# Technical Note

| | | | |
|---|---|---|---|
| **By:** | [redacted] | **Date:** | 7 December 2015 |
| **Subject:** | SH88 Shared Path - Economic Analysis (SP11) | **Our Ref:** | 3384403 |

## Introduction

The extension of the SH88 shared use path from St Leonards the rest of the way to Port Chalmers is expected to provide a safer off-road cycle and walking path compared to the current alternative of using SH88.

Although this work is split into two stages, it has been evaluated as a single combined package of works, as the majority of the benefits only accrue once both stages have been completed.

### Previous Evaluation

An economic evaluation of the project was undertaken during the Scheme Assessment phase in February 2014. At that stage the cost of the scheme was considerably lower than the current estimate, with a total package cost of $7M.

This evaluation produced a BCR for the complete works of 4.2.

### Cycle Demand

#### Existing Cyclist Demand and Growth

Cyclist numbers on the existing Ravensbourne Harbour Cycle Way were surveyed by the NZ Transport Agency over a two hour period on the afternoon of Wednesday 4th February 2014, between 5:45 and 7:45pm, and are reported in Dunedin One Way System (SH1) Cycle Survey Report issued in March 2014. These results, along with those from the previous two years, are shown in **Table 1**.

**Table 1: Observed Cyclist Numbers on Ravensburne Harbour Cycle Way [2 hours]**

| Year | To Maia | To City | Combined | Commuters | Daily* | Growth Rate (pa) |
|---|---|---|---|---|---|---|
| 2014 | 68 | 35 | 103 | 33 | 226 | 62% |
| 2013 | 25 | 9 | 34 | 16 | 66 | -26% |
| 2012 | 36 | 10 | 46 | 26 | 81 | |

* See below and **Table 2** for daily calculation.

With the survey being undertaken towards the end of the evening peak period, it is likely to have included both commuting cyclists heading home and recreational cyclists enjoying a ride along the harbour. For the recreational cyclists, it is highly likely that they were on round trips, heading out along the harbour and back again. Although these cyclists will probably have been counted twice, they will also have probably travelled twice the distance of the commuters making their one way trip home.

The number of commuter cyclists has been estimated as the difference in the number of cyclists heading away from the city and the number heading to the city.

**Table 2** shows the calculation of the daily number of commuter and recreational cyclists, with recreational cyclists split between those riding on a weekday and those riding on a weekend (or public holiday) day. The 2014 totals then form the basis of the daily cyclist numbers shown in **Table 1**, which use a weighted average based on 245 weekdays and 120 non-weekdays per year. This is then reduced by 25% to reflect the effects of colder weather during half of the year i.e. during these colder months, assumed that only half of the daily cycle trips are still made.

**Table 2: Calculated Cyclist Numbers by Period and Type**

| | Commuters | | | Recreation - Weekday | | | | | Recreational - Weekend | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **AM** | **PM** | **Total** | **Bal** | **AM** | **IP** | **PM** | **Total** | **Day** | **Total** |
| 2014 | 33 | 33 | **66** | 70 | 35 | 140 | 70 | **245** | 280 | **280** |
| 2013 | 16 | 16 | **32** | 18 | 9 | 36 | 18 | **63** | 72 | **72** |
| 2012 | 26 | 26 | **52** | 20 | 10 | 40 | 20 | **70** | 80 | **80** |
| **Expansion Factors** | | | | | 0.5 | 2 | 1 | | 4 | |

The observed growth rate between 2012 and 2014 reported in **Table 1** is very high at 62% per annum. This has most likely been influenced by the relatively recent completion of this section of the cycle way, which has led to a high rate of growth in the short term, which is unsustainable in the longer term.

To determine a more realistic growth rate, reference has been made to the Census "Main means of travel to work" data to determine commuter cycling numbers and growth for the four Area Units along the north side of the harbour out to Port Chalmers. This data is reported in **Table 3**.

**Table 3: Census Main Means of Travel to Work (Ravensbourne, St Leonards-Blanket Bay, Sawyers Bay and Port Chalmers)**

| | 2001 | 2006 | 2013 |
|---|---|---|---|
| Cycle | 45 | 45 | 72 |
| Walk | 96 | 90 | 72 |
| Other mode to work | 1,632 | 1,782 | 1,659 |
| Cycle Demand Indicator | 2.5% | 2.3% | 4.0% |
| Walk Demand Indicator | 5.4% | 4.7% | 4.0% |
| **Cycle growth – 2006 to 2013 (pa)** | | | **9%** |
| **Walk growth – 2006 to 2013 (pa)** | | | **-3%** |

The Census figures show a 9% per annum increase in commuter cycling numbers between 2006 and 2013. This growth figure has been used in this economic assessment, as it is more sustainable over a 40 year evaluation period than the 62% from **Table 1**.

Sensitivity test assuming a stagnant rate of growth (0% per annum) and lower rates of 2% and 4% per annum have also been undertaken.

**Forecast New Cyclist Demand**

In addition to the underlying growth in cycling numbers, a new or significantly expanded cycle facility is expected to generate new cycle trips. These are estimated based on a catchment area around the cycle facility, with decreasing likelihood of people starting to cycle the further away they are from it.

In the case of the extension of the SH88 Shared Use Path, the "liveable" extent of these catchment areas is constrained by the presence of the Otago Harbour on one side of the path, and a range of hills on the other. **Figure 1** shows the location and extent of the four Area Units on the northern side of the harbour between the city and Port Chalmers.

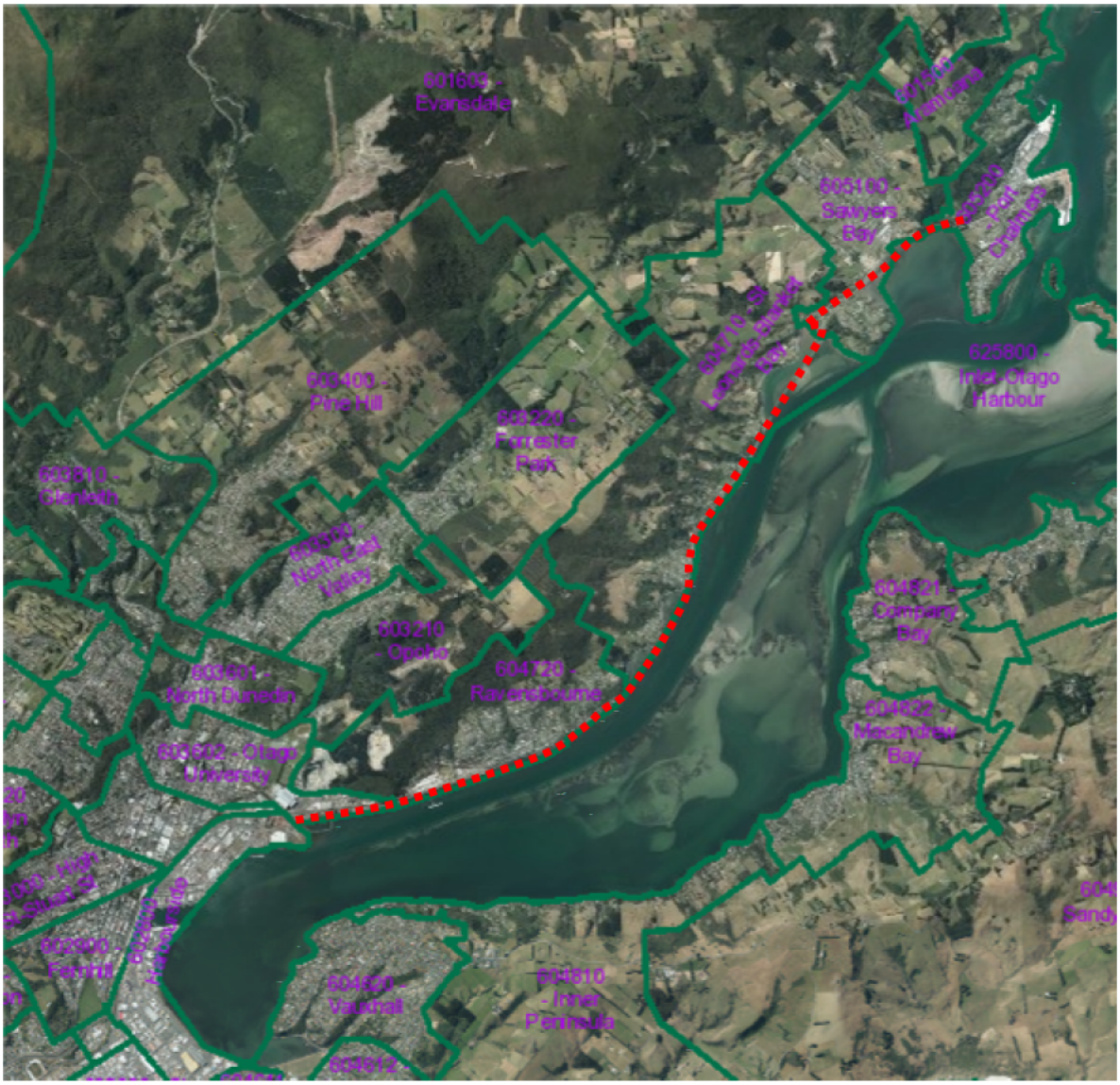


**Figure 1: Area Unit Boundaries along full length of SH88 Share Path**

This catchment area has only been assessed for the new section of shared use path (between Moa Street and Port Chalmers). This will result in a conservative assessment of the catchment, as it excludes people living near the existing section of shared use path who might start cycling if they were able to travel all the way to Port Chalmers on a high quality cycle facility.

# Economic Analysis

This economic analysis has been undertaken using the SP11 procedures specified in the NZ Transport Agency's Economic Evaluation Manual (EEM). It is acknowledged that these procedures are generally limited to schemes with an undiscounted capital cost of $5M or less, but they are considered appropriate in this instance to generate a rough order BCR. This can then inform the decision as to whether the more detailed economic analysis procedures should be used to refine the BCR generated here.

## Costs

### Construction Cost Estimates

Base, Expected and 95$^{th}$ Percentile cost estimates have been prepared separately for the Stage 1 and 2 works, and these are summarised in **Table 4**.

**Table 4: Stage 1 and 2 Cost Estimates ($)**

| | Base | Expected | 95th Percentile |
|---|---|---|---|
| Stage 1 | 4,845,000 | 5,440,000 | 7,150,000 |
| Stage 2 | 11,640,000 | 14,685,000 | 17,395,000 |
| **Total** | **16,485,000** | **20,125,000** | **24,545,000** |

### Maintenance Costs

Maintenance costs have not been estimated for this project, but have been approximated as 0.25% per annum of the capital cost estimates (which is probably a bit high but will give a conservative outcome in this evaluation).

### Present Value of Costs

**Table 5** reports the present value of construction and maintenance costs for the scheme over a 40 year evaluation period.

**Table 5: Present Value of Costs ($M)**

| | Base | Expected | 95th Percentile |
|---|---|---|---|
| Construction Costs | 15.494 | 18.920 | 23.072 |
| Maintenance Costs | 0.598 | 0.740 | 0.892 |
| **Total** | **16.093** | **20.028** | **23.964** |

The scheme has been assessed against the Expected costs in all cases except for the sensitivity test around the construction costs.

## Benefits

In accordance with the SP11 procedures, the following benefits were calculated for the scheme:

- Cyclist travel time cost savings (reported in Worksheet 4 in **Appendix A**);
- Cyclist health and environmental benefits (reported in Worksheet 5 in **Appendix A**);

- Pedestrian health and environmental benefits (reported in Worksheet 5 in **Appendix A**); and
- Safety benefits for cycling facility (reported in Worksheet 5 in **Appendix A**).

The following key assumptions were made during the calculation of these benefits of the scheme:

- Length of existing shared use path – 5.2 km
- Length of new shared use path – 4.9 km
- Length of finished shared use path – 10.1 km
- Number of existing cycle trips/day – 226
- Number of additional cycle trips/day – 140
- Annual growth rate for cyclists – 8.6%
- Number of existing pedestrian trips/day – 52
- Number of additional pedestrian trips/day – 0
- Annual growth rate for pedestrians – 0%

The last two assumptions, relating to pedestrian use of the shared use path, reflects a conservative view that the extension will primarily be used by cyclists, as the distance of this extension from the main population base of Dunedin is likely to mean that most pedestrians are unlikely to use this new section. However, it is probably that some of the people living near the extended section will use it, although this has not been assessed due to difficulties in estimating the likely numbers.

In addition, it is likely that the shared use path will be used by some of the cruise ship passengers and crew who disembark in Port Chalmers. This is especially so as this scheme completes the off-road link all the way into Dunedin. However, an assessment of these benefits has not been made due to the uncertainties around cruise ship numbers and the number of passengers and/or crew likely to cycle to/from Dunedin.

The present value of the scheme benefits are reported in **Table 6**.

**Table 6: Present Value of Scheme Benefits ($M)**

| Benefit | Benefit Amount |
|---|---|
| Cyclist travel time cost savings | 0.127 |
| Cyclist health and environmental benefits | 25.910 |
| Pedestrian health and environmental benefits | 0 |
| Safety benefits for cycling facility | 2.636 |
| **Total** | **28.673** |

### Scheme BCR

Based on the present value of the Expected costs reported in **Table 5** and the benefits in **Table 6**, the scheme has a BCR of **1.5**.

### Sensitivity Tests

To test the effect of different assumptions on the outcome of this economic assessment, the following sensitivity tests have been undertaken:

- Base, Expected and 95$^{th}$ Percentile construction costs

- Different growth rates for cyclists.

### Construction Costs

The BCR has been assessed using the Base and 95th Percentile costs, as well as the standard Expected costs. These results are presented in **Table 7**.

**Table 7: Present Value of Alternative Costs ($M) and Resultant BCR**

| | Base | Expected | 95th Percentile |
|---|---|---|---|
| Total Costs | **16.093** | **19.650** | **23.964** |
| Total Benefits | 28.673 | 28.673 | 28.673 |
| **BCR** | **1.8** | **1.5** | **1.2** |

With the assumptions listed earlier, the scheme has a BCR above one for the full range of cost estimates.

### Growth Rates

As discussed earlier, there were two observed growth rates that could have been used for the annual increase in cyclist numbers. Both of these were higher than the growth rates tabulated in the EEM, with the surveyed increase between 2012 and 2014 being unrealistically so at 62% per annum. Even the lower growth rate determined from the Census increase in the number of people cycling to work between 2006 and 2013 (8.6% per annum) may be unsustainably high over the 40 year evaluation period.

To test the effects on the economic evaluation of lower growth rates, sensitivity tests with cyclist growth rates of 0%, 2% and 4% per annum have been undertaken, with the outcomes shown in **Table 8**.

**Table 8: Present Value of Scheme Benefits ($M) and BCR with Different Cyclist Growth Rates**

| Benefit | 8.6% | 4% | 2% | 0% |
|---|---|---|---|---|
| Cyclist travel time cost savings | 0.127 | 0.906 | 0.075 | 0.059 |
| Cyclist health and environmental benefits | 25.910 | 18.451 | 15.188 | 11.925 |
| Pedestrian health and environmental benefits | 0 | 0 | 0 | 0 |
| Safety benefits for cycling facility | 2.636 | 1.877 | 1.545 | 1.213 |
| **Total** | **28.673** | **20.419** | **16.808** | **13.197** |
| **BCR** | **1.5** | **1.0** | **0.9** | **0.7** |

Under the current assumptions, the scheme requires a cyclist growth rate of approximately 4% per annum or above to have a BCR of one or more.

## Summary

These works will extend the existing harbourside off-road shared use path all the way through to Port Chalmers from Dunedin. With the extension, there is expected to be an increase in the number of cyclists

Based on an Expected (undiscounted) capital cost of $20.1M, and using the Census 8.6% per annum growth rate, these works are estimated to have a BCR of **1.5**.

Looking at the range of costs, the BCR rises to 1.8 using the Base estimate and falls to 1.2 with the 95$^{h}$ percentile costs.

Based on the 2013 Census, a cyclist growth rate of 8.6% per annum has been used. The project retains a BCR above 1.0 for a growth rate above 4% per annum.

# Appendix A – SP11 Worksheets

# SP11 Walking and cycling facilities

Spreadsheet v 3 (27-March-14)

**Worksheet 1 - Evaluation summary**

Worksheet 1 provides a summary of the general data used for the evaluation as well as the results of the analysis. The information required is a subset of the information required for assessment in terms of the NZTA's *Planning and Investment Knowledge Base* .

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | Evaluator(s) | [redacted] | | | | |
| | Reviewer(s) | [redacted] | | | | |
| **2** | Activity details | | | | | |
| | Approved organisation name | NZ Transport Agency | | | | |
| | Activity name | SH88 Shared Path - St Leonards to Port Chalmers | | | | |
| | Your reference | | | | | |
| | Activity description | | | | | |
| | Describe the issues to be addressed | | | | | |
| **3** | Location | | | | | |
| | Brief description of location | Northern side of Otago Harbour between Dunedin and Port Chalmers | | | | |
| **4** | Alternatives and options | | | | | |
| | Describe the do-minimum | | | | | |
| | Summarise the options assessed | Option A - Expected Cost / Option B - Base Cost / Option C - 95th Percentile Cost | | | | |
| **5** | Timing | | | | | |
| | Time zero (assumed construction start date) | 1 July 2016 | | | | |
| | Expected duration of construction (months) | 12 | | | | |
| | Period of analysis | 40 | | | | |
| **6** | Economic efficiency | | | | | |
| | Date economic evaluation completed (mm/yyyy) | Dec-15 | | | | |
| | Base date for costs and benefits | 1 July 2015 | | | | |
| | Land designation required | | | | | |
| **7** | Data (only fill the applicable data) | | | | | |
| | Existing pedestrian/cycling volumes | 226 AADT in year 2014 | | | | |
| | Estimated new pedestrian/cyclist volume (from WS SP11-7) | 140 AADT | | | | |
| | Estimated motor vehicle volumes | 8,600 AADT | | | | |
| | Estimated motor vehicle speed | 70.00 km/h | | | | |
| | Pedestrian/cyclist growth rate | 8.57 % | | | | |
| | Width available for walking/cycling before | 0.50 m | | | | |
| | Width available for walking/cycling after | 3.00 m | | | | |
| | Length walked/cycled after works | 10.10 km | | | | |
| | Length walked/cycled before works | 5.20 km | | | | |
| | Expected reduction in private vehicle travel | km per year | | | | |
| **8** | PV cost of do-minimum | | | | $ 0 | **A** |
| **9** | PV cost of the preferred option | | | | $ 19,650,184 | **B** |
| **10** | Benefit values from worksheet 4, 5, 6 | | | | | |
| | PV travel time cost savings | $ 89,596 | **C** x Update factor $^{TTC}$ | 1.42 | = $ 127,226 | **X** |
| | PV facility benefits | $ 22,727,886 | **D** x Update factor $^{WCB}$ | 1.14 | = $ 25,909,790 | **Y** |
| | PV crash cost savings | $ 2,126,040 | **E** x Update factor $^{AC}$ | 1.24 | = $ 2,636,289 | **Z** |

**11** $BCR_N = \frac{\text{PV net benefits}}{\text{PV economic costs}} = \frac{\mathbf{X + Y + Z}}{\mathbf{B - A}} = \frac{28,673,305}{19,650,184} = 1.46$

# SP11 Walking and cycling facilities

Spreadsheet v 3 (27-March-14)

**Worksheet 3 - Cost of the option(s)**

Worksheet 3 is used for calculating the PV cost of the walking or cycling facility.

**1** PV of estimated cost of proposed work (as per attached estimate sheet)

$ 20,127,477 x 0.94 = $ 18,919,828 **(a)**

**2** PV of maintenance in year 1

$ 0 **(b)**

**3** PV of annual maintenance costs following the work

(years 2 to 40 inclusive) $ 50,300 x 14.52 = $ 730,356 **(c)**

**4** PV of periodic maintenance costs

Time zero 1st July in the year 2016

Periodic maintenance will be required in the following years:

| Year | Type of maintenance | Amount $ | SPPWF | Present Value |
|---|---|---|---|---|
| | | | | |
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| | | | | |
| | | | | |
| | | | | |

Sum of PV of periodic maintenance costs = $ 0 **(d)**

**5** PV cost of additional annual maintenance

$ x 14.52 = $ 0 **(e)**

**6** PV of total cost of option

PV total costs **(a)** + **(b)** + **(c)** + **(d)** + **(e)** = $ 19,650,184 **B**

Transfer the PV total cost for the preferred option **B**, to **B** on worksheet 1

# SP11 Walking and cycling facilities

Spreadsheet v 3 (27-March-14)

**Worksheet 3 - Cost of the option(s)**

Worksheet 3 is used for calculating the PV cost of the walking or cycling facility.

**1** PV of estimated cost of proposed work (as per attached estimate sheet)

$ 16,483,485 x 0.94 = $ 15,494,476 **(a)**

**2** PV of maintenance in year 1

$ 0 **(b)**

**3** PV of annual maintenance costs following the work

(years 2 to 40 inclusive) $ 41,200 x 14.52 = $ 598,224 **(c)**

**4** PV of periodic maintenance costs

Time zero 1st July in the year 2016

Periodic maintenance will be required in the following years:

| Year | Type of maintenance | Amount $ | SPPWF | Present Value |
|---|---|---|---|---|
| | | | | |
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| | | | | |
| | | | | |

Sum of PV of periodic maintenance costs = $ 0 **(d)**

**5** PV cost of additional annual maintenance

$ x 14.52 = $ 0 **(e)**

**6** PV of total cost of option

PV total costs **(a)** + **(b)** + **(c)** + **(d)** + **(e)** = $ 16,092,700 **B**

Transfer the PV total cost for the preferred option **B**, to **B** on worksheet 1

# SP11 Walking and cycling facilities

Spreadsheet v 3 (27-March-14)

**Worksheet 3 - Cost of the option(s)**

Worksheet 3 is used for calculating the PV cost of the walking or cycling facility.

**1** PV of estimated cost of proposed work (as per attached estimate sheet)

$ 24,544,653 x 0.94 = $ 23,071,974 **(a)**

**2** PV of maintenance in year 1

$ 0 **(b)**

**3** PV of annual maintenance costs following the work

(years 2 to 40 inclusive) $ 61,400 x 14.52 = $ 891,528 **(c)**

**4** PV of periodic maintenance costs

Time zero 1st July in the year 2016

Periodic maintenance will be required in the following years:

| Year | Type of maintenance | Amount $ | SPPWF | Present Value |
|---|---|---|---|---|
| | | | | |
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| | | | | |
| | | | | |
| | | | | |

Sum of PV of periodic maintenance costs = $ 0 **(d)**

**5** PV cost of additional annual maintenance

$ x 14.52 = $ 0 **(e)**

**6** PV of total cost of option

PV total costs **(a)** + **(b)** + **(c)** + **(d)** + **(e)** = $ 23,963,502 **B**

Transfer the PV total cost for the preferred option **B**, to **B** on worksheet 1

# SP11 Walking and cycling facilities

Spreadsheet v 3 (27-March-14)

## Worksheet 4 - Travel time cost savings

Worksheet 4 is used for calculating pedestrian and cyclist travel time cost savings.

**1** Road category (Select) — Urban arterial

**2** Travel time data

| | | | | | |
|---|---|---|---|---|---|
| Walkers and/or cyclists average annual daily traffic current (AADT) (or volumes affected by the improvement) | | | | | 226 |
| Walking or Cycling growth rate (per annum) | | | | | 8.57% |
| Travel time cost (TTC) | (Table 4.1b) | | | $ | 4.59 |

| | Do-minimum | | Option | |
|---|---|---|---|---|
| Length of route (km) | $L^{dm}$ | 5.20 | $L^{opt}$ | 10.10 |
| Mean speed | $VS^{dm}$ | 20.00 | $VS^{opt}$ | 20.00 |
| Relative attractiveness | (Table SP11.1) | | | 2.00 |

**3** Annual TTC for the do-minimum

$$\frac{AADT \times 365 \times L^{dm} \times TTC}{VS^{dm}} = \$ \quad 98{,}444 \quad \textbf{(a)}$$

**4** Annual TTC for the option

$$\frac{AADT \times 365 \times L^{opt} \times TTC}{VS^{opt} \times RA} = \$ \quad 95{,}604 \quad \textbf{(b)}$$

**5** Value of annual TTC savings — **(a) - (b)** = $ 2,840 **(c)**

**6** PV of travel time cost savings — DF 31.55 — **(c)** x DF = $ 89,596 **C**

Transfer the PV of travel time cost savings for the preferred option **C**, to **C** on worksheet 1

# SP11 Walking and cycling facilities

Spreadsheet v 3 (27-March-

## Worksheet 5 - Benefits for walking and cycling facilities

Worksheet 5 is used to calculate the walking and cycling facility benefits for the various options. Only one category for walking and one category for cycling may be used in an evaluation of a proposal. If an activity contains more categories, they must be submitted as separate evaluations.

Activities that combine walking and cycling may claim benefits for both modes but safety issues arising from pedestrian/cycle conflicts must be addressed, and if there are additional crash costs these must be accounted for in worksheet 6. Make sure the estimates of the new number of pedestrians and/or cyclists generated by the facility are realistic.

Required information:
L Length of new facility in kilometres
NPD Number of additional pedestrians per day
NTD Number of additional cycle trips per day
NSD Number of additional and existing cycle trips per day
DF Discount factor. The discount factor may differ by mode depending on the growth rate

### Health and environment benefits for walking facility

Pedestrian growth rate (per annum) 0.00%

**1** Health and environment benefits for footpaths and other pedestrian facilities

Benefit = number of additional pedestrians/day x length of new facility in km x 365 x $2.70

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L | 10.10 | x NPD | 0 | x 365 x $2.70 x DF | 14.52 | = $ | 0 | **(a)** |

**2** Health and environment benefits from improvements at hazardous sites (provision of overbridges, underpasses, bridge widening or intersection improvements for pedestrians)

Benefit = number of additional pedestrians/day x 365 x $2.70

| | | | | | | |
|---|---|---|---|---|---|---|
| NPD | | x 365 x $2.70 x DF | 14.52 | = $ | 0 | **(b)** |

Transfer total **(a)** or **(b)** to **D** on worksheet 1.

### Health and environment benefits for cycling facility

Cyclist growth rate (per annum) 8.57%

**3** Health and environment benefits for cycle lanes, cycleways or increased road shoulder widths

Benefit = number of additional cycle trips/day x length of new facility in km x 365 x $1.40

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L | 10.10 | x NTD | 140 | x 365 x $1.40 x DF | 31.55 | = $ | 22,727,886 | **(c)** |

**4** Health and environment benefits from improvements at hazardous sites (provision of overbridges, underpasses, bridge widening or intersection improvements for cyclists)

Benefit = number of additional cycle trips/day x 365 x $4.20

| | | | | | | |
|---|---|---|---|---|---|---|
| NTD | | x 365 x $4.20 x DF | 31.55 | = $ | 0 | **(d)** |

Transfer total **(c)** or **(d)** to **D** on worksheet 1.

### Safety benefits for cycling facility

**5** Safety benefit for cycle lanes, cycleways or increased road shoulder widths in the absence of a specific crash analysis

Benefit = number of new and existing cycle trips/day x length of new facility in km x 365 x $0.05

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| L | 10.10 | x NSD | 366 | x 365 x $0.05 x DF | 31.55 | = $ | 2,126,040 | **(e)** |

**6** Safety benefit from improvements at hazardous sites in the absence of a specific crash analysis (provision of overbridges, underpasses, bridge widening or intersection improvements for cyclists)

Benefit = number of new and existing cycle trips/day x 365 x $0.15

| | | | | | | |
|---|---|---|---|---|---|---|
| NSD | | x 365 x $0.15 x DF | 31.55 | = $ | 0 | **(f)** |

Transfer total **(e)** or **(f)** to **E** on worksheet 1.

# SP11 Walking and cycling facilities

Spreadsheet v 3 (27-March-14)

**Worksheet 7 – Cycle demand**

This worksheet is used to calculate cycle demand for a new cycle facility. The new commuters section of the worksheet calculates the total new daily cyclist commuters. The new other section calculates the total daily new other cyclists. Finally the overall new cyclists is devised.

**New and Existing cyclists**

| | Buffers (km) | <0.4 | 0.4 to <0.8 | 0.8 to ≤ 1.6 |
|---|---|---|---|---|
| **1** | Area ($km^2$) | 1.81 | 2.13 | 5.04 |
| **2** | Density per square kilometre | 1,153.37 | 819.88 | 236.71 |
| **3** | Population in each buffer **(3)** = **(1)** x **(2)** | 2,082.39 | 1,748.04 | 1,193.74 |
| **4** | Total population in all buffers (Sum of **(3)**) | 5,024.16 | | |
| **5** | Commute share (single value for all) | 3.99% | | |
| **6** | Likelihood of new cyclist multiplier | 1.04 | 0.54 | 0.21 |
| **7** | Row **(7)** = **(3)** x **(6)** | 2,165.69 | 943.94 | 250.68 |
| **8** | Sum of row **(7)** | 3,360.31 | | |
| **9** | Cyclist rate **(9)** = (**(5)** x 0.96) + 0.32% | 4.15% | | |
| **10** | Total existing daily cyclists **(10)** = **(4)** x **(9)** | 208.68 | | |
| **11** | Total new daily cyclists **(11)** = **(8)** x **(9)** | 139.57 | | |

## SP11 Walking and cycling facilities

Spreadsheet v 3 (27-March-1 )

**Worksheet 8 - BCR and incremental analysis**

| | | |
|---|---|---|
| Time zero | 1 July | 2016 |
| Base date | 1 July | 2015 |

| BCR calculations | Do-minimum | Option A | Option B | Option C | Option D |
|---|---|---|---|---|---|
| **Benefits** | | | | | |
| PV Travel time cost savings | | 127,226 | 127,226 | 127,226 | |
| PV Health and environment | | 25,909,790 | 25,909,790 | 25,909,790 | |
| PV Crash cost savings | | 2,636,289 | 2,636,289 | 2,636,289 | |
| **PV total benefits** | 0 | 28,673,305 | 28,673,305 | 28,673,305 | 0 |
| **Costs** | | | | | |
| PV Capital costs (do-min) | | 18,919,828 | 15,494,476 | 23,071,974 | |
| PV Maintenance costs | | 730,356 | 598,224 | 891,528 | |
| **PV total costs** | 0 | 19,650,184 | 16,092,700 | 23,963,502 | 0 |
| **$BCR_N$** | | 1.46 | 1.78 | 1.20 | 0.00 |
| Target incremental BCR (from appendix A12.4) | | | | | |

| Base option for comparison | | | Next higher cost option | | | Incremental analysis | | |
|---|---|---|---|---|---|---|---|---|
| Option | Total costs **(1)** | Total benefits **(2)** | Option | Total costs **(3)** | Total Benefits **(4)** | Incremental costs **(5)=(3)-(1)** | Incremental benefits **(6)=(4)-(2)** | Incremental $BCR_N$ **(7)=(6)/ (5)** |
| | | | | | | 0 | 0 | 0.00 |
| | | | | | | 0 | 0 | 0.00 |
| | | | | | | 0 | 0 | 0.00 |
| | | | | | | 0 | 0 | 0.00 |