-sacs without cycle connections) would, however, be sensibly omitted from an assignment model.

2.25 Set against this however, needs to be a recognition that any benefits of such refinement to (at least implied) 'accuracy' of the modelled network would need to be carefully balanced against the 'costs' in time and budget – and the latter are more likely to be affected by potential re-calibration (and/or re-validation) of base model components.

2.26 A discussion on the pros and cons of potential refinement of the network structure within any constraints of the Project would, however, be welcomed.

Matrix Estimation

2.27 It is apparent that significant reliance has been placed upon matrix estimation (**ME**) processes to provide demands for (2013) base model calibration and these are clearly important, serving as they do serve as a key basis for future (cycle) demand forecasting.

2.28 ME is a fairly well-established technique used in (vehicle-focused) transport modelling, which can provide an improved estimation of the origin and destination scale and pattern of trips. The process takes an initial estimate of the scale and pattern of trips and modifies this, such that it better matches observations – normally counts.

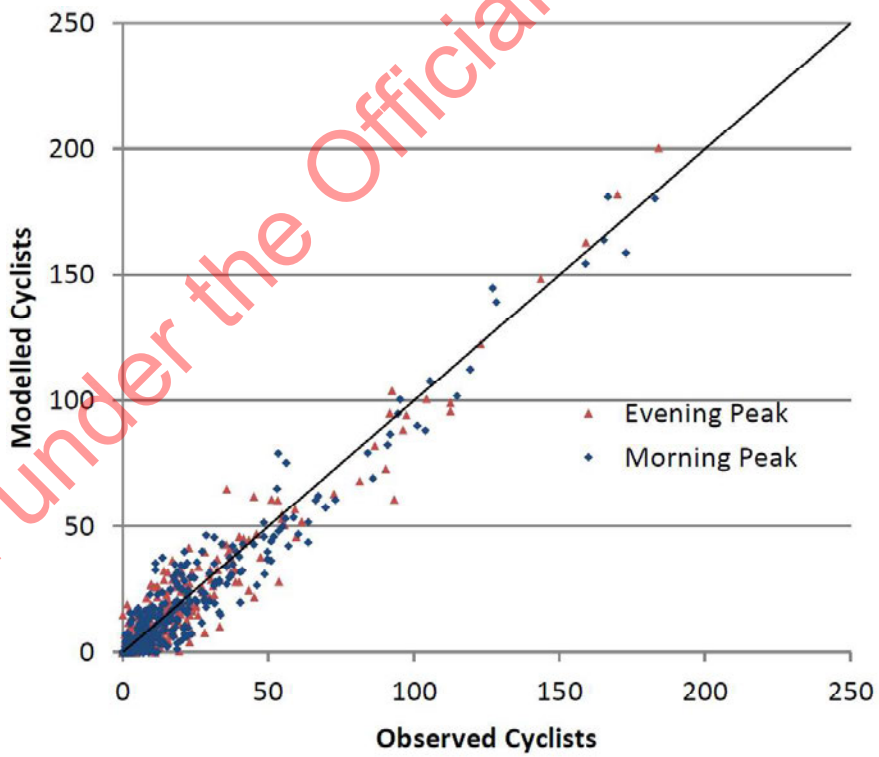


Figure 2-10: Existing Auckland 2013 Cycle Model Calibration[10]

2.29 However the technique can have a number of drawbacks, which can be expected to be potentially magnified when applied to cycle trip-making:

[10] Sourced from recent Presentation and reported to use around 700 counts

- Cycle count data can be highly variable, particularly if ultimately expanded to provide an estimate of daily cycle travel; This is acknowledged within the recent Presentation by Flow, where it is noted that there may be 'massive variability' of cyclist numbers on routes due to:
  - Weather
  - School terms and university semesters
  - Seasonal variations
  - Often conflicting count data
  - Much more variability than traffic (car) volumes
- It is stated that 'typically' there may be ±65% daily variation from an annual average in 2016.
- Counts may often not be (sufficiently) comprehensive e.g. with closed screenlines.
- The network 'supply' (and particularly user-perceptions for route-choice) for cycling are potentially highly-variable (e.g. the speed different cyclists actually travel, as well as what level of importance different potential market segments place on time, versus say the directness of routes or their perceived safety. It is fairly fundamental when using matrix-estimation techniques, that there is no (or at least very limited) scope for such error in the representation of network supply and assignment - or the process can simply obtain an *apparently* 'good' fit through significant scaling of a limited number of matrix cells. The resulting matrix may *appear* to provide a 'good' fit to the counts - but may not actually bear a close relationship to reality.
- Major issues can, potentially, arise with applicability to future scenarios, given significant change.
- Flow do appear aware of these risks however. For example, they have stated (to paraphrase) that the effects of their matrix estimation to modify initial estimates have been limited (presumably through the use of XA factor(s)?.

2.30 It would be therefore be helpful for Flow to clarify the following aspects of ME model processes within a more-detailed model-focussed discussion:

- How/if potential variability in count data has been accounted for?
- Whether/how Counts may have been adjusted to reflect an (estimated) average weekday AM and PM peak prior to application of ME? Are peak count/weekday and/or 7-day annual average estimates appropriately reconciled?
- Use of adopted ME constraints (e.g. XA Factors) and how these may have (been) varied through the Model and particularly immediate Project area.
- What key assignment parameters have been (will be) adopted for current base model calibration/validation and are these retained for future scenarios?

Demand Forecasting

2.31 While the IBC report gives a reasonable explanation of process (then) adopted, it appears (potentially) as though there *may* be a limited response of trip generation, distribution and mode-shift within the proposed model framework, with forecast (cycle) demands essentially being the product of a number of fundamental exogenous assumptions and processes?.

2.32 Such assumptions should certainly **not** be viewed as a necessarily as a 'fatal flaw' - but must be recognised as imposing some level of uncertainty regarding the potential accuracy of resulting forecasts. For example, it appears as though, essentially, future demands (may) have been at least partially-'fitted' around a basic (exogeneous?[11]) assumption in an overall level of (cycle) trip growth (+15.3% by ??? – from memory check)

2.33 The level of relative attractiveness of the cycle network in general and SeaPath in particular, to some potential users, is in reality likely to be affected by such matters as increasing congestion and the (potential) for alternatives such as enhanced PT, as well as the route and standard or potential Seapath Options as well as such matters as Skypath tolls.

2.34 More clarity would be therefore be helpful regarding how these matters are (to be) dealt with within the proposed DBC modelling framework particularly trip abstraction (potential market penetration) of cycle trips attracted from existing modes (e.g. PT & Ferry, as well as trips that may otherwise occur as a Car Driver or Passenger).[12]

Other matters for Discussion (not yet finessed!)

Forecast Years to be Modelled

2.35 Proposed principal evaluation (model) years of 2016, 2026 and 2046 are fine by me – see reasoning later under Economic Evaluation.

Model Calibration/Validation

2.36 It appears as though a certain amount of calibration, rather than independent validation

[11] A very brief explanation of the origin of these (aspirational?) estimates would be helpful to the Reviewer.

[12] The draft does state that the model "is responsive to changes in cycle infrastructure, in that high-quality infrastructure between any two nodes will result in more trips between those nodes being undertaken bicycle, than a scenario with poorer quality cycle infrastructure". However, this is consistent with a method that is still an 'assignment-only' approach, with the same basic demand matrix for the study area being applied irrespective of the quality of the cycle network??

has occurred to enable the current 2016 model forecasts[13]) – Again not a criticism but should be acknowledged and any attendant risks identified:

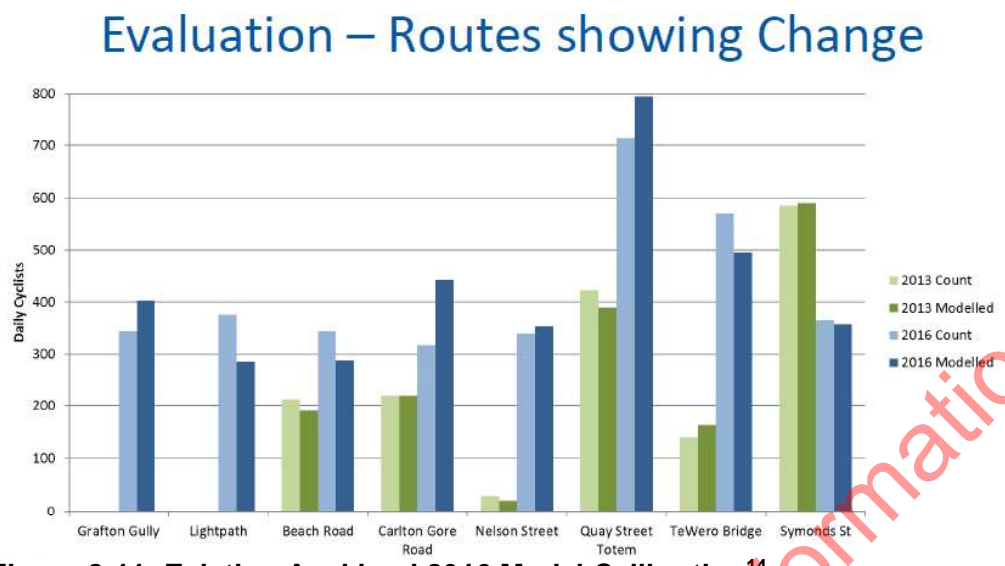
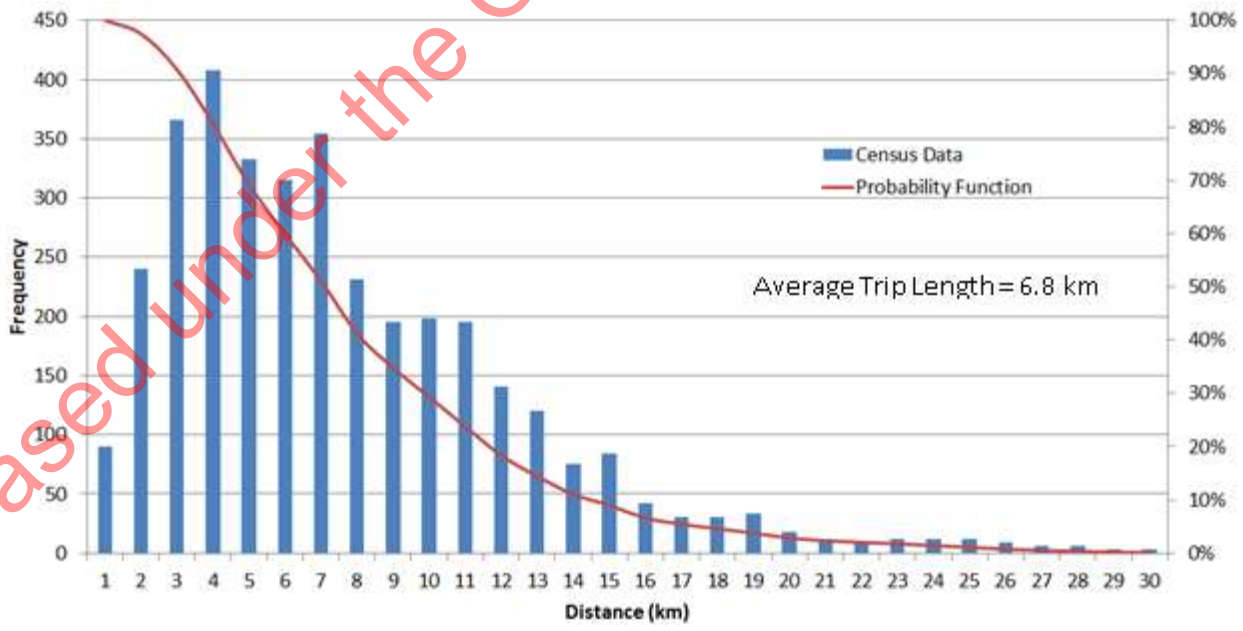


Figure 2-11: Existing Auckland 2016 Model Calibration[14]

2.37 Trip Length Distribution: Note probability function used (ref Figure 2-11) – but this does not show actual *results* of application of adopted probability function. Really need to compare Model *performance* to Census Data? i.e. Can we see the modelled 2013 and 2016 TLDs for the network as a whole to compare and (ultimately) the future TLDs, including specifically extracted for trips assigned to use Seapath? (Example comparison from Christchurch being shown in Figure 2-12).



13 We note that there are some reasonably-significant differences between the supplied Scenario I8B and I11 **2016** estimates of key land use inputs, with e.g. overall regional employment apparently 9% higher in the latter.

14 Sourced from recent Presentation and reported to be prior to subsequent 'validation' (sic).

Figure 2-12: IBC Evaluation Figure 2 (2013 Census; Journey to Work Distance by Cycle (Auckland))

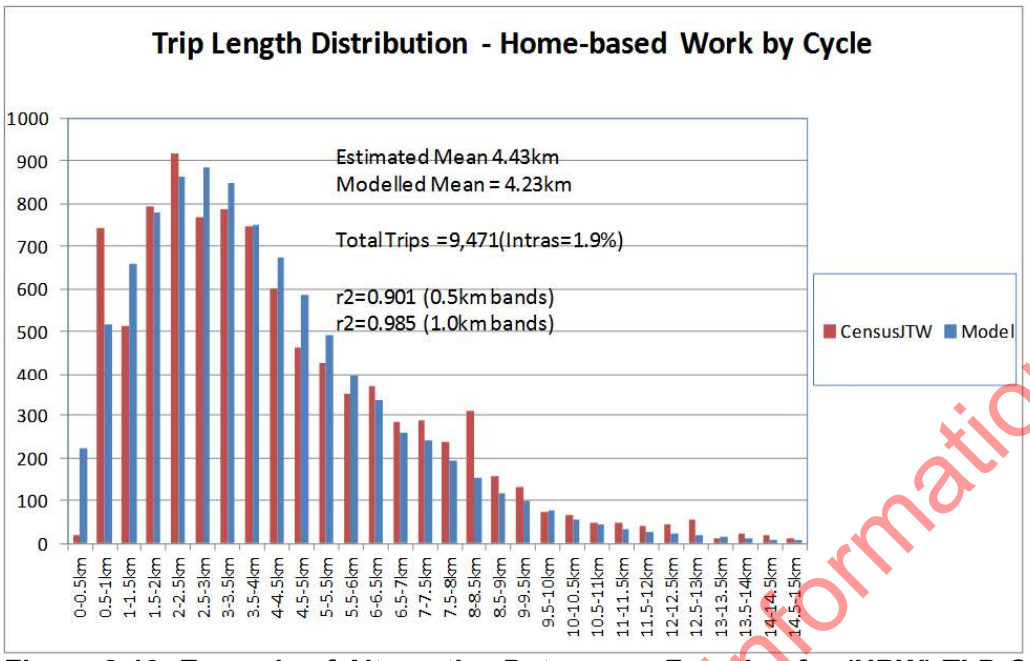


Figure 2-13: Example of Alternative Deterrence Function for (HBW) TLD Calibration[15]

2.38 (Caveat being that we note that the proposed model framework is a simplified approach, aggregating commuting trip demand with ALL other purposes prior to assignment of a single matrix for each period – Acknowledge that the TLD is likely to vary by purpose? – see e.g. Figure 2-14)

[15] The particular deterrence function [EXP(-0.5*D)] used to obtain the illustrated JTW model distribution. Care must be taken with such comparisons however differences may be expected due to different methods. e.g. The Census JTW data trip length distribution shown here is based on straight-line distance, but at the relatively coarse geographic level of CAU's. It also *necessarily excludes intra-CAU data* (where no such distance estimate is possible). The modelled mean however is based on assigned distances between relatively much-smaller model zones (approx. 1,400, covering greater Christchurch) and therefore also includes more cycle trips occuring *within* CAUs. We would therefore expect the mean distance to be shorter that implied by a Census JTW analysis

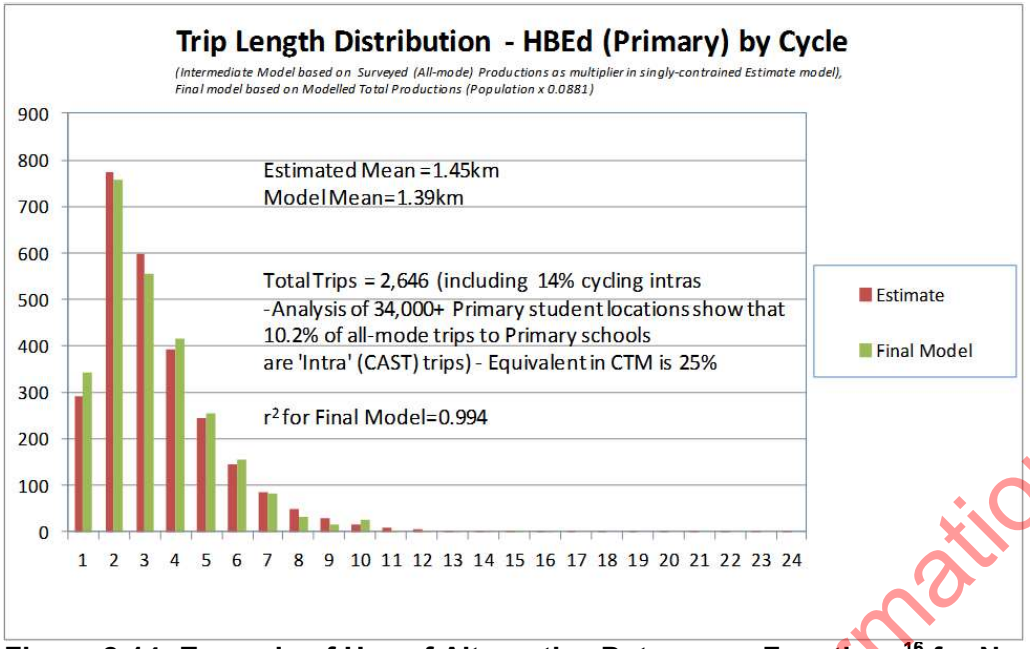


Figure 2-14: Example of Use of Alternative Deterrence Functions[16] for Non-Commuting Trip Purposes

Market Segmentation

2.39 Appears to be a reasonable assumption that commuting and recreational use will be primary purposes (for cycle mode at least).

2.40 Proposed method (appropriately) simplified, but may fail to capture full potential demand for Project?

2.41 Can this be (adequately) considered by using parameter sensitivity tests (e.g. peak>AADT)?

2.42 We do note potentially-significant school roll within reasonably close proximity to Project (IBC alignment). While not necessarily required to be modelled in detail – see above - this potential may, presumably, be one of a number of factors that is considered within a wider MCA process when considering alternative alignment options?

16 $D^{1.0}$*EXP(-2.0*D)

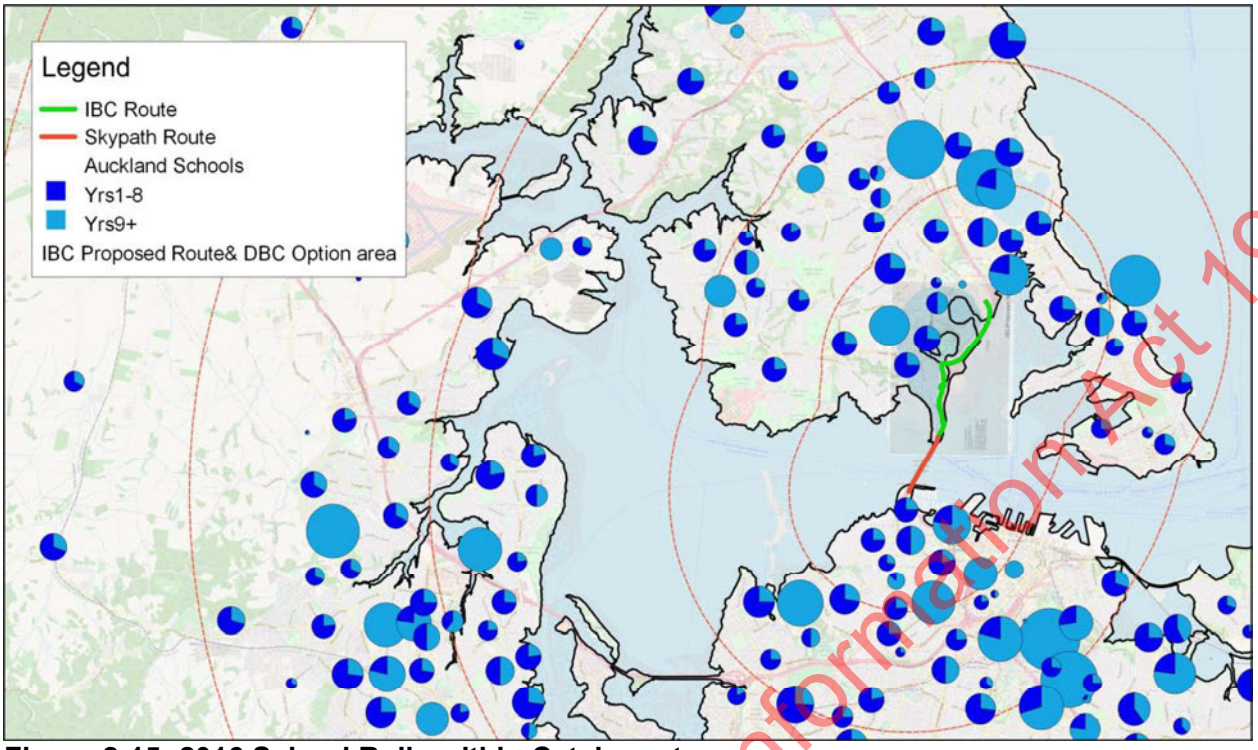


Figure 2-15: 2016 School Rolls within Catchment

Future Do-Minimum Network(s) Modelling

2.43 Draft method appropriately notes importance of early agreement on assumptions to be adopted: We would welcome more detailed and firm proposals for this aspect from the Project team to review.

2.44 It may be that several DM scenarios may be prudent to consider (including potential tolling of Skypath) - or at least (at this stage) to simply provide confidence that option selection is unlikely to be critically-influenced by the D-M(s) adopted.

Option Network(s) Modelling, including Potential Staging

2.45 To be considered when project is progressed further. Usual process would be to filter 'long-list' options with MCA that *would* likely make use of *limited* scenario modelling (e.g. single year)[17], *then* examine short-list in more detail (including staging options). At this stage it would be helpful to look at incremental BCR assessment, as well as other relevant Project evaluation and risk factors.

[17] Whether modelling is conducted (helpfully), at this stage may be dependent upon any network refinement conducted (e.g. within the 'option catchment' signalled within the Aecom Background Briefing document).

3 Economic Evaluation.

General

3.1 The overall approach proposed is supported, including the proposed departures to the SP11 process, as the approach proposed will almost certainly ultimately provide a more-robust benefit-cost assessment as a result. Where SP11 values/methods are adopted/adapted, these should reflect the current EEM SP11 values (currently 28/4/17).

3.2 It is recommended that the Evaluation approach concentrate its level of detail on those components that have most influence on the benefit-cost appraisal, these being (in descending order):

- Capital Cost Estimates (including ultimately internal or external parallel assessment)
- Health and Environment Benefits for Cyclists
- Decongestion
- Health and Environment Benefits for Pedestrians
- Travel Time Cost Savings for Cyclists and Pedestrians (noting the latter are proposed to be assumed as negligible)
- Cycle Safety benefits[18]
- Maintenance Cost Estimates (considering only the net costs of the proposed option will be adequate)

3.3 However, in terms of benefit estimation, we do note that the draft method does not mention other potentially-important (economic) components of the Project benefits

3.4 Non-monetised Benefits may include the perceived value of a reduction in Community Severance facilitated by the project (enhancing the potential benefits of Skypath).

3.5 National Strategic Factors (**NSF**) include the potential for agglomeration benefits (increased productivity) due to a perceived (rather than necessarily actual) improvement in accessibility/attractiveness to particular areas, in particular Takapuna and the Auckland CBD. The latter alone has been recently estimated to contribute $16b annually (2015) to the nation's GDP[19]. Thus the potential to increase this, if only very marginally, could potentially 'swamp' the more conventional transport benefits noted above and increase the 'true' Project BCR significantly.

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18 While a relatively-minor component, we are unclear regarding the rationale for the proposed restriction of cycle-safety benefits for the portion of travel on the Project alone, given this is inconsistent with the proposed treatment of health and environment benefits; This may potentially be allied to a (lack of) model response to the improved infrastructure in terms of generating additional cycling trips?

19 http://www.knowledgeauckland.org.nz/assets/publications/TR2017-007-Pedestrian-connectivity-economic-productivity-Auckland-city-centre.pdf

Principal Assessment Land Use Scenario and Years

3.6 The land use data supplied by Flow is illustrated below for an (assumed) 'primary catchment. While this does not of course necessarily equate precisely to the potential growth in project benefits, such a comparison (and supporting analysis) does serve to indicate several things:

- At a high-level, the proposed Scenario I11 land use might be expected to generate larger benefits than the scenario adopted for the IBC, but the differences are unlikely to be significant (less than +2%); and
- The proposed adoption of 2016, 2026 and 2046 assessment years (only) would yield benefits only around 0.5% lower[20] than more time-consuming alternatives (such as modelling every 5 years or adding only 2036).

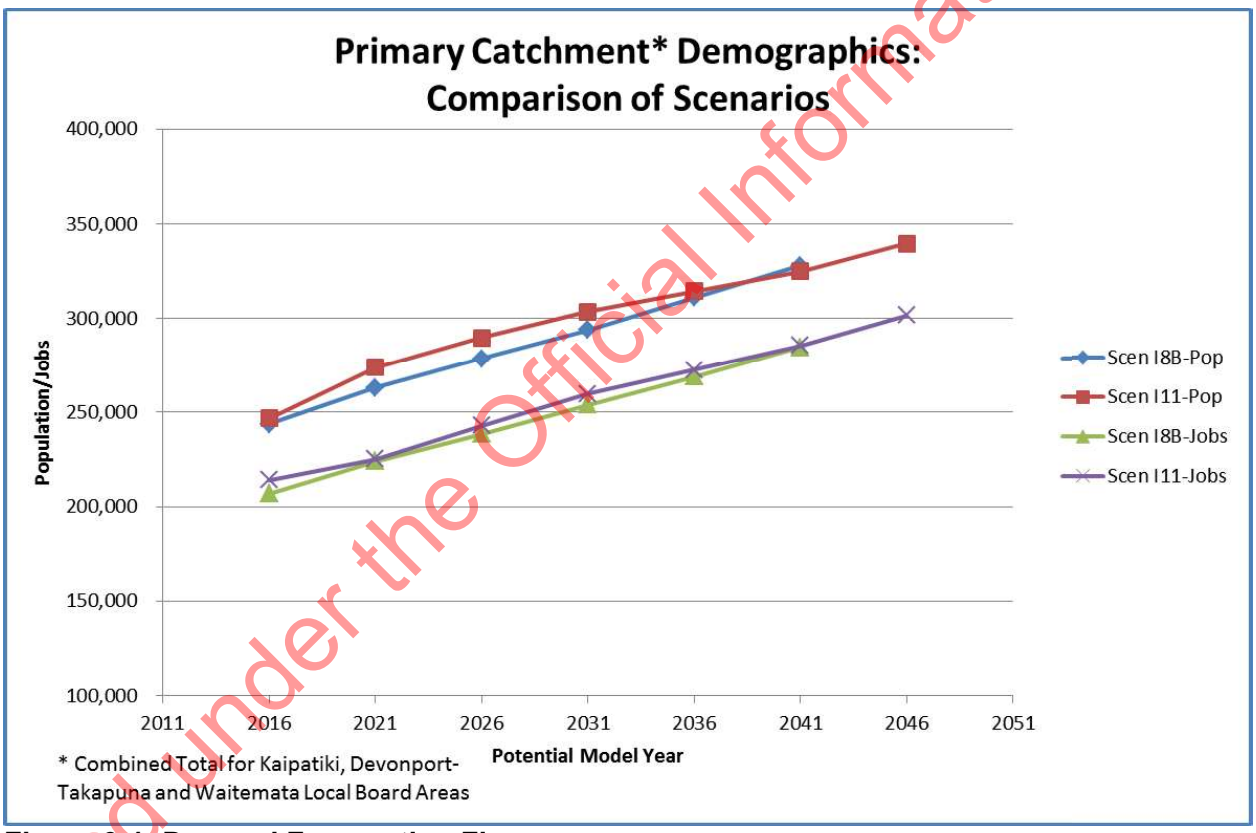

Figure 3-1: Demand Forecasting Figure

20 Comparison of PV over 40 years at 6% discount rate, assumed benefits commence at 2021 and would be in line with assumed catchment population growth; straight-line interpolation between potential 'assessment years' and any post-2046 benefits capped beyond 2046 (Noting that post-2046 benefits under such secanrios contribute around 15-16% of overall PV).

Benefit-Cost Sensitivity Testing

3.7 The EEM does require that risk analysis be conducted where "there is a significant element of uncertainty" and notwithstanding the reasonably-sophisticated proposed methods for Option demand estimation, it is likely that this may be applied to the demand estimates.

3.8 This need not be an onerous task, e.g. (necessarily) requiring multiple additional model runs and can usually be achieved using alternative parameter assumptions within calculation spreadsheets (and/or with relatively-simple matrix-based calculations).

3.9 It would be helpful to discuss and agree the key tests proposed to be conducted by the Consultant in this respect prior to reporting submitted for formal review (accepting that 'central' parameters do need to be agreed early on).

3.10 As noted above, we will expect that *incremental* BCR assessment(s) will also ultimately be provided, to determine whether additional Option benefits may exceed their additional costs. Such assessment may include Project 'scenarios' that represent potential alternative staging to effect an ultimate complete Option.

Costs

3.11 While clearly a significant factor in terms of overall benefit-cost appraisal, we do note that it will be beyond our sphere of expertise to determine whether the capital costs adopted for each Option will be robust estimates.

3.12 We would expect, however, that ultimately a parallel cost estimate is undertaken to provide this confidence and confirm values adopted for the benefit-cost appraisal are sensible (and potentially provide a range to test BCR sensitivity).

flow
TRANSPORTATION SPECIALISTS

technical note

PROJECT	**SEAPATH DBC - DEMAND MODELLING AND ECONOMICS**
SUBJECT	**RESPONSE TO PEER REVIEW WORKING NOTE 1**
TO	Section 9(2)(a) **(AECOM)**
FROM	Section 9(2)(a)
DATE	9 NOVEMBER 2017

The following technical note documents the actions agreed following discussions held between Section 9(2)(a) of Flow Transportation Specialists (Flow, SeaPath DBC sub consultants) and Section 9(2) of Quality Transport Planning (QTP, peer reviewers).

The numbering within this document follows that used in QTP's Working Note 1.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
1.14	Initial refinements should be considered to ensure that Option selection… is not unduly biased or compromised.	Agreed. DBC options to be evaluated were received by Flow on 8 November and indicate that **some refinement of the model structure within Northcote will be necessary**.
1.15	It is important, as an early stage, to agree Do-Minimum (DM) network(s)… It may be that several DM scenarios may be prudent to consider (e.g. potential tolling of Skypath) - or at least (at this stage) to simply provide confidence that option selection is unlikely to be critically-influenced by the D-M adopted.	Agreed. **Confirmation of future Do Minimum networks is being sought**. It was also agreed to carry out a **sensitivity test on the model outputs, to assess the effects of tolling/no tolling on SkyPath**.
1.16	Within the economic evaluation, sensitivity-testing to important variables is important but, given the proposed (modelling and economics) methodology, is likely to be relatively expedient.	Agreed. Specific sensitivity tests were not discussed, but Flow suggest that **sensitivity tests be run on the impact that congestion on SH1 may have on cycling uptake**. The cycle model process uses elasticities to translate improved cycle infrastructure into mode shift, based on current trends in Auckland. It's possible that cycling uptake on SeaPath may follow a different trend, due to SH1 congestion and the limited existing mode choices. We suggest testing using higher/lower elasticities, as a proxy for lower/higher background traffic congestion.
2.3	However, it is apparent, from both the draft DBC methodology and the recent Presentation, that further work has occurred to enhance the Auckland Cycle Model since the IBC Evaluation was conducted.	The significant changes that have been made to the Auckland Cycle Model since the SeaPath IBC were discussed. Most significantly, these changes include: ◆ Extending the model to include all of urban Auckland (approximately 500+ ART zones) ◆ Creating a 'feedback loop' so that changes to the modelled cycle network results in changes to forecast demands ◆ Refining growth from a regional average to zonal growth ◆ Significant refinement of zones and the modelled network Other changes referred to in paragraph 2.3 of QTP's Working Note have occurred subsequent to the above major changes, and are relatively minor calibrations.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
2.6	The model extent (Figure 2-2 below) does, however, appear to be somewhat less than stated above, with the northern extent at the SH1/Oteha Valley Road interchange, being located some 10km to the north of the Seapath (IBC route) termination.	See comments in relation to 2.3
2.10	A discussion on the pros and cons of potential refinement of the zone structure and its nature - albeit such would sensibly still be predicated on respecting ART boundaries and land use/trip forecasts - within any constraints of the Project, would be helpful.	See comments in relation to 2.3, and actions in relations to 1.14
2.12	'Scenario I11' is thus now proposed to be adopted. The proposal appears sensible, subject to confirmation that this has indeed been adopted by the Auckland planning agencies as the (latest) 'default' scenario (as indicated to support the use of Scenario I8B for the IBC Evaluation).	As discussed, Scenario I11 is confirmed as the current default scenario for evaluating transport projects within Auckland, agreed by Auckland Transport, Auckland Council and the NZ Transport Agency.
2.13	It *may* be appropriate to consider sensitivity of the Project Option(s) demand and BCR to alternative land-use growth in due course. However, this may be most expediently achieved by a fairly simple process of factoring projected demand (and/or resulting benefits), rather than full modelling runs.	Agreed. **Simple sensitivity tests on demands and/or BCRs are proposed based on factoring model outputs**.
2.19	It may be that Flow already have adopted alternative sectors, and it would be helpful to agree that these are appropriate prior to reporting.	The use of presenting both model inputs (land use forecasts, existing cycle trips) and model outputs (forecast cycle trips) was discussed. **Aggregating this data by Local Boards was agreed as a suitable means of presenting information**, to demonstrate correlation between inputs and outputs.
2.22	The simplistic network nature (adopted for the **IBC**) can be seen, with many routes also apparently coded simply as 'straight' lines or with very few intermediate points. This relative lack of accuracy can be important in the context of assignment (and particularly cycle assignment) models, given that the SATURN software (normally) uses the geographic distance calculated from a more-accurate 'GIS" file input.	As discussed, the Auckland Cycle Model continues to use 'hard entered' distance inputs. The model uses speed as a proxy for route 'relative attractiveness' and as a result, these entered distances form a significant input to the model process.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
2.26	A discussion on the pros and cons of potential refinement of the network structure within any constraints of the Project would, however, be welcomed.	See actions in relations to 1.14
2.30	It would be therefore be helpful for Flow to clarify the following aspects of ME model processes within a more-detailed model-focussed discussion: ◆ How/if potential variability in count data has been accounted for? ◆ Whether/how Counts may have been adjusted to reflect an (estimated) average weekday AM and PM peak prior to application of ME? Are peak count/weekday and/or 7-day annual average estimates appropriately reconciled? ◆ Use of adopted ME constraints (e.g. XA Factors) and how these may have (been) varied through the Model and particularly immediate Project area. ◆ What key assignment parameters have been (will be) adopted for current base model calibration/validation and are these retained for future scenarios?	As discussed, variability in count data was addressed by: ◆ Sourcing the majority of data points from annual March counts, for which there was generally 5 to 8 years count history. This allowed inconsistent counts to be checked and corrected for weather conditions if necessary ◆ Data collected outside of March 2013 was corrected for seasonality ◆ Automatic, continuous data was available for approximately a dozen major cycle routes, giving a high degree of certainty on these dozen key routes (Tamaki Drive, Northwestern Cycleway, etc) ◆ Controls such as XA Factors were used to limit the effects of matrix estimation ◆ Trip length distributions were compared before and after estimation to ensure consistency. It was noted that almost all forecast cycle trips on SeaPath will be 'new users', as these cycle trips are currently not possible without SkyPath. The model takes these new user trips directly from the ART model, rather than the 2013 base model and as a result, the base model will have very little impact on SeaPath forecasts.
2.34	More clarity would be therefore be helpful regarding how these matters are (to be) dealt with within the proposed DBC modelling framework particularly trip abstraction (potential market penetration) of cycle trips attracted from existing modes (e.g. PT & Ferry, as well as trips that may otherwise occur as a Car Driver or Passenger).	The developments to the model since the IBC were discussed. It was noted that the demand process has changed from the fixed 15.3% long term active mode share assumed for the IBC, to a variable process where new cycle trips are generated only between two zones where new cycle infrastructure is proposed.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
2.35	Proposed principal evaluation (model) years of 2016, 2026 and 2046 are fine by me – see reasoning later under Economic Evaluation.	The use of a 2016 model was discussed, noting that: ◆ It would be beneficial to include a 2016 forecast for the economic evaluation, as extrapolating benefits backward from 2026 and 2046 may result in overestimated early benefits (refer figure 3.1 of QTP's Working Note) ◆ While there are I11 land use projections for 2016, there is no 2016 ART model run, which would be needed to create an I11 2016 cycle model ◆ The I9 2016 cycle model could be used, but it is not clear if Flow will have time to update this redundant model. **It was agreed that a suitable approach will be to model only 2026 and 2046, but to dampen down early benefits for the project** (eg 2021 to 2026). This would reflect both the non-linear land use forecasts discussed above, but also a 'bedding in' of the project after construction, to reflect gradual behaviour change.
2.37	Trip Length Distribution: Note probability function used (ref Figure 2-11) – but this does not show actual *results* of application of adopted probability function. Really need to compare Model *performance* to Census Data? i.e. Can we see the modelled 2013 and 2016 TLDs for the network as a whole to compare and (ultimately) the future TLDs, including specifically extracted for trips assigned to use Seapath? (Example comparison from Christchurch being shown in Figure 2-12).	**It was agreed that Flow would produce trip-length distribution plots to compare existing (census), base model, and forecast trip length distributions.**
2.42	We do note potentially-significant school roll within reasonably close proximity to Project (IBC alignment). While not necessarily required to be modelled in detail – see above - this potential may, presumably, be one of a number of factors that is considered within a wider MCA process when considering alternative alignment options?	It was agreed that the impacts of SeaPath options that serve schools better (or worse) than other options is best dealt with in the MCA process, rather than by the model.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
3.3-3.5	However, in terms of benefit estimation, we do note that the draft method does not mention other potentially-important (economic) components of the Project benefits Non-monetised Benefits may include the perceived value of a reduction in Community Severance facilitated by the project (enhancing the potential benefits of Skypath). National Strategic Factors (**NSF**) include the potential for agglomeration benefits (increased productivity) due to a perceived (rather than necessarily actual) improvement in accessibility/attractiveness to particular areas, in particular Takapuna and the Auckland CBD. The latter alone has been recently estimated to contribute $16b annually (2015) to the nation's GDP[19]. Thus the potential to increase this, if only very marginally, could potentially 'swamp' the more conventional transport benefits noted above and increase the 'true' Project BCR significantly.	It was agreed that due to time constraints, the economic evaluation would in the first instance focus on the traditional benefit streams listed in paragraph 3.2 of QTP's Working Note. Should it be necessary increased project benefits, then the wider economic benefits listed to the left will be explored.
3.10	As noted above, we will expect that *incremental* BCR assessment(s) will also ultimately be provided, to determine whether additional Option benefits may exceed their additional costs. Such assessment may include Project 'scenarios' that represent potential alternative staging to effect an ultimate complete Option.	The four options to be assessed as part of the DBC were discussed, and it was agreed that the four options themselves will provide an incremental assessment when compared, as they sequentially provide sections of a coastal SeaPath, while sequentially relying less on existing on-street infrastructure. No further incremental BCR assessment is considered necessary.

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Memorandum

To:	Section 9(2)(a) (Flow)
From:	Section 9(2)(a)
Subject:	SeaPath Demand and Economic Benefit Evaluation Peer Review: Working Note 2 (Review of July 2018 Report and Economic Benefits Spreadsheets)
Date:	Friday 17th August 2018
Copy:	Section 9(2)(a) (Aecom), Out of scope (NZ Transport Agency)

Dear Section 9(2)(a)

0 Introduction

0.1 As you are aware, QTP Ltd. have been appointed to assist the NZ Transport Agency (the Agency) in development of the business case for the SeaPath Shared Use Path, with a specific focus on a review of the supporting modelling and economics.

0.2 The Peer Review is an ongoing process, with the review to date comprising the following key components:

- A review of the Draft methodology proposed (17th October 2017) reported in a Draft QTP Working Note 1 (dated 3rd November 2017);
- Subsequent discussion and agreement on issues and actions, as capture in the Flow Technical Note of 9th November 2017, and reflected in an updated QTP Working Note 1 (dated 9th November 2017); and
- QTP's preliminary review, by way of emailed comments on 14th December 2017, of version A of the Demand Assessment and Economic Benefit Evaluation report of the same date.

0.3 The purpose of this Memo is to provide initial feedback to the project team on the updated Demand Assessment and Economic Benefit Evaluation report (the '**Evaluation Report'**) dated 27 July 2018.

0.4 Our general observation is that the updated Evaluation Report is clear, well presented and that overall the modelled demands and economic benefits appear reasonable. Thus comments made here are relatively minor and the need for brevity should not be taken as a 'negative' review.

0.5 A key point of note is that the Auckland Cycle Model (**ACM**) appears to have been modified substantially since the process and methodologies involved in the estimation of cycle demands were documented at a reasonably high level back in December 2014 for what was the equivalent of an Indicative Business Case (**IBC**) level of appraisal. As

the assumptions and methodologies adopted within the ACM are greatly influential to the appraisal of the economic benefits of the scheme, it has been requested that a separate, updated report be prepared by Flow, as the developers of the ACM, documenting the development of the updated ACM. To that end, such a report has just been received (Thursday 16th August) for the purpose of Peer Review, which will follow in a supplementary document.

0.6 The specific information considered as part of this stage of the review is:

- SeaPath Demand Assessment and Economic Evaluation report (Flow, Version C, 27 July 2018) ('**the Evaluation Report**');
- Model assignment '.UFS' files for the reference case, and Options 1 and 2 (requested and received 9 August 2018);
- Economic evaluation spreadsheets 'Economics Opt1.xlsx and Opt2.xlsx' (also requested and received 9 August 2018);
- Option staging schematic '80624_Rev 1_SeaPath_Option Staging.pdf' (received 9 August 2018); and
- SeaPath scheme design plans (subsequently received from AECOM on 10 August 2018).

0.7 We re-iterate that this Memo does not comprise our 'final' Peer Review, but is merely a stage in the ongoing review process. Further feedback will be provided on the ACM Model Development Report just received. Further checks of the supplied model files will also be undertaken in the context of this reporting. Ultimately it is anticipated that a Peer Review Report will be submitted summarising the key findings of the review, limitations of the appraisal process, with the feedback and actions from the various stages of the review to date (including this Memo) appended to the report.

0.8 As previously noted in our email comments of 14th December, in terms of the scope of our review of the economic assessment, this will not be complete until a document is provided that summarises the full economic case, reflecting the costs of the options (in addition to the benefits), including incremental benefit-cost analysis as appropriate (see also note 1.1, below).

0.9 The section numbers below reflect those of the Evaluation Report (but not the paragraph numbers).

1 Introduction

1.1 Figure 1 indicates an improved shared path on Onewa Road as part of Option 1, but this improvement is not illustrated as part of Option 2. There may be clear rationale for this (relating to diminished demand under Option 2), but it is recommended this be documented and / or the potential incremental benefit of such an improvement be included within incremental benefit-cost analysis.

1.2 The relationship between coded capacity indices, speeds and weightings of cost components used in the assignment (and demand response) modelling is not presently

understood, pending Peer Review of the ACM report, but there could potentially be a consistency issue with the Onewa Road speeds (rather than link indices) used in the assignment process which do differ between the base case and Option 2 in the supplied model UFS files.

1.3 We note that the modelling has been undertaken with and without a $2 user toll assumed on SkyPath (as part of the do-minimum network). This bears further review to ensure that the method by which the monetary toll has been specified is consistent with the perceived user costs used in the assignment and demand estimation process.

2 Demand Assessment

2.1 Methodology

2.1.1 5th bullet point wording "Is responsive to changes in cycle infrastructure…" is retained from earlier reporting on earlier versions of the ACM that it is understood included an assignment response to new infrastructure, but did not included a demand response. Suggest clarifying this statement in the light that the updated ACM is understood to include a demand and assignment response to changes in cycle infrastructure.

2.2 Just to note that in relation to Footnote 1 that further information on the ME process (controls, effects) is anticipated to be provided in the ACM report.

2.3 Base Cycle Model

2.3.1 Given the discussion in the following paragraphs, should this section be titled '2016 Cycle Model', as it is in-fact a forecast from the 2013 base?

2.3.2 Table 2 Comparison of Base Model and Count Data (as above should probably be 2016 Model as the Base model is understood to be for 2013).

2.3.3 Whilst the majority of count sites show reasonable correlation between the counts and the model, clearly there are issues with the base model reflection of counts on Lake Road and Queen Street that warrant further investigation and possibly corrective action.

2.3.4 The two counts listed as south of King Street both show counts of around 100 cycles per day (**cpd**) compared to a modelled cycle volume of 36. As a minor point, it would be useful to note what distinguishes the two listed counts (date and / or location?). This is considered a significant discrepancy as the cycle volumes are the highest counted, but the lowest modelled.

2.3.5 The high cycle demand at this location may be related to the Northcote Point ferry service, which is included within the cycle model, but would appear that the 'cost' of travel may be too high and suppressing modelled demand compared to that counted. It may also be a popular recreational route for which the demand cannot be well reflected within the model based on demands and assignments of a single combined trip purpose.

2.3.6 At very least, this issue does warrant explanation and consideration of how this could affect the assessed benefits.

2.3.7 The model also poorly reflects counts on Lake Road between Exmouth Road and Onewa Road, the three sites averaging a count of 24 cpd compared to 64 modelled. Again, this warrants further explanation, consideration of implications for appraisal, and possible remedial action, such as zone splitting and / or centroid location adjustment to make demands less 'lumpy' in the vicinity of the proposed scheme and competing routes.

2.3.8 Whilst these 'outliers' may raise cause for concern, it should be recognised that the current total daily cycle volumes (up to around 100 cpd) are very low compared to those forecast on SkyPath and SeaPath in the future (up to around 3,000 vpd). By way of context, The NZ Transport Agency's Transport Modelling Development Guidelines (**TMDG**) recognise that the precision to which relatively low traffic volumes may be modelled is limited, and in this regard adopt the internationally widely used GEH error statistic as the principal measure of model vs count acceptability, applied at an hourly level. By way of example, the 'target' GEH measure is 5 or less for around 80% of links in an urban model. Because GEH error statistics are applied at the hourly level, it is common practice to divide modelled and observed daily flows by 10 to approximate them to hourly forecasts. On this basis, the GEH error for the Queen Street count is around 3. Whilst the TMDG guidelines are usually applied to (motorised) traffic models, the comparison does illustrate the implied accuracy to which transport models may be anticipated to reflect relatively low transport demands. However, with these outlying count sites being located in close proximity to SeaPath, it is strongly recommended that the underlying causes for the discrepancy be investigated and implications for appraisal be reported. Again we note that the accuracy with which relatively low cycle volumes may be modelled is greatly influenced by model granularity.

2.4 Forecast Cyclist Demands

2.4.1 Again, a minor point that given the previous sub-section related to 2016 demands, which are themselves a forecast from the 2013 base, this sub-section might be referred to as 'Future Year Cyclist Demands' ?

2.4.2 Generally, checks on the modelled future year cycle volumes of Table 3 appear sensible, in terms of:

- Increases in modelled cycle flows between 2026 and 2046 generally being consistent (between 50% and 60%), one exception being Option 1 Esmonde to Exmouth that warrants a check. We note that at this stage, prior to reviewing the ACM report, the basis of the significant growth is not confirmed as early versions of the ACM simply reflected target (aspirational) mode share assumptions.
- The effects of tolling SkyPath on modelled cycled volumes are reasonably consistent between locations and options and years, being around -20% in projected volumes (and increasing in proximity to SkyPath, up to 24% as would be anticipated).

- Option 2 increases in modelled cycle volumes on SeaPath over Option 1 between Esmonde and Onewa are around 80% in 2026, increasing to 100% (a doubling) in 2046.

2.4.3 It is however interesting to note that Option 1 has only a small impact on forecast Reference Case SkyPath volumes, being around just 5%, whilst Option 2 also has a more significant impact of around 15%.

2.4.4 In terms of actual, rather than relative numbers, it is notable that relatively high forecast demands between Esmonde Road and Onewa Road do not translate to high increases on SkyPath. For example, 2026 without tolling, Option 2, has forecast volumes of up to 1200 cpd, but results in an increase on SkyPath of less than 300 cpd. Thus the implication from the modelling is that SeaPath is mainly accommodating reassignment of trips that are occurring in the reference case, and also increasing local trips to/from Northcote Point, more so than increasing demand across the harbour (e.g. between the Takapuna area and the central city). This is also evident from the cycle demand plots of Appendices A and B.

2.4.5 Finally, we note that cross-checks of the estimated cycle demands against approximate traffic volumes on the adjacent roads indicate credible cycle mode share values. For example, in 2026, cycle mode share for Option 2, without SkyPath tolling is approximately 0.7% of the SH1 traffic volumes (around 155,000 vpd) between Onewa Road Esmonde Road, and SkyPath cycle mode share is around 1% of current daily volumes across the Auckland Harbour Bridge (around 200,000 vpd). These figures compare to a 1.1% cycle commute mode share for Auckland (EEM Table A20.1).

3 Key Performance Indicators

3.1 Cycle Travel Times

3.1.1 Whilst certainly not a flaw in the appraisal methodology, it is a significant limitation of the ACM, in terms of usefulness of the model and its interpretation, that the coded cycle speeds are, apparently not able to indicate cycle travel times. This is understood to be because the speed has been used as an indication of cycle facility attractiveness (subject to review of the ACM report). An alternative method would have been to use the 'KNOBS' facility to adjust costs to reflect the relative attractiveness of alternative cycle facilities on a link, leaving the speed to be indicative of the average cycle speed for a given standard of facility (and contributory to the overall perceived cost).

3.1.2 The estimated travel times listed in Table 4 are used as the basis of the travel time benefits calculated, as described at section 4.1.1 of the Evaluation Report. Whilst this is considered a reasonable approach, and it is recognised that the assessed travel time benefits to not constitute a large proportion of the assessed benefits, these assumptions do bear review in relation to the scheme plans forwarded by AECOM. For example, from the scheme plans and current road network, it is understood that Option 2 has grade-separated crossings of slip roads and therefore no signalised intersections / crossings prior to Esmonde Road, whilst the reference case has 4 signalised crossing

plus two further intersections (a roundabout and a give-way) where cyclists must give-way and incur delay.

3.1.3 The stated length of Option 2 also bears review (as also used in the model and economic assessment), which appears to be around 3.7km in the drawing chainage (and in our approximate measurement in GoogleEarth) compared to 3.5km adopted.

3.1.4 We also consider, from our experience, that the assumed ***average*** speeds (across all users, including acceleration and deceleration effects and side-friction) are rather high for the reference case and for SeaPath, being 25kph and 30 kph respectively. We would anticipate values to be no more than 20kph and 25kph respectively.

3.1.5 The likely effect of a review of the calculated cycle travel times is to increase the benefits of the options, relative to the reference case.

3.2 Forecast Cycle Trips from Takapuna to SkyPath

3.2.1 The Table 5 demands appear reasonable in the context of the assigned volumes presented in Table 3 and the observations regarding re-assignment of trips compared to increased cycling demand (mode-share).

3.3 Forecast Cycle Trips

3.3.1 The model-wide increase in forecast cycle trips of Table 6 have been compared to those between Takapuna and SkyPath, reported in Table 5.

3.3.2 The proportion of 'new' cycle trips between Takapuna and SkyPath of total new cycling trips does vary considerably depending on Option, Year and tolling scenario:

- As would be expected, Option 2 results in a greater proportion of 'new' trips between Takapuna and SkyPath than Option 1 (around 20 percentage points higher);
- The proportion of 'new' trips between Takapuna and SkyPath is greater in 2046 than 2026. Presumably this reflects growth patterns with higher-than average forecast demographic growth in Takapuna from 2026 to 2046 than the model-wide average'; and
- The SkyPath tolling scenario does serve to reduce the proportion of 'new' trips between Takapuna and SkyPath (by 5 to 10 percentage points), presumably because in terms of travel 'cost', the additional toll is more influential for longer-distance, higher cost trips (between Takapuna and SkyPath), than more localised trips to/from Northcote.

3.3.3 It is not understood why the total number of new daily cycle trips for Option 1 in 2046, with SkyPath tolling, should be less than in 2026, when other scenarios show an increase, this figure bearing review and explanation.

3.4 Forecast Cycle Trip Lengths

3.4.1 A minor point, but the text says that the 2026 Option 1 distribution is obscured by the 2026 Option 2 distribution, but the latter doesn't appear in the graph key, suggesting the data is not referenced in the graph. From the key, it looks like the graph is not displaying either the 2046 Option 1 or 2026 Option 2 distributions.

3.4.2 The trip length distributions illustrated generally look reasonable for the 2013 base model compared to the census data. It would be worth noting the implications of any consistency issues with how the model inter-zonal trip distances are calculated compared to the trip lengths derived from the 2013 census data (e.g. zone centroid lengths, basis of census-based lengths) and if these definitional differences might contribute to the difference in short trip lengths illustrated. This may best be addressed within the (currently not reviewed) ACM reporting. It would also be worth noting the author's explanation for the further increase in modelled shorter trips in future years.

4 Economic Benefit Evaluation

4.1 Methodology

4.1.1 As per previous discussion, we are comfortable with the proposed methodology that replaces simplistic procedures and assumptions applied within the EEM Simplified Procedures for Walking and Cycling Facilities (SP11) with outputs based on the ACM.

4.2 Travel Time Benefits

4.2.1 These are a relatively small component of overall benefits (being around 10% of those calculated for Option 1).

4.2.2 We note that adopting a value of time based on the average of the EEM cycling commuting value and the lesser 'cycling for other purposes' value is conservative. We would suggest weighting the value to commuting in the same ratio as that assumed within SP11-7 for expansion of commuting trips to all trips (1.10% / 1.38%) would be reasonable. However, in practice the effects of this change to the overall economics are negligible.

4.2.3 As per comment above at 3.1, we consider the adopted minimum speeds bear review and could result in a small increase in the overall benefits given the average speeds in the reference case may be over-estimated.

4.3 Health and Environmental Benefits for Pedestrians

4.3.1 These are a modest, but significant component of overall benefits (being around 15% of those calculated for Option 1).

4.3.2 No potential issues are noted with how these have been calculated and implemented.

4.4 Health and Environmental Benefits for Cyclists

4.4.1 These represent the largest component of overall benefits (being around 50% of those calculated for Option 1).

4.4.2 No potential issues are noted with how these have been calculated and implemented.

4.4.3 We would however note that SP11 does **not** apply a fully composite value of $1.45 (as indicated in the text), as the $0.05 attributed to safety is applied separately. This is in common with the same process applied in the SeaPath appraisal, which requires safety benefits to be applied to new **and** existing trips, unlike health and environmental benefits that apply only to new trips.

4.4.4 As the health and environmental benefits are the largest contribution to overall project benefits, it is useful to undertake a cross-check with the benefit implied by the standard SP11 process (whilst acknowledging that this is highly simplistic).

4.4.5 The health and environmental benefits are a function of the new trips attributed to a project. The SP11 procedures simply sum the population within three different 'buffer' distances from the project to estimate existing usage based on cycle commuting mode share. The new trips attributed to a scheme are then calculated based on three probabilities applied to the buffer populations that decline with distance. This is a very simplistic approach that does not take into account the role a cycle route has in attracting longer distance trips as part of wider cycle network. However, the implication of the procedure is that for a constant population density within 1.6kms of a project, the total new daily cyclists are 50% of current demand. For SeaPath, the Options result in an increase in trips of around 35% beyond the base case. Given that there is a relatively low urban density immediately adjacent to parts of the corridor, but that the scheme has an important role as part of a longer-distance strategic cycle network, the new demands forecast by the modelling appear reasonable, if not a little conservative, compared to the relative increase implied through application of SP11.

4.5 Safety Benefits

4.5.1 These are the smallest component of overall benefits (being around 2.5% of those calculated for Option 1). As such, application of the simplified procedures would appear appropriate in terms of appraisal effort.

4.6 Decongestion

4.6.1 Decongestion benefits are not identified in the EEM SP11 process, but are recognised in EEM section A20.3 under the full procedures for calculating walking and cycling benefits. We agree with the overall approach applied that uses the available NCI SATURN model covering the study area to quantify the vehicle travel time, congestion and operating costs benefits for private vehicle users switching modes to cycling.

4.6.2 We do however suggest further detail is provided on:

- the method by which trips have been removed from the SATURN model (if this uses SLA and / or the extent of the zones to which the trip reductions have been applied);
- some evidence of the derived decongestion values per vehicle-km; and
- The basis of the assumed car occupancy of 1.2.

4.7 Predicted Benefits

4.7.1 As a minor point, we note that the standard EEM appraisal period is 40 years from time zero (assumed to be 1st July 2018), but the benefit stream has been applied for 41 years. This serves to increase scheme benefits by just over 1.2%.

4.7.2 We further note the 'damping' of initial benefits, which are assumed to increase linearly from 0% to 100% over a 5 year period. We agree with this approach, though the figures adopted are likely to be perhaps overly conservative, with, for example benefits in year 2 of the scheme only being 40% of their calculated value. Alternative 'damping' assumptions we have tested do however make relatively little difference to the assessed overall discounted benefits (around a 2% increase).

4.7.3 The benefits tabulated in Table 7 appear reasonable in terms of the modelled effects of the SkyPath Toll (notwithstanding further information and review to be undertaken in relation to the consistency of the specification of the monetary toll in relation to the generalised costs components, as noted at 1.3 above).

4.7.4 The presented Option 2 benefits are more than double (approximately 2.5 times) those of Option 1. This is a little surprising given that the new section of cycleway proposed under Option 2 (between SkyPath and Onewa Rd) is parallel to an alternative route with upgraded cycle infrastructure assumed in the do-minimum (On Queen Street).

4.7.5 Further review of the coding of the options and do-minimum 'reference case' will be undertaken following digestion and review of the ACM modelling report.

4.8 Sensitivity Tests

4.8.1 Some 7 sensitivity tests are listed and an eighth (but described as a sixth in the text, and understood to relate to 7,500 users of SkyPath per day, rather than per hour as stated) is discussed.

4.8.2 We agree with the range of tests described and consider that the demand elasticities and trip length assumptions in particular have the potential to significantly affect the assessed benefits.

5 Peer Review

5.1 Given the evolving nature of the appraisal process, the improved documentation provided and yet to be reviewed, and that peer review feedback to date has been described as 'preliminary' pending a more detailed and 'final' review when further

information is submitted, we suggest that the text of section 5 is modified to reflect the evolving, staged process, rather than being the subject of two separate reviews.

flow
TRANSPORTATION SPECIALISTS

technical note

PROJECT	**SEAPATH DEMAND MODELLING AND ECONOMICS**
SUBJECT	**RESPONSE TO PEER REVIEW WORKING NOTE 2**
TO	Section 9(2)(a) Section 9(2)(a) **(AECOM),** Out of scope **(NZTA),** Section 9(2)(a) **(QTP)**
FROM	Section 9(2)(a)
DATE	23 AUGUST 2018

The following technical note documents the response to, and subsequent actions, the peer review of the "SeaPath Shared Path: Demand Assessment and Economic Benefit Evaluation" report. The peer review was carried out by Section 9(2)(a) of Quality Transport Planning (QTP), and is documented in the "SeaPath Demand and Economic Benefit Evaluation Peer Review: Working Note 2" memorandum.

The numbering within this document follows that used in QTP's Working Note 2.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
1.1	Figure 1 indicates an improved shared path on Onewa Road as part of Option 1, but this improvement is not illustrated as part of Option 2. There may be clear rationale for this (relating to diminished demand under Option 2), but it is recommended this be documented and / or the potential incremental benefit of such an improvement be included within incremental benefit-cost analysis.	The brief received by Flow was for Options 1 and 2 to be assessed as alternatives, with the improved shared path on Onewa Road to be included only in Option 1. If the two options were to be constructed as stages however, the Onewa Road portion would be a part of Option 2. The route to SkyPath from the intersection of Onewa Road/Queen Street would be approximately 1.8 km via the Northcote Safe Routes, and approximately 2.2 km via SeaPath. This is a relatively large difference and the model would not however assign any cyclists via the longer route, even with an improved shared path on Onewa Road was included.
1.2	The relationship between coded capacity indices, speeds and weightings of cost components used in the assignment (and demand response) modelling is not presently understood, pending Peer Review of the ACM report, but there could potentially be a consistency issue with the Onewa Road speeds (rather than link indices) used in the assignment process which do differ between the base case and Option 2 in the supplied model UFS files.	Awaiting review of the model development report to clarify use of capacity indices/speeds. Regarding Onewa Road, the Reference Case and Option 2 models have the same 'relative attractiveness' for this link, and as a result the same "speed". Option 1 differs as per item 1.1 above.
1.3	We note that the modelling has been undertaken with and without a $2 user toll assumed on SkyPath (as part of the do-minimum network). This bears further review to ensure that the method by which the monetary toll has been specified is consistent with the perceived user costs used in the assignment and demand estimation process.	Toll costs have been converted to a distance using the same process used to generalise ferry trip costs in the base model, using an assumed 15 km/h average speed and a $22.78/hr value of time (current EEM values as at 2013 base model development).
2.1.1	5th bullet point wording "Is responsive to changes in cycle infrastructure…" is retained from earlier reporting on earlier versions of the ACM that it is understood included an assignment response to new infrastructure, but did not included a demand response. Suggest clarifying this statement in the light that the updated ACM is understood to include a demand and assignment response to changes in cycle infrastructure.	Agreed – clarified in report

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
2.3.1	Given the discussion in the following paragraphs, should this section be titled '2016 Cycle Model', as it is in-fact a forecast from the 2013 base?	Agreed – clarified in report
2.3.2	Table 2 Comparison of Base Model and Count Data (as above should probably be 2016 Model as the Base model is understood to be for 2013).	Agreed – clarified in report
2.3.4	The two counts listed as south of King Street both show counts of around 100 cycles per day (cpd) compared to a modelled cycle volume of 36. As a minor point, it would be useful to note what distinguishes the two listed counts (date and / or location?). This is considered a significant discrepancy as the cycle volumes are the highest counted, but the lowest modelled.	The 2016 model forecasts 36 daily cyclists on Queen Street, all of which continue onto the city via the Northcote/Birkenhead ferry. The model additionally forecasts 59 daily cyclists using this ferry service via the Birkenhead ferry terminal. Summing these, the 88 daily cyclists forecast using this ferry service is a result of the 83 daily cyclists from surveys carried out by Auckland Transport in 2013 and included in the base model development, plus some land use growth to 2016. When developing the base model however, there was no data available to split the Northcote and Birkenhead components of these ferry users. This figure agrees relatively well with the 98 to 116 cyclists subsequently surveyed on Queen Street, and suggests that cyclists were in 2016 choosing to cycle onto the Northcote terminal via Maritime Terrace and Queen Street, rather than boarding at Birkenhead as the model predicts. This difference in trip assignment does not have an impact on the forecast models however, as with SkyPath in place, no cyclists are predicted to use either ferry service, with all existing such trips are predicted to transfer to SkyPath. The two differing counts on Queen Street were obtained in different weeks of November 2016.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
2.3.7	The model also poorly reflects counts on Lake Road between Exmouth Road and Onewa Road, the three sites averaging a count of 24 cpd compared to 64 modelled. Again, this warrants further explanation, consideration of implications for appraisal, and possible remedial action, such as zone splitting and / or centroid location adjustment to make demands less 'lumpy' in the vicinity of the proposed scheme and competing routes.	The model includes no north-south links between Lake Road and Birkenhead Avenue – a distance of some 1.6 km. In practice, there is an alternative local link immediately west of Lake Road (Woodside Avenue/Fowler Street), as well as several walkways through Kauri Glen Park that may be used by cyclists. Including these links in the model, and the Woodside Avenue/Fowler Street link in particular, would reduce modelled demands on this section of Lake Road in the 2016 model. The forecast models would likely be relatively unaffected however, as the Lake Road route receives separated cycle infrastructure and would be the preferred route for most cyclists.
2.4.1	Again, a minor point that given the previous sub-section related to 2016 demands, which are themselves a forecast from the 2013 base, this sub-section might be referred to as 'Future Year Cyclist Demands'?	Agreed – clarified in report
3.1.1	Whilst certainly not a flaw in the appraisal methodology, it is a significant limitation of the ACM, in terms of usefulness of the model and its interpretation, that the coded cycle speeds are, apparently not able to indicate cycle travel times. This is understood to be because the speed has been used as an indication of cycle facility attractiveness (subject to review of the ACM report). An alternative method would have been to use the 'KNOBS' facility to adjust costs to reflect the relative attractiveness of alternative cycle facilities on a link, leaving the speed to be indicative of the average cycle speed for a given standard of facility (and contributory to the overall perceived cost).	Agreed; however modelling cyclist travel times was not an intended output when the model was initially developed in 2014.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
3.1.2	The estimated travel times listed in Table 4 are used as the basis of the travel time benefits calculated, as described at section 4.1.1 of the Evaluation Report. Whilst this is considered a reasonable approach, and it is recognised that the assessed travel time benefits to not constitute a large proportion of the assessed benefits, these assumptions do bear review in relation to the scheme plans forwarded by AECOM. For example, from the scheme plans and current road network, it is understood that Option 2 has grade-separated crossings of slip roads and therefore no signalised intersections/crossings prior to Esmonde Road, whilst the reference case has 4 signalised crossing plus two further intersections (a roundabout and a give-way) where cyclists must give- way and incur delay.	The relatively high speeds recorded by the tube counters for the Northcote Safe Routes project was also noted by Flow – it may be that this route is currently popular with faster-than-average cyclists, and this data is not a fair representation of future SeaPath users. In light of this, the average speeds recommended (20-25 km/h) have been adopted. The estimated speeds have been corrected to include the intersection delays noted. Refer also item 3.1.3 which relates to the signalised crossing of Onewa Road.
3.1.3	The stated length of Option 2 also bears review (as also used in the model and economic assessment), which appears to be around 3.7km in the drawing chainage (and in our approximate measurement in Google Earth) compared to 3.5km adopted.	The difference in distance appears to relate to two different sets of plans. The modelling was carried out on an alignment that passed to the west of Onewa interchange, crossing Onewa Road at a signalised crossing. A subsequent alignment however passes straight through the interchange, with grade separated crossings of motorway ramps. This has affected the intersection delay assumed (see 3.1.2 above), but also the travel distance. A sensitivity test will be run on the 2026 model demands, to assess the scale of this change.
3.3.3	It is not understood why the total number of new daily cycle trips for Option 1 in 2046, with SkyPath tolling, should be less than in 2026, when other scenarios show an increase, this figure bearing review and explanation.	This is a rounding error, and both figures are in fact 204 daily cyclists. That is to say, there is no growth in new trips forecast from 2026 to 2046, and this is consistent with the outcome for Option 1 without SkyPath tolling. This suggests that the ART model has not predicted any significant growth in relevant[1] car or public transport trips between Northcote and Takapuna, despite the increase in land use activity forecast for both.

[1] Refer model development report for relevant trips included in model

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
3.4.1	A minor point, but the text says that the 2026 Option 1 distribution is obscured by the 2026 Option 2 distribution, but the latter doesn't appear in the graph key, suggesting the data is not referenced in the graph. From the key, it looks like the graph is not displaying either the 2046 Option 1 or 2026 Option 2 distributions.	Agreed – clarified in report
3.4.2	The trip length distributions illustrated generally look reasonable for the 2013 base model compared to the census data. It would be worth noting the implications of any consistency issues with how the model inter-zonal trip distances are calculated compared to the trip lengths derived from the 2013 census data (e.g. zone centroid lengths, basis of census-based lengths) and if these definitional differences might contribute to the difference in short trip lengths illustrated. This may best be addressed within the (currently not reviewed) ACM reporting. It would also be worth noting the author's explanation for the further increase in modelled shorter trips in future years.	The 2013 census trip length distribution is a representation of the uncorrected census travel to work matrices, assigned to the base modelled network. As such, all trip length distributions plotted have the same limitations (in terms of zone centroid lengths and network available), but are also directly comparable. It is difficult to pin point an exact explanation for the increase in forecast trips in the 1 to 4 km range, as there are many factors which affect this, including: ◆ The distribution of trips within the ART model, which would be expected to reduce in forecast years in response to intensification, particularly with regard to zones close to the city centre ◆ The trip length probability function applied to the Auckland Cycle Model (refer model development report) ◆ The demand elasticity process (refer model development report), where increases in cycle trips are proportional to reductions in distance and to improvements in 'relative attractiveness'. When applying these elasticities, trips between closely-spaced O-D pairs will proportionally increase to a greater degree than trips between distant O-D pairs, particularly given almost all cycle investment projects proposed to 2026 are less than 5 km long and CBD-centric.
4.2.2	We note that adopting a value of time based on the average of the EEM cycling commuting value and the lesser 'cycling for other purposes' value is conservative. We would suggest weighting the value to commuting in the same ratio as that assumed within SP11-7 for expansion of commuting trips to all trips (1.10% / 1.38%) would be reasonable. However, in practice the effects of this change to the overall economics are negligible.	Agreed – this has been adopted in the economics

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
4.2.3	As per comment above at 3.1, we consider the adopted minimum speeds bear review and could result in a small increase in the overall benefits given the average speeds in the reference case may be over-estimated.	Agreed – lower speeds adopted in economics
4.4.3	We would however note that SP11 does not apply a fully composite value of $1.45 (as indicated in the text), as the $0.05 attributed to safety is applied separately. This is in common with the same process applied in the SeaPath appraisal, which requires safety benefits to be applied to new and existing trips, unlike health and environmental benefits that apply only to new trips.	Agreed – clarified in report
4.6.2	We do however suggest further detail is provided on: ◆ the method by which trips have been removed from the SATURN model (if this uses SLA and / or the extent of the zones to which the trip reductions have been applied); ◆ some evidence of the derived decongestion values per vehicle-km; and ◆ The basis of the assumed car occupancy of 1.2.	Decongestion values have been obtained by removing a percentage of cross-harbour trips between Takapuna/Northcote and the CBD/Ponsonby from the NCI SATURN models. The average trip length removed was 8.5 km, and 100 trips were removed to identify a value per vehicle-km removed. Refer separate decongestion economics spreadsheet. The 2013 census commute to work car occupancy across Auckland was 1.06 persons per car, and 1.03 for trips originating in Northcote and Takapuna. The 1.2 assumed is conservative and allows for some future increase in ride sharing.
4.7.1	As a minor point, we note that the standard EEM appraisal period is 40 years from time zero (assumed to be 1st July 2018), but the benefit stream has been applied for 41 years. This serves to increase scheme benefits by just over 1.2%.	The final version of the report will not feature discounted benefits but instead only the 2026 and 2046 undiscounted benefits. AECOM will discount costs and benefits and compile the economic evaluation.
4.7.2	We further note the 'damping' of initial benefits, which are assumed to increase linearly from 0% to 100% over a 5 year period. We agree with this approach, though the figures adopted are likely to be perhaps overly conservative, with, for example benefits in year 2 of the scheme only being 40% of their calculated value. Alternative 'damping' assumptions we have tested do however make relatively little difference to the assessed overall discounted benefits (around a 2% increase).	As above

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
5.1	Given the evolving nature of the appraisal process, the improved documentation provided and yet to be reviewed, and that peer review feedback to date has been described as 'preliminary' pending a more detailed and 'final' review when further information is submitted, we suggest that the text of section 5 is modified to reflect the evolving, staged process, rather than being the subject of two separate reviews	Agreed – clarified in report

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Memorandum

To:	Section 9(2)(a) (Flow)
From:	Section 9(2)(a)
Subject:	SeaPath Demand and Economic Benefit Evaluation Peer Review: Working Note 3 (Review of Auckland Cycle Model Report August 2018)
Date:	Tuesday 28th August 2018
Copy:	Section 9(2)(a) (Aecom), Section 9(2)(a) (Aecom), Out of scope (NZ Transport Agency)

Dear Section 9(2)(a)

0 Introduction

0.1 As you are aware, QTP Ltd. have been appointed to assist the NZ Transport Agency (the Agency) in development of the business case for the SeaPath Shared Use Path, with a specific focus on a review of the supporting modelling and economics.

0.2 The Peer Review is an ongoing process, with the review to date comprising the following key components:

- A review of the Draft methodology proposed (17th October 2017) reported in a Draft QTP Working Note 1 (dated 3rd November 2017);
- Subsequent discussion and agreement on issues and actions, as captured in the Flow Technical Note of 9th November 2017, and reflected in an updated QTP Working Note 1 (dated 9th November 2017); and
- QTP's preliminary review, by way of emailed comments on 14th December 2017, of version A of the Demand Assessment and Economic Benefit Evaluation report of the same date.
- QTP's Working Note 2 (dated Friday 17th August 2018) providing initial feedback on the updated Demand Assessment and Economic Benefit Evaluation report (the '**Evaluation Report**') dated 27 July 2018

0.3 Working Note 2 noted that the Auckland Cycle Model (**ACM**) appeared to have been modified substantially since the process and methodologies involved in the estimation of cycle demands were documented at a reasonably high level back in December 2014 for what was the equivalent of an Indicative Business Case (**IBC**) level of appraisal. As the assumptions and methodologies adopted within the ACM are greatly influential to the appraisal of the economic benefits of the scheme, it was requested that a separate, updated report be prepared by Flow, as the developers of the ACM, documenting the development of the updated ACM. To that end, the ACM Model Development Report (**MDR**) was provided by Flow on Thursday 16th August.

0.4 The purpose of this Memo is to provide initial feedback to the project team on the MDR, with particular consideration of how the assumptions and methodologies employed may affect the SeaPath Economic Benefit Valuation.

0.5 The ACM confirms substantial changes have been made to the model since last documented, including modelling the demand-response to proposed cycle infrastructure, rather than relying on exogenous mode-share targets.

0.6 We re-iterate that we consider the development and use of the cycle model for appraisal to be a significant improvement over alternative procedures, such as Economic Evaluation Manual (**EEM**) Simplified Procedures or the application of NZ Transport Agency Research Report 340.

0.7 We support the use of relatively simple modelling techniques with increasing model complexity only being justified where model forecasts are considered to provide substantially improved accuracy.

0.8 The section numbers below generally reflect those of the MDR (but not the paragraph numbers). Second-level headings in grey-blue (for example, **3.1 Model Extent**) are introduced in this review to identify the subject-area, whereas those in black (for example, **4.1 Methodology**) reflect the structure of the MDR.

1 Introduction

1.1 The report lists some 16 cycle infrastructure projects for which the ACM has been used to estimate cycle demands. The widespread use of the model highlights its potential usefulness and the importance of robust appraisal for the substantial investment in cycle infrastructure proposed.[1]

2 Input Data Used

2.1 The wide range of data sources is noted. The use of the UK-based Department of Transport data to convert daily trips to peak period trips appears to be at odds with the rest of the data which is New Zealand-based. It would seem that local data, possibly derived from a number of cycle counts, might be more appropriate to scale total forecast cycle demands to peak hours (as described in section 4.1 of the MDR).

3 Modelled Network

3.1 Model Extent

3.1.1 The extent of the modelled network appears sufficient to capture potential cycle demands on SeaPath (and SkyPath).

[1] The Auckland Cycling Programme Business Case recommends an investment of $635m over the period 2018-2028.

3.2 Model Resolution

3.2.1 As noted in previous reviews, the model resolution is generally coarse, in terms of both the network representation and the modelled zone structure. We do however note that zone structure has been refined in the lower North Shore. Whilst the coarse zone and link structure is considered to limit the accuracy to which modelled cycle demands on a given section of road may be modelled, the limitation is not considered to have a significant impact on the purpose of the model for the SeaPath economic evaluation. Overall, the resolution is generally sufficient to model the overall impacts of the scheme on cycle demands and changes in cycled distance between the reference case and scheme options.

3.3 Model Periods

3.3.1 Only morning and evening peak periods are modelled, with estimates of daily cycle demands (and therefore benefits) derived from these periods. The report states that insufficient count data was available for the development of an interpeak model. Perhaps more importantly, the derived cycle demands depend on a probability function fitted to census journey to work trip distances that may not be appropriate for an interpeak model.

3.4 Cycle Network Representation

3.4.1 The MDR confirms that the cycle network is represented by links with speeds based on a relative attractiveness. These act in a similar way to speeds, but serve to differentiate between cycle facilities of different standards in terms of attractiveness in a similar manner to the valuation of the resulting travel time as applied in the EEM[2].

3.4.2 As noted in Working Note 2, whilst certainly not a flaw in the appraisal methodology, it is a significant limitation of the ACM, in terms of usefulness of the model and its interpretation, that the coded cycle speeds are not able to indicate cycle travel times. An alternative method would have been to use the 'KNOBS' facility to adjust costs to reflect the relative attractiveness of alternative cycle facilities on a link, leaving the speed to be indicative of the average cycle speed for a given standard of facility (and contributory to the overall perceived cost).

3.4.3 We note that the attractiveness values applied in the model provide relatively little difference in attractiveness between different levels of cycle provision compared to those of the EEM. We further note however note that the subsequent calculation of economic benefits does use the same values of attractiveness as the EEM, the relative attractiveness applied in the model influencing cycle demand and routing. For example, the EEM assumes a relative attractiveness of 2.0 for an off-street cycle path and 1.0 for on-street cycling with no marked cycle lane, implying a 50% reduction in travel time costs as a result of providing a cycle path. By contrast, the ACM assumes an attractiveness of 15 for a high standard cycle path such as SeaPath, reducing to 11-12

[2] Appendix A20 Cycle demand analysis Table A20.2.

for arterial on-road cycling, yielding only a 23% reduction in costs. In fact, because model assignments have been undertaken using both time and distance as components in the cycle 'cost', the cost relativity diminishes slightly further, in this example being a 22% reduction in costs.

3.5 Cycle Trip Assignment

3.5.1 The report notes that the assignment within the modelling uses an 'all or nothing' assignment, rather than stochastic distribution (around the least-cost route). Stochastic assignments are considered to potentially be a very useful method of introducing some variability in cycle assignments given that assignments are undertaken as a single class of cyclists. Different users for different purposes (or sometimes exactly the same cyclists on different trips) will choose different routes as they value time and amenity / safety differently. Further explanation on the choice of this assignment technique is suggested.

3.6 Ferry Route Representation

3.6.1 The various cross-harbour ferry routes are represented in the model as valid routes for cyclists. We note that equivalent Ferry crossing distances have been calculated to convert crossing times and fares to modelled cycle distances. The EEM standard value of time has been used, which is at odds with the economic appraisal, as this includes a proportion of 'on employers' business' trips. Thus the value of time applied at $22.78 is more than double that applied in the appraisal ($10.80) and warrants explanation.

4 2013 Base Model

4.1 Methodology

4.1.1 The text directly above Table 2 may be a remnant from previous reporting. Second to last sentence bears review as it is understood the inclusion of different trip types does affect the overall cycle demand numbers.

4.1.2 It would be extremely useful to know how the 'pool of potential cycle trips' compares to the total ART model trips, and the resulting factor by which the home-based work trips are expanded to represent all cycle trips. Suggest modifying the table columns to Trip Types, Total Trips, Proportion Included, Included Trips, and an added row with Totals. This becomes important in understanding how the model accounts for mode shift (section 5.3 of the report) and allows an understanding / sense-check on the applied expansion of commuting trips to all purposes.

4.1.3 As noted at paragraph 2.1 above, it would be useful to understand why the factoring of daily cycle demands to period cycle demands is based on UK travel statistics, rather than local counts.

4.1.4 The adjustment of home-based education cycle trips to better match observed trips is a pragmatic adjustment to modelled demands. I've been unable to locate the referenced 2013 traffic count data used for this purpose. It is suspected that the relatively few

schools to which this adjustment has been applied (9 schools for which cycle volumes greater than 50 students cycles are recorded) is a function of the limited survey data, rather than only 9 schools in Auckland having more than 50 students cycle to school. As the adjustment has been applied to the morning peak hour only, this would suggest that daily cycle volumes near to schools, based on the peak hour models, do not fully include this adjustment as the return trip from schools is effectively missing.

4.1.5 Ideally, schools to/from educational establishments would be estimated as a separate class of cyclists given they are significant in number, have different cycle trip-lengths to commuters and tend to take the safest routes through the network. However, for the purpose of assessing the cycle demands and economic benefits of SeaPath, trips to school are not considered likely to represent a large component of the assessed economic benefits.

4.1.6 The reflection of high cycle demands on popular recreational cycle routes as fixed demands is considered a pragmatic approach to reflecting these trips that do not relate to modelled origin and destination zones. It is noted that SeaPath is likely to attract a number of recreational users and in this regard potential demands for SeaPath (and SkyPath) are likely to be under-estimated in the model. Because health benefits accrue to all cycle facility users, this could represent a significant under-estimation of scheme benefits. Whilst a conservative approach, suitably conservative estimates of recreational users could be added to the model and / or the economic appraisal through reference to current use on other facilities and possibly the SkyPath Transport Assessment Report.

4.2 Matrix Estimation

4.2.1 The controls specified as 'tempering' the Matrix Estimation (**ME**) process are somewhat loose, being the default seed values (zero) and the default XAMAX (zonal pair adjustment factors to satisfy each link count) value of 5. Where a large number of counts is used, each zonal pair may get factored for each count it passes through and in this regard tighter values are recommended for conventional traffic models (the SATURN manual suggest a value of 2). It is however recognised that the difficulties in estimating cycle demands may warrant greater flexibility in the demand factoring applied. Rather than revisiting the matrix estimation process, it is suggested in the first instance that the effects of matrix estimation on cycle demands are reported at a geographical sector level to identify how the matrix estimation is changing the prior estimates of demand.

4.2.2 Sector matrix changes are best presented using a sector system with a maximum of 10 sectors and should include central Auckland and the North shore as discrete sectors.

4.2.3 This information would supplement the flow and trip-length distribution effects of ME already provided in the reporting that do appear reasonable.

4.3 Model Validation

4.3.1 The validation process is stated to use counts that are independent of the ME process. This is highly desirable, but further information is requested:

i. Are the validation counts at different locations to those of the ME process, or just for different dates?
ii. What is the rationale in deciding which counts are used for ME and which for model validation?
iii. Model plots showing counts used for ME and model validation (similar to those of Appendix A, but with the count set used for validation illustrated in a different colour).

4.3.2 The presented validation of the model illustrating the coefficient of determination (**R^2**) and the line of best fit illustrate that the model appears to be reflecting observed traffic volumes reasonably well.

4.3.3 We would further agree that the use of the GEH error statistic is not suitable for cycle models and the NZ Transport Agency's Transport Model Development Guidelines (**TMDG**) targets for the % Root of the Mean Squares of the Errors (**%RMSE**) are questionable with regards to cycle models.

4.3.4 An alternative measure is suggested to supplement the R^2 and slope values to provide an indication of the typical accuracy of the model. The simple measure suggested is the % Mean Absolute Error (**%MAE**). This is simply the average (or sum) or the absolute errors (between modelled and observed flows) divided by the average (or sum) of the observed flows. The measure is simple to calculate and interpret, being indicative[3] of typical model accuracy. Whilst little used for traffic models, it is suggested that this simple measure provides a far more interpretable measure of typical accuracy than the %RMSE that would be applicable for a wide range of models.

4.3.5 A general recommendation is that a tabulation of counts, modelled flows and differences is provided, as is usual practice in a model validation report. Outliers should be highlighted and explanations provided (preferably pre and post ME). Whilst for SeaPath a comparison of observed and modelled flows local to the project is provided in the Appraisal Report, a tabulation of count vs modelled flows allows the variation in the area if interest to be viewed in the context of the wider comparison (and further checks to be made of all counts and model flows in the area of influence of a scheme).

5 Forecast Model Demands

5.1 Methodology

5.1.1 We agree with the overall approach now implemented in the ACM where changes in demand reflect both landuse growth and a mode-shift response to infrastructure

[3] The measure is only indicative of model accuracy because it is based on the sum (or average) of the absolute errors and counts, rather than summing (or averaging) the % error for each count. This is to avoid very small counts and flows with very high % errors biasing the overall model error statistic. As such, it is a 'weighted' measure.

investment. This is a fundamental change to the demand forecasting capabilities of the model since they were last documented in December 2014, where future cycle demands were based on aspirational mode-share targets and it is understood that the cycle demand growth did not reflect future landuse patterns.

5.2 Accounting for Land Use Growth

5.2.1 The growth is stated (in the AM peak) for each ij cell to be based on the average of the residential growth in the origin zone and the forecast employment growth in the destination zone. The problem with this approach is that it implies growth to trip ends that may not occur. For example, consider an expanding new residential suburb where the population is forecasts to double, and a built-out employment zone where no further employment is anticipated. The methodology assumes a growth in trips to the employment zone equating to 50% of the base residential zone. For this reason, Furnessing trip ends would be more appropriate (based say on the growth in trip ends from the ART model).

5.2.2 The methodology applied is not a fatal-flaw, but does serve to reduce the accuracy of forecasting potential cycle demand patterns associated with growth areas (residential and employment growth).

5.3 Accounting for Mode Shift

5.3.1 The ACM adopts an unconventional approach to the modelling of mode-shift in response to improved cycle infrastructure. The approach adopted is to identify a matrix of 'potential' cycle demands and then to factor these demands to estimate additional trips (beyond a reference case, understood to be 2013). Additional trips are estimated based on both the change in distance between OD pairs and the change in attractiveness. A distance-based elasticity and a relative attractiveness elasticity are stated to have been applied to estimate the additional trips in response to the changes in distances and attractiveness.

5.3.2 The adopted methodology differs from a conventional modelling approach in that, by definition, elasticities apply to **reference case** demands to estimate how they will change in response to a change in some measure (usually transport 'costs') between the same reference case and the future scenario. Hence the method applied does not really use elasticities in the conventional sense, instead applying **factors** to the pool of future demands.

5.3.3 The issue with the approach taken is that neither the potential cycle demands nor the factors used for the demand response can be readily related to data-sources for the purpose of sensibility checks. In essence, the potential cycle demands are likely to be far higher than current cycle demands (subject to requested quantification – refer 4.1.2 above) or even estimated future mode share and the factors are likely to be far lower than typical elasticities, in order to achieve a realistic response.

5.3.4 Whilst it would be my strong preference to explore alternative methods that would

provide greater confidence in the mode-shift response, this view is tempered to some degree by the data presented at Figures 5 and 6 and Table 6 of the MDR that do provide some validation of the model's predictive capabilities based on before and after cycle-counts at a number of cycling improvement projects.

5.3.5 From Figure 5, the ACM provides a very impressive estimation of cycle volumes for some seven schemes implemented between 2013 and 2016, particularly when bearing in mind daily and seasonal count variations. Effectively, as described at section 5.4 of the MDR, the response factors have been adjusted as a method of calibrating the model's response to infrastructure improvements.

5.3.6 Due to the fundamental nature of this potential issue with the demand forecasting capabilities of the ACM, I have liaised directly with Flow regarding my concerns and their rationale for the methodology employed. In short, Flow have advised that the methodology employed was viewed as being less sensitive than alternative methodologies that apply elasticities to current cross-harbour trips that are greatly suppressed due to the impediments posed by use of the Ferries and / or long alternative routes via the Upper Harbour Bridge. Whilst I understand this concern, the majority of the demand response could be reflected using the trip length probability function already developed for the ACM based on current census trip lengths (refer Figure 3 of the MDR), with appropriate treatment of ferry tolls, crossing times and wait times to convert these to distances (or costs).

5.3.7 In practice, I understand the model has evolved from humble beginnings in 2014 with limited scope in relation to subsequent updates. Should the model be subject to further comprehensive updates, I would suggest an alternative method of demand response to improved infrastructure be trialled. As such, whilst the approach adopted is unconventional, I accept that the data presented in section 5.4 of the report does serve to provide some validity to the predictive capabilities of the model in response to new infrastructure which greatly reduces the risk of inaccurate cycle demand forecast in application of the ACM in its current form.

5.3.8 Further evidence of the 'sense' of the modelled response to infrastructure improvements is provided in section 5.3.5 of the MDR. The modelled responses of demands to more comprehensive cycle infrastructure measures represented within the ACM are compared to reported international effects of infrastructure on cycle demands. The ACM responses appear credible, generally being on the conservative side of international experience. I would however note the difficulty in obtaining credible data that relates only to the demand response of new facilities rather than including the results of re-assignment of cycle trips from current routes on to new facilities, which can tend to over-estimate the reported cycle demand response.

Network Effects

5.3.9 A further factoring of potential cycle trips has been introduced into the model to account for potential modal shift for a comprehensively developed cycle network potentially being greater than the sum of incremental demand increases for each cycle

infrastructure upgrade.

5.3.10 The methodology identifies model zones than are relatively well connected by cycle infrastructure to other zones within 5km. In simple terms, a model zone connected by high quality infrastructure (modelled as speeds) to all other zones within 5km would be subject to a doubling of potential demands whilst a poorly connected zone has no further factoring of demands (a factor of 1) with intermediate levels of infrastructure being subject of an interpolated factor (based on the modelled speed as a proxy for cycle infrastructure attractiveness).

5.3.11 Given the uncertainty surrounding the assumptions (the distance used and the factors) and the scale of anticipated response, I have liaised further with Flow on the rationale applied.

5.3.12 In essence, Flow have advised of the desire for the model to capture increased cycling as a viable mode, particularly for 'tours' of trips, once a comprehensive network of cycle infrastructure (including 'quiet routes') is in place. The rationale is that where an impediment exists for one tour leg (for example, work to gym) this potentially supresses cycling as a viable mode for the complete tour (for example home to work to gym to home). Hence once a viable cycling network is available for the whole 'tour', a step-change in cycle use could be anticipated.

5.3.13 Whilst I understand the potential effects attempting to be captured by this methodology, my question then becomes 'is this additional complexity sufficiently robust to provide more accurate forecasts and what are the effects of invoking the Network Effects for this appraisal?' There are many unknowns / guesstimates with the process: a 5km extent, how the attractiveness is applied, possibility of double-counting attractiveness effects and the appropriateness of the elasticities applied to a potential cycle demand. It is quite possible we could see perverse effects where a zone becomes connected in one direction to a new facility and results in an increase in demands in the opposite direction on an improved arterial road. Furthermore, the implementation doesn't appear to reconcile with the 'step-change' rationale provided, as the increase in demand is applied on a sliding scale.

5.3.14 Accordingly, I am not able to conclude that the implementation of 'Network Effects' does improve the accuracy of the modelling and therefore don't consider the additional complexity justified in this instance.

5.3.15 Flow have confirmed that the impacts of the Network Effects module on the SeaPath modelled demands is relatively small, increasing demands on SeaPath by around 4% in 2026 and 6% in 2041. If there is a strong desire to include this module in the SeaPath appraisal process, my recommendation is that this is included as a sensitivity test to the assessed benefits and that this does not form part of the 'central' modelling of the options.

5.4 2016 Model Calibration

5.4.1 In addition to the calibration of the relative attractive factor (noted at 5.3.5, above) it is noted that evening peak period 'growth' is reported to be dampened by 10%. Please confirm if this relates to the infrastructure demand response growth, or total growth between the base and future models. If this applies to total growth, please provide further rationale on why this is considered necessary given that this is based on a limited model calibration exercise, understood to apply only to growth between 2013 and 2016, at a few count locations. The concern is that longer-range forecasts may be significantly reduced (10%) based on this limited calibration exercise that might relate more to quirks of the limited dataset (daily and seasonal count variations, for example), rather than being reflective of a genuine trend in (long-term) model over-estimation of demands in the PM peak hour.

5.4.2 As noted at 5.3.5 above, the comparison of (calibrated) modelled flows to counts at seven sites on improved cycle routes, as provided in Figure 5 of the MDR is very impressive. Whilst the comparison of modelled flows to counts on unimproved routes is also generally good, please provide comment on the reasons for the very high over-estimation of cycle flows at Grafton Road in 2016 and the under-estimation of flows on the NW Cycleway Kingsland in 2016.

5.4.3 As noted in previous reviews, Table 6 is considered a powerful demonstration of why developing a cycle model is a cost-effective investment for estimating future cycle demands (and benefits) given the shortcomings of alternative procedures that may grossly over-estimate potential cycle demands, particularly for on-street facilities.

6 Model Limitations

6.1 The model limitations are noted and we are in generally agreement with these. In relation to these, we make the following points for clarification:

i. We note the limitations of in the modelling of recreational trips. It is understood that no specific estimate of recreational trips for SeaPath (or SkyPath) are implemented in the model. Whilst we are comfortable with this as the basis of a conservative appraisal of potential demands and benefits, we suggest (refer 4.1.6 above) a suitably conservative estimate of recreational trips for SeaPath (and SkyPath) applied to fixed routes could be made.

ii. In relation to the above, we note the reported need for care required in factoring peak (commuter) model outputs to estimate daily demands for SkyPath. How is this consideration applied for the SeaPath appraisal?

iii. We note the recent update to the ART model to include trips to park and ride facilities. Whilst beyond the scope of the current appraisal and therefore does not require further consideration of this issue at this stage, we note that there could be some complications in how park and ride trips are reflected within the cycle model, depending on how cycle trips that may use a park and ride facility are captured in the Census J2W data, the expansion of cycle commuting trips to all trip types and future forecasting.

6.2 Finally, in addition to the listed model limitations, we would note the following further key limitations:

- The accuracy of the modelled cycle volumes is limited to some degree by the relatively coarse nature of the ACM in relation to zone size and network resolution;
- The ACM provides broad estimates of total cycle demands but the model architecture does not lend itself to accurate modelling of education-related cycle trips which have a different trip length distribution to commuting trips, have different assignment characteristics in generally being prepared to take longer, safer routes on cycle infrastructure, and the growth of which is not reflected well in the current demand forecasting process; and
- The future demand forecasts use some unconventional processes in estimating potential response to new infrastructure change and future landuses that bear exploration of alternative techniques in any future comprehensive update of the ACM.

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technical note

PROJECT	**SEAPATH DEMAND MODELLING AND ECONOMICS**
SUBJECT	**RESPONSE TO PEER REVIEW WORKING NOTE 3**
TO	Section 9(2)(a) Section 9(2)(a) **(AECOM),** Out of scope **(NZTA),** Section 9(2)(a) **(QTP)**
FROM	Section 9(2)(a)
DATE	29 AUGUST 2018

The following technical note documents the response to, and subsequent actions, the peer review of the "SeaPath Shared Path: Demand Assessment and Economic Benefit Evaluation" report. The peer review was carried out by Section 9(2)(a) of Quality Transport Planning (QTP), and is documented in the "SeaPath Demand and Economic Benefit Evaluation Peer Review: Working Note 3" memorandum.

The numbering within this document follows that used in QTP's Working Note 3.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
3.5.1	The report notes that the assignment within the modelling uses an 'all or nothing' assignment, rather than stochastic distribution (around the least-cost route). Stochastic assignments are considered to potentially be a very useful method of introducing some variability in cycle assignments given that assignments are undertaken as a single class of cyclists. Different users for different purposes (or sometimes exactly the same cyclists on different trips) will choose different routes as they value time and amenity / safety differently. Further explanation on the choice of this assignment technique is suggested.	The relative attractiveness scale applied to links within the model has been calibrated, and the overall model validated, using the 'all or nothing' assignment documented. While developing multiple user classes to represent different cyclist types would provide another level of depth to the model, it would require the relative attractiveness scale to be re-calibrated, due to the changes in route assignments that it would create. This suggestion will be considered when next the model is substantially updated.
3.6.1	The various cross-harbour ferry routes are represented in the model as valid routes for cyclists. We note that equivalent Ferry crossing distances have been calculated to convert crossing times and fares to modelled cycle distances. The EEM standard value of time has been used, which is at odds with the economic appraisal, as this includes a proportion of 'on employers' business' trips. Thus the value of time applied at $22.78 is more than double that applied in the appraisal ($10.80) and warrants explanation.	The value of time applied to ferry fares of $22.78 was set during the initial model build and calibration in 2014, based on the standard value of time for travel of all purposes. A lower value of time was later adopted for subsequent economic evaluation purposes, but the earlier ferry fare calibration was not corrected. If a lower value of time was applied to the ferry fares (ie $10.80 per hour), then each ferry fare would be represented by a longer travel distance within the ACM. For the assessment of SeaPath, this correction would make the existing ferry routes less attractive, and result in higher demands on SeaPath. In this regard, the use of a higher value of time for ferry fares has resulted in more conservative estimates of demands on SeaPath. We do not propose revising the modelling, but retaining the conservatism that the above assumptions provide.
4.1.1	The text directly above Table 2 may be a remnant from previous reporting. Second to last sentence bears review as it is understood the inclusion of different trip types does affect the overall cycle demand numbers.	It is correct that this is a remnant from previous reporting. This sentence will be removed in the final report.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
4.1.2	It would be extremely useful to know how the 'pool of potential cycle trips' compares to the total ART model trips, and the resulting factor by which the home-based work trips are expanded to represent all cycle trips. Suggest modifying the table columns to Trip Types, Total Trips, Proportion Included, Included Trips, and an added row with Totals. This becomes important in understanding how the model accounts for mode shift (section 5.3 of the report) and allows an understanding / sense-check on the applied expansion of commuting trips to all purposes.	The table will be expanded as suggested in the final report.
4.1.3	As noted at paragraph 2.1 above, it would be useful to understand why the factoring of daily cycle demands to period cycle demands is based on UK travel statistics, rather than local counts.	The UK data was used to convert daily commute data to peak period commute trips, and the UK DOT publishes this data (ie 24 commute profiles by hour). This could not be obtained from local counts without interviewing cyclists (over a 24 period) what their travel purpose was (commute or other).
4.1.4	The adjustment of home-based education cycle trips to better match observed trips is a pragmatic adjustment to modelled demands. I've been unable to locate the referenced 2013 traffic count data used for this purpose. It is suspected that the relatively few schools to which this adjustment has been applied (9 schools for which cycle volumes greater than 50 students cycles are recorded) is a function of the limited survey data, rather than only 9 schools in Auckland having more than 50 students cycle to school. As the adjustment has been applied to the morning peak hour only, this would suggest that daily cycle volumes near to schools, based on the peak hour models, do not fully include this adjustment as the return trip from schools is effectively missing.	Comprehensive school bike shed count data was provided by Auckland Transport. The reviewer is correct however in that estimates of daily cyclists near schools will be low, as the afternoon trip falls outside the evening peak model.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
4.1.6	The reflection of high cycle demands on popular recreational cycle routes as fixed demands is considered a pragmatic approach to reflecting these trips that do not relate to modelled origin and destination zones. It is noted that SeaPath is likely to attract a number of recreational users and in this regard potential demands for SeaPath (and SkyPath) are likely to be under-estimated in the model. Because health benefits accrue to all cycle facility users, this could represent a significant under-estimation of scheme benefits. Whilst a conservative approach, suitably conservative estimates of recreational users could be added to the model and / or the economic appraisal through reference to current use on other facilities and possibly the SkyPath Transport Assessment Report.	Manually applying fixed demands to represent recreational trips across the Auckland Harbour Bridge was considered in the assessment. This approach was not applied however, to maintain a conservative model.
4.2.1	The controls specified as 'tempering' the Matrix Estimation (ME) process are somewhat loose, being the default seed values (zero) and the default XAMAX (zonal pair adjustment factors to satisfy each link count) value of 5. Where a large number of counts is used, each zonal pair may get factored for each count it passes through and in this regard tighter values are recommended for conventional traffic models (the SATURN manual suggest a value of 2). It is however recognised that the difficulties in estimating cycle demands may warrant greater flexibility in the demand factoring applied. Rather than revisiting the matrix estimation process, it is suggested in the first instance that the effects of matrix estimation on cycle demands are reported at a geographical sector level to identify how the matrix estimation is changing the prior estimates of demand.	A sector analysis will be added to the model development report.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
4.3.1	The validation process is stated to use counts that are independent of the ME process. This is highly desirable, but further information is requested: i. Are the validation counts at different locations to those of the ME process, or just for different dates? ii. What is the rationale in deciding which counts are used for ME and which for model validation? iii. Model plots showing counts used for ME and model validation (similar to those of Appendix A, but with the count set used for validation illustrated in a different colour).	i. Counts were a combination of different sites, and sites that had been surveyed more than once – generally where an intersection was surveyed in Auckland Transport's March 2013 survey programme, then surveyed a second time for a specific project, or where an automated count was also available. ii. For the most part, counts were split randomly between estimation and validation. iii. These will be added to the model development report.
4.3.4	An alternative measure is suggested to supplement the R2 and slope values to provide an indication of the typical accuracy of the model. The simple measure suggested is the % Mean Absolute Error (%MAE). This is simply the average (or sum) or the absolute errors (between modelled and observed flows) divided by the average (or sum) of the observed flows. The measure is simple to calculate and interpret, being indicative3 of typical model accuracy. Whilst little used for traffic models, it is suggested that this simple measure provides a far more interpretable measure of typical accuracy than the %RMSE that would be applicable for a wide range of models.	This measure will be added to the model development report.
4.3.5	A general recommendation is that a tabulation of counts, modelled flows and differences is provided, as is usual practice in a model validation report. Outliers should be highlighted and explanations provided (preferably pre and post ME). Whilst for SeaPath a comparison of observed and modelled flows local to the project is provided in the Appraisal Report, a tabulation of count vs modelled flows allows the variation in the area if interest to be viewed in the context of the wider comparison (and further checks to be made of all counts and model flows in the area of influence of a scheme).	This table will be added to the model development report.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
5.3.15	Flow have confirmed that the impacts of the Network Effects module on the SeaPath modelled demands is relatively small, increasing demands on SeaPath by around 4% in 2026 and 6% in 2041. If there is a strong desire to include this module in the SeaPath appraisal process, my recommendation is that this is included as a sensitivity test to the assessed benefits and that this does not form part of the 'central' modelling of the options.	The 4% to 6% increase in demands due to network effects is considered conservative, given that the development of Auckland's cycle network is currently in its infancy. The observed response between infrastructure investment and demands from 2013 to 2016 against which the model's forecasts are calibrated, are reasonably expected to accelerate in the future as the cycle network gains connectivity and cycling becomes a normalised activity. We also note that the 4% to 6% demand effect is countered by the opposing conservative factors such as those in 3.6.1 and 4.1.6 above. It is further noted that as the network effects also apply to the future Reference Case, the net effects on the project's benefit appraisal are likely to be insignificant. Flow do not recommend removing network effects from the assessment.
5.4.1	In addition to the calibration of the relative attractive factor (noted at 5.3.5, above) it is noted that evening peak period 'growth' is reported to be dampened by 10%. Please confirm if this relates to the infrastructure demand response growth, or total growth between the base and future models. If this applies to total growth, please provide further rationale on why this is considered necessary given that this is based on a limited model calibration exercise, understood to apply only to growth between 2013 and 2016, at a few count locations. The concern is that longer-range forecasts may be significantly reduced (10%) based on this limited calibration exercise that might relate more to quirks of the limited dataset (daily and seasonal count variations, for example), rather than being reflective of a genuine trend in (long-term) model over-estimation of demands in the PM peak hour.	This dampening has been applied to 2013 to 2016 growth only.

Table 1: Summary of Actions/Responses

Item	QTP comment	Flow response/Action
5.4.2	As noted at 5.3.5 above, the comparison of (calibrated) modelled flows to counts at seven sites on improved cycle routes, as provided in Figure 5 of the MDR is very impressive. Whilst the comparison of modelled flows to counts on unimproved routes is also generally good, please provide comment on the reasons for the very high over- estimation of cycle flows at Grafton Road in 2016 and the under-estimation of flows on the NW Cycleway Kingsland in 2016.	The Northwestern cycleway result may be the result of school children cycling to the nearby Newton School, but also the result of the model assigning Sandringham Road cyclists to New North Road rather than the cycleway. With regard to the Grafton Road site, the model predicts small increases in cyclists using Carlton Gore Road, the Domain and Grafton Road as a route Between Newmarket and the city, and this aligns with anecdotal evidence. This is not replicated in the count data, and it is suspected that uphill cyclists on Grafton Road either use the footpath or cycle in the right hand traffic lane in order to turn right into the Grafton Gully cycleway. Both users would miss the counter in the kerbside lane.
6.1.ii	In relation to the above, we note the reported need for care required in factoring peak (commuter) model outputs to estimate daily demands for SkyPath. How is this consideration applied for the SeaPath appraisal?	Peak period demand estimates have been factored to daily estimates by applying the factor obtained from data on Tamaki Drive – a similarly recreational waterfront route.

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