Appendix I – Active Mode Appraisal Technical Note

1 Technical Note – Active Mode Appraisal

Project:	Third Crossing of Lake Lothing, Lowestoft	Date:	16.12.15
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Subject:	Active Mode Appraisal Methodology		
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1.1 Introduction

1.1.1 Overview

This technical note details the economic appraisal of the changes resulting from the proposed third crossing of Lake Lothing in Lowestoft, in terms of the impact on active modes, i.e. pedestrians and cycle users. The technical note describes the approach used to appraise the scheme, in terms of its impact on active modes, the sources of data used and assumptions applied, as well as summarising the overall economic results.

Four key active mode indicators are considered as part of the appraisal:

- Physical Activity (Health) impacts;
- Absenteeism impacts;
- Journey Quality/Ambience impacts; and
- Journey Time impacts

The economic appraisal of the scheme has followed the guidance set out by the Department for Transport (DfT) and specifically follows the approach set out in the following Transport Analysis Guidance (TAG) documents:

- TAG Unit A1.1: Cost-Benefit Analysis (Nov 2014);
- TAG Unit A4.1: Social Impact Appraisal (Nov 2014); and
- TAG Unit A5.1: Active Mode Appraisal (Jan 2014).

1.1.2 Technical Note Structure

The remainder of this technical note is set out as follows:

Section 1.2 provides an overview of the methodology adopted for calculating the active mode economic benefits for the scheme, including the approach to generating without scheme and with scheme demand;

Section 1.3 sets out the physical activity (health) impacts that are forecast to result from the scheme;

Section 1.4 describes the absenteeism impacts that are expected to be generated by the scheme;

Section 1.5 describes the journey quality/ambience impacts that are forecast to result from the scheme;

Section 1.6 details the Journey Time savings estimated from a new crossing

Section 1.7 presents the overall active mode benefits over the appraisal period; and

Section 1.8 details the high and low demand sensitivity testing.

1.2 Overview

1.2.1 Lake Lothing Third Crossing Scheme

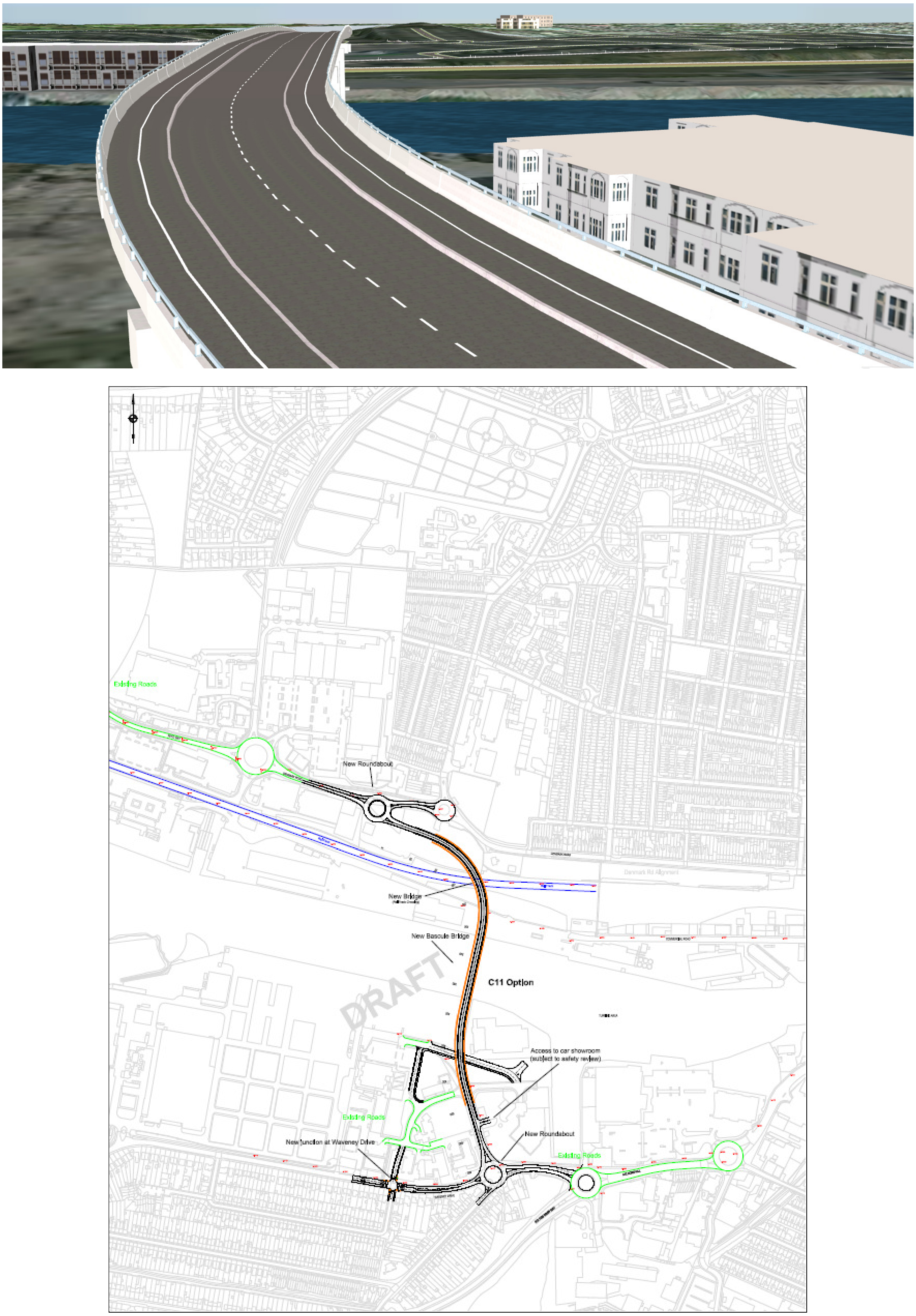
The proposal is for a new (third) crossing over Lake Lothing, Lowestoft. Lake Lothing is a large saltwater lake which flows into the North Sea. It measures approximately 180m at its widest point, and forms the inner harbour of the Port of Lowestoft. The lake separates the north and south areas of the town; the town centre is located on the northern side of the lake.

Currently there are only two road crossing points over the lake, one at the eastern (seaward) side of the lake and the other towards the western end. The A12 forms a north-south route on the eastern side of Lowestoft, which crosses Lake Lothing by means of a bascule bridge. To the west, another north-south route is provided by Bridge Road, where the A146 connects to the A1117, which crosses Lake Lothing by means of a lifting bridge. Also at the western end there is a pedestrian and cycle bridge immediately adjacent to Bridge Road; this crosses Mutford Lock.

The Lake Lothing area has suffered greatly from the decline of shipbuilding and traditional industries, and is a key area for regeneration. The proposed scheme will support regeneration by improving access to the lake area, reducing impacts of severance and by relieving congestion in, and around, the town centre. It is anticipated that the provision of a third crossing will encourage a greater uptake of active modes through improved infrastructure provision for these modes as well as shorter journey lengths for some trips. An additional route across the lake together with a modal shift towards active modes will also help to reduce congestion in the town by reducing the number of vehicles on the roads.

Figure 1-1 includes a visualisation of the proposed crossing together with an extract of the proposed third crossing alignment, which is for a bascule bridge positioned in a central location, between the two existing bridges. The bridge is approximately 600m in length and features off-road segregated pedestrian and cycle paths on both sides of the carriageway.

Figure 1-1 – Lake Lothing Third Crossing Proposal



Methodology

This active mode appraisal only focuses on the benefits for active modes associated with the package of sustainable travel, road safety and pedestrian/cycle improvements forming part of the proposal. As outlined in Section 1.1, the active mode appraisal is focused on four key indicators. Table 1-1 outlines these four indicators, and identifies where the Third Crossing scheme is expected to have an impact.

Table 1-1 – Summary of Elements of Appraisal

Active Mode Indicator	Location Focus of Assessment	Active Mode Appraised	Explanation
Physical Activity (Health)	Third Crossing, A12 (Bascule Bridge) and Bridge Road	Pedestrians & Cycle users	The provision of a new crossing with pedestrian and cycle infrastructure is anticipated to encourage greater cycle and pedestrian movements, with associated health benefits.
Absenteeism	Third Crossing	Pedestrians & Cycle users	
Journey Quality	Third Crossing, A12 (Bascule Bridge) and Bridge Road	Pedestrians & Cycle users	Reduced traffic levels on the existing bridges can improve journey quality for existing routes. Also the provision of off carriageway segregated cycle and pedestrian paths will provide quality benefits for cycle users and pedestrians.
Journey Time	Third Crossing	Pedestrians & Cycle users	The provision of a third crossing in a central location can improve journey times by removing traffic from existing routes as well as improving accessibility and cycle speeds through reduced distances to travel and reduced journey times in this area.

1.2.2 *Calculating 'Without Scheme' and 'With Scheme' Demand*

In order to quantify the impact of the scheme on active modes, demand estimates for pedestrians and cyclists have been calculated for Do-Nothing (Without Scheme) and Do Something (With Scheme) scenarios. Each of the active mode appraisal calculations requires an estimate of the walking and cycling demand, either in terms of the number of people, or the number of trips undertaken.

The demand estimates produced were based on the available count data on the existing bridge crossing points on the A12 Bascule Bridge and Bridge Road (Mutford Lock / A1117) area as shown in Table 1-2. All surveys counted the number of pedestrians and/or cyclists observed crossing the location during a 12 hour (7am – 7pm) period.

Table 1-2 – Summary of Pedestrian and Cycle Survey Counts

Date	Location	Count
Fri 07/10/2011	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing	Pedestrian and Cycle Count (carriageway and footway)
Sat 08/10/2011	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing	Pedestrian and Cycle Count (carriageway and footway)
Fri 25/05/2012	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing	Pedestrian and Cycle Count (carriageway and footway)
Sat 26/05/2012	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing	Pedestrian and Cycle Count (carriageway and footway)
Tue 17/03/2015	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing Land to south west of Mutford Lock crossing	Pedestrian and Cycle Count (carriageway and footway) Pedestrian Count
Wed 18/03/15	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing	Cycle count
Thu 19/03/2015	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing	Cycle count
Fri 20/03/2015	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing	Cycle count
Sat 21/03/15	A12/Bascule Bridge and Bridge Road/Mutford Lock crossing	Cycle count

TEMPRO Growth Factors

TEMPRO (Trip End Model Presentation Program) takes account of local planning data including population, employment, car ownership, together with traffic growth factors to provide local traffic projection factors.

The growth factors obtained from TEMPRO, detailed in Table 1-3, provide an uplift factor for estimated growth in walking and cycling numbers for the Waveney District. The average figures for the two modes were used in the calculations to estimate uplifts in pedestrian and cycle numbers for both with and without scheme scenarios.

Table 1-3 – TEMPRO Uplift Factors

Count Yr	Opening Yr	Walk			Cycle		
		Origin	Destination	Average	Origin	Destination	Average
2014	2020	1.0265	1.0266	**1.0266**	1.0155	1.0159	**1.0157**

(Uplifts are based on Geographical Area - Waveney; Purpose Definition - Walking and Cycling; Time Period - Average Day; Trip End Type - O/D)

Cycle User Base Demand

The usage of the existing crossing points by cyclists has been calculated using count information available for both the Bascule Bridge and Mutford Lock area. The count data included counting cyclists on-carriageway as well as off-carriageway. At the Mutford Lock (western) area there are two possible crossing points available for cyclists to cross between the northern and southern sides of the lake. These comprise of Bridge Road and a lifting pedestrian/cycle bridge over Mutford Lock to the west of Bridge Road.

The cyclist count surveys recorded the number of cyclists crossing these locations over a 12 hour period (7am-7pm) as detailed in Table 1-2.

As a starting point, a 'reference demand' figure for cycle user activity has been selected. This is based on an average of the 12 hour (7am-7pm) survey counts taken on the existing crossing points over the lake. The average number of cyclist trips crossing the Bascule Bridge (A12) and Mutford Lock area, in both directions was 1,739 and 472, respectively, in a 12 hour period. The flows were uplifted by a factor of 1.15 to give 24hr flow values.

Pedestrian Base Demand

Pedestrian count information was available for both the Bascule Bridge and Mutford Lock area. At the Mutford Lock (western) area there are two possible crossing points available for pedestrians to cross between the northern and southern sides of the lake. These comprise of the road crossing (i.e. footways alongside Bridge Road) and a lifting pedestrian bridge over Mutford Lock.

The pedestrian count surveys recorded the number of pedestrians crossing these locations over a 12 hour period (7am-7pm) as detailed in Table 1-2.

An average trip number using the survey data was calculated which indicated 7,014 pedestrian trips (in both directions) were made using the Bascule Bridge and 839 trips crossing between the north and south sides of the lake at the Mutford Lock area at the western end of the lake. The flows were uplifted by a factor of 1.15 to give 24hr flow values.

Converting Trips to Individuals

The number of trips in the 'without scheme' and 'with scheme' scenarios were estimated using the survey data as described above. However, a number of the active mode calculations require an estimate of the number of individuals, rather than trips.

In line with TAG Unit A5.1, where the number of individual users is unknown, the number of individual users is based on the assumption that 90% of trips are part of a return journey using the same route, to avoid double counting in the calculation of the number of individuals affected. The formula to calculate the number of individual users is as follows:

$$((No.of\ Trips\ *90\%)/2)+(No.of\ Trips*10\%)$$

1.2.3 *Without scheme demand (Do-nothing scenario)*

Average numbers of pedestrians and cyclists crossing the existing bridges were derived from the survey data. Estimates of future numbers were calculated by multiplying the average trip numbers by the relevant TEMPRO growth factor for an opening year of 2020 (as per Table 1-3). The number of individuals was calculated using the formula detailed in the paragraph above. This gave the following total trip and individual numbers at the existing crossing locations:

- Cyclists: 2,583 cyclist trips and 1,420 individual cyclists
- Pedestrians: 9,271 pedestrian trips and 5,099 individual pedestrians

1.2.4 *With scheme demand (Do-something scenario)*

As highlighted above the do-nothing scenario includes an uplift in cyclist and pedestrian numbers using TEMPRO growth factors. This forecasted the increase in trips by these modes using the existing bridges. However, through the provision of an additional crossing point it is considered that further uplifts in travel by these modes will occur. This is because in some circumstances the trip length will reduce and travel on foot or bicycle may become a more viable mode (Section 1.2.5 details the methodology for calculating this uplift).

It was assumed a proportion of the existing and additional pedestrians and cyclists would cross a third, central, bridge if it was available. The proportion of existing pedestrians and cyclists diverting to a new central bridge was assumed to be the same as the vehicular proportional change on the bridges, provided by the outputs of the traffic modelling. The traffic modelling projected that, in 2035, 37% of vehicular traffic in the AM peak would use the new central crossing point whereas 34% would use the crossing in the PM peak. Therefore, the average of the AM and PM peak proportions (i.e. 36%) was used as the percentage of pedestrians and cyclists that would divert from existing crossing points to use the new crossing.

The methodology of calculation of trips and benefits for the 4 key active mode indicators are considered as part of the appraisal:

- Physical Activity (Health) impacts;
- Absenteeism impacts;

- Journey Quality/Ambience impacts; and
- Journey Time impacts

1.2.5 *Estimation of Uplifts resulting from a new crossing point over the lake*

In order to estimate the uplift in demand that could result from the implementation of the scheme, a desktop research exercise was conducted to find appropriate comparative packages that had been implemented in other relevant locations. Whilst it was not possible to find a study which exactly resembled this scheme, the research identified a wide range in levels of increases in walking and cycling from provision of additional, new and improved active mode infrastructure outlined below:

Cycle Schemes

The change in cycling flows across the bridge was calculated by estimating uplifts relating to the improved infrastructure by looking at the outcome of previous schemes.

- Cycle lane scheme on Lewes Road, Brighton showed a 14% uplift in cycling post implementation.
- A new pedestrian and cyclist bridge, Diglis Bridge in Worcester, showed an annual increase in cycle numbers passing the site from 31,000 to 465,000 (1400% increase).
- Post implementation of the London Greenway cycle routes an average increase in cycling of 18% was recorded.
- Evaluation of the Government's Sustainable Travel Towns project showed a 26% to 30% increase in cycling trips resulting from improved infrastructure
- Similarly the Cycling Towns initiative evaluation indicated a 27% increase in cycling from the baseline cycling numbers and a 4% increase per annum.
- A public realm improvement in Darlington town centre, referred to in Manual for Streets 2, showed the number of cyclists to have increased by 30% post implementation of the scheme.
- Data relating to a Sustrans Cycle Route in Skellingthorpe, Lincoln showed a 25% increase in cycle numbers over a two year period (2012-14).
- Before and after counts in 2004 on a Cycle Street in Oss, Netherlands demonstrated a cycling increase of 11% and reduction in motor traffic of around 30%.
- A study of the implementation of cycle infrastructure in Copenhagen showed the construction of cycle tracks resulted in 18-20% increase in cycle/moped traffic and a decrease of car traffic on those roads, whereas introduction of lanes resulted in a 5-7% increase in cycling numbers.

It can therefore be seen implementation of cycle infrastructure can increase usage by a range of proportions. For this exercise it was considered a range of increases in cycling numbers of 5% to 30% would be appropriate to test the range of benefits.

Pedestrian Schemes

The change in pedestrian flows across the bridge was calculated by estimating uplifts relating to the improved infrastructure by looking at the outcome of previous schemes.

- The evaluation of the Government's Sustainable Travel Towns project showed a 10% to 13% increase in walking trips as a result of improved pedestrian facilities.
- The Living Streets report "*The Pedestrian Pound*" stated that evaluations of pedestrian improvements in Coventry and Bristol showed a 25% increase in footfall on Saturdays and improved routes to and from Wanstead High Street increased footfall by 98%.
- Pedestrian and cycle improvements in Kingston showed a 12% increase in pedestrian usage after the scheme was implemented.

For this appraisal it was considered that a range of increases in pedestrian numbers of 5% to 15% would be appropriate to test the range of possible benefits resulting from the scheme.

In order to test the assumptions being made different scenario tests are being applied. A 'Low' scenario tested a reduction in uplift in active mode users and a 'High' Scenario test showing an increased uplift. Table 1-4 details a summary of the uplifts used to test the different scenarios for this scheme.

Table 1-4 – Summary of Scenario Tests Uplifts

Assumptions and Results	Scenario Tests		
	Core	Low	High
Overall Cycle user Uplift	17.5%	5%	30%
Overall Pedestrian Uplifts	10%	5%	15%

In addition to the generic uplifts referred to above it was also assumed that the provision of a new bridge between the two existing crossing points would reduce the journey length and/or time for some existing trips creating additional modal shift.

To calculate this the 2011 census data was interrogated to assess the number of commuters travelling to or from the Lower Super Output Areas (LSOA) in the immediate vicinity of the bridge landing points, as it was assumed the new crossing would represent the preferred way of travel to/from those areas.

The calculation looked at the total number of commuters travelling within reasonable walking and cycling distances. The proportion of commuters for each mode of travel is available via the census data, this was used to calculate the expected numbers of commuters travelling by each mode. A 5% modal shift to active modes was applied to the number of people travelling by car, taxi and bus. This gave an estimated number of new active mode users as a result of modal shift brought about by the new crossing opportunity. 21 new pedestrian and cycle users were considered to result from modal shift and this was split on a 2:1 ratio of pedestrians to cyclists based on average travel to work mode proportions for the area.

A 5% modal shift was considered appropriate based on a Sustrans appraisal of a new pedestrian footbridge at Canary Wharf. This report suggested a 5% increase in cycling trips and 11% increase in walking trips would be expected as a result of the provision of a new bridge.

1.3 Physical Activity Impacts (Health)

1.3.1 Overview

TAG Unit A5.1 states that physical activity impacts typically form a significant proportion of benefits for active mode schemes. It is expected that the implementation of the scheme will result in increased levels of physical activity due to two key factors: the provision of improved cycle and pedestrian infrastructure and the reduction in traffic levels along the Bascule Bridge (A12) and Bridge Road (A146/A1117).

1.3.2 Assumptions & Methodology

The method for calculating physical activity impacts is taken from 'Quantifying the health effects of cycling and walking' (World Health Organisation (WHO), 2007). The calculation seeks to forecast the physical activity impacts that may result from the package for both pedestrians and cycle users.

The assessment follows the guidance set out in TAG Unit A5.1 and the recent DfT publication, 'Investing in Cycling and Walking: The Economic Case for Action' (2015). As outlined in the following sections, the method requires estimates of the number of new pedestrians and cycle users as a result of the scheme; the time per day they will spend active; and mortality rates applicable to the group affected by the package. The assessment uses the latest mortality and relative risk parameters from the WHO Health Economic Assessment Tool (HEAT) updated guidance[1].

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[1] Walking and for Cycling. Methodology and User Guide. Economic Assessment of Transport Infrastructure and Policies. 2014 Update (WHO, 2014)

The physical activity impacts have been calculated using the assumptions set out in Table 1-5.

Table 1-5 – Physical Activity Assumptions

Variable	Value	Source
Number of new pedestrians (assuming 10% uplift of without scheme and modal shift of existing commuters)	523	Derived from count data and uplifts applied
Number of new cycle users (assuming 17.5% uplift of without scheme and modal shift of existing commuters)	255	
Proportion of increase in walking/cycling attributable to intervention	75%	Assumption of 75% as it is considered the new bridge is the main reason for a change.
Mortality Rate for Pedestrians (Deaths per 100,000 Persons per Year)	434.10	WHO HEAT Mortality Database
Mortality Rate for Cycle users (Deaths per 100,000 Persons per Year)	248.97	
Average Time Spent Walking (mins)	14.1	Average walking trip length from National Travel Survey 2013 (1.2km) / DMRB 11.3.8 guidelines for average pedestrian walking speed (5kph)
Average Time Spent Cycling (mins)	14.4	Average cycle trip length from National Travel Survey 2013 (4.8km) / DMRB 11.3.8 guidelines for average cycling speed (20 kph)
HEAT Reference Case – Pedestrian Minutes Active[2] (mins/day)	24	WHO HEAT Parameters
HEAT Reference Case – Pedestrian Relative Risk	0.11	
HEAT Reference Case – Cycle user Minutes Active[3] (mins/day)	14.3	
HEAT Reference Case – Cycle user Relative Risk	0.10	
Value of a Statistical life	£1,640,134	DfT TAG

[2] Volume of walking per person calculated based on 168 minutes per week.
[3] Volume of cycling per person calculated based on 100 minutes per week for 52 weeks of the year.

In order to calculate the physical activity impact for the package, the following calculations are undertaken:

- **Number of new users attributable to the intervention** – Number of new users * Proportion of walking/cycling attributable to intervention;
- **Expected deaths amongst new users –** New users attributable to intervention * (mortality rate / 100,000);
- **Do Something scenario relative risk**[4] **–** (Average time spent cycling / Reference case minutes active) * Reference case relative risk;
- **Lives saved in the Do Something scenario –** Expected deaths amongst new users * Do Something scenario relative risk;
- **Value per Year –** Lives saved in the Do Something scenario * Value of a statistical life

1.3.3 *Physical Activity (Health) Impact Results*

The forecast physical activity (health) impacts, based on the HEAT assessment are summarised in Table 1-6 for the Core Scenario for the opening year in 2010 prices.

Table 1-6 – Summary of Physical Activity (Health) Impacts (2010 prices)

Impact	Pedestrians	Cycle users	Total
Core Scenario: Physical Activity (Health) benefit per annum	£180,623	£78,836	£259,458

1.4 Absenteeism

1.4.1 *Overview*

TAG Unit A5.1 outlines that improved health from increased physical activity (including walking and cycling) can also lead to reductions in short term absence from work. As previously outlined, it is anticipated that the measures being implemented through the scheme will encourage an uplift in physical activity (through increased walking and cycling) as a result of the improved cycling and walking provision.

1.4.2 *Assumptions & Methodology*

This section describes the assumptions and methodology used to assess the impact of the scheme on absenteeism levels. The calculation of impacts follows the guidance set out in TAG Units A4.1 and A5.1. The method requires estimates of the number of new commuting pedestrians and cycle users as a result of the package;

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[4] To avoid inflated values at the upper end of the range, the risk reduction is capped: A maximum 45% risk reduction in the risk of mortality for cycling (corresponding to 450 minutes per week) and a maximum 30% risk reduction (corresponding to 458 minutes per week) for walking

the time per day they will spend active; and average absenteeism rates and labour costs.

The absenteeism impacts for the core scenarios have been calculated using the assumptions set out in Table 1-7.

Table 1-7 – Absenteeism Impact Assumptions

Variable	Value	Source
Number of new pedestrians (assuming 10% uplift of without scheme demand and calculation of modal change from existing commuters)	523	% uplift applied to study area wide demand estimate, derived from count data.
Number of new cycle users (assuming 17.5% uplift of without scheme demand and calculation of modal change from existing commuters)	255	
Proportion of new cycle users that are commuters	50%	Assumption made in the absence of suitable data. Based on type of environment and likely trip purpose.
Proportion of new pedestrians that are commuters	50%	Assumption made in the absence of suitable data. Based on type of environment and likely trip purpose.
Average time spent cycling (mins)	14.4	Based on National Travel Survey 2013 and DMRB average speeds.
Average time spent walking (mins)	14.1	
Average annual absenteeism rate per person (days per year)	7.2	CIPD – Absence Management Annual Report, 2013
Expected reduction in absenteeism from increase physical activity	6%	World Health Organisation (WHO) - Health and Development through Physical Activity and Sport, 2003
Activity per day to achieve 6% reduction in absenteeism (minutes)	30	
Median Gross Annual Earnings for Full-time Employees (£)	£27,200	Office for National Statistics (ONS) - Annual Survey of Hours and Earnings, 2013
Salary on-cost multiplier	2.1	UK 2013 average
Proportion of increase in walking and cycling attributable to intervention	75%	Assumption of 75% given that actual level is unknown and new bridge is considered main reason for change.
Number of working days	220	Standard economic assumption

In order to calculate the absenteeism impact for the scheme, the following calculations are undertaken:

- **Reduction in sick days per affected individual** – Expected reduction in absenteeism from increase physical activity * Expected reduction in absenteeism from increase physical activity;
- **Estimated employment cost per day** – (Median Gross Annual Earnings for Full-time Employees (£) * Salary on-cost multiplier) / Number of working days;
- **Absenteeism benefit per affected individual** – Reduction in sick days per affected individual * Estimated employment cost per day;
- **Value of Reduction in Absenteeism per New Pedestrian/Cycle user per Annum** – (Absenteeism benefit per affected individual * Proportion of new pedestrians/cycle users that are commuters * Average time spent walking/cycling (mins) / Activity per day to achieve 6% reduction in absenteeism (minutes); and
- **Overall Absenteeism impact on Pedestrians / Cycle users** – Value of Reduction in Absenteeism per New Pedestrian/Cycle user per Annum * Number of new pedestrians/cycle users) * Proportion of increase in walking/cycling attributable to intervention.

1.4.3 *Absenteeism Impact Results*

The forecast absenteeism impacts are detailed in Table 1-8 and show an opening year benefit in 2010 prices for the Core Scenario.

Table 1-8 – Summary of Absenteeism Impacts (2010 prices)

Impact	Pedestrians	Cycle users	Total
Core Scenario: Absenteeism benefit per annum	£10,221	£5,093	£15,314

1.5 Journey Quality/Ambience Impacts

1.5.1 *Overview*

TAG Unit A5.1 states that journey quality is an important consideration in scheme appraisal for pedestrians and cycle users. It includes fear of potential accidents and therefore the majority of concerns are about safety (e.g. segregated cycle tracks greatly improve journey quality over cycling on a road with traffic). It is also fair to assume that a lower level of vehicular traffic will create a more pleasant environment for cycle users and pedestrians.

This section provides an overview of the journey quality benefits that are forecast to result from the scheme. Given that the journey quality/ambience impact experienced by pedestrians and cycle users vary, the impacts for each mode have been reported separately.

1.5.2 *Methodology*

The calculation of benefits follows the guidance set out in TAG Unit A5.1 and uses the data contained within the TAG Databook to quantify the impact of the Third Lake Lothing crossing on pedestrian and cycle users. The approach is based on assigning a 'quality value' to each trip made by existing and new users. It is important to note that journey quality benefits are subject to the 'rule of half', current users of a route will experience the full benefit of any improvements to quality but the benefits to new users are halved.

Table 1-9 and Table 1-10 outline the published research figures as a guide to the potential maxima for an improvement, as included within the TAG Databook. The values in the table give an approximate monetary benefit of the introduction of a pedestrian and/or cycling scheme and include not only infrastructural changes, but facilities as well. These monetary values include all aspects of quality, including environmental quality, comfort, convenience and perceived improvements to safety.

Table 1-9 – Values of Aspects in Pedestrian Environment (2010 prices and values)

Scheme type	Value (p/km)	Source
Street lighting	3.8	Heuman (2005)
Kerb level	2.7	
Crowding	1.9	
Pavement evenness	0.9	
Information panels	0.9	
Benches	0.6	
Directional signage	0.6	

Table 1-10 – Values of Journey Ambience of Different Types of Cycle Facility Relative to No Facilities (2010 prices and values)

Scheme Type	Value (p/min)	Source
Off-road segregated cycle track	7.03	Hopkinson & Wardman (1996)
On-road segregated cycle lane	2.99	Hopkinson & Wardman (1996)
On-road non-segregated cycle lane	2.97	Wardman et al. (1997)
Wider lane	1.81	Hopkinson & Wardman (1996)
Shared bus lane	0.77	Hopkinson & Wardman (1996)

1.5.3 *Cycle user Impact Assumptions*

The number of new and existing cycle users is required to calculate the journey quality benefits. This was calculated by estimating proportions of the new and existing users that would use the existing bridge crossings and the proposed third crossing.

As previously outlined an increase in cycle trip numbers has been forecasted using the TEMPRO growth factors together with an estimated uplift resulting from the implementation of the scheme. It was assumed that a proportion (36%) of the new and existing users would use the new crossing point and factored into the calculations for journey quality benefits using the figures in Table 1-11. As described in Section 1.2.4 the 36% reflects the proportion of total vehicular traffic estimated to use the new crossing from the traffic modelling exercise. Given the users are expected to divert from the existing bridges they are considered to be existing users rather than new users for the purposes of the calculations. The number of new users was derived by calculating the proportion of uplift, i.e. 17.5%, in cycle trips of the total increase in cycle trips.

It has been assumed that the scheme measures will result in benefits for cycle users through the provision of an off-road segregated cycle lane. The existing bridges have cycle facilities in the form of shared use paths. Therefore the improvement is from a shared unsegregated path to a segregated path. The improvement is considered to warrant a quality value of 2.03p/min. This was calculated using the values in Table 1-10 and based on an assumption that a shared use path is worth the average of off-road segregated (7.03) and non-segregated on-road (2.97), giving a value of 5p/min. The upgrade from shared use path to segregated path is then the difference between the value of the shared use path and the value of an off-road segregated path, i.e. 7.03 -5.00 = 2.03p/min.

Additionally, through the provision of a new crossing location the volume of traffic using the existing crossing points is expected to reduce and therefore can improve the ambience of the new and existing bridges. The traffic modelling work forecasted that the flows on the Bascule Bridge and Bridge Road (Mutford Lock) bridges would reduce by around 25% and 19% respectively. A bespoke value for the benefit of reduced traffic was calculated using an average of the cycle benefit inputs, i.e. off-road segregated track, on-road segregated cycle lane and on-road non-segregated cycle lane. This gave a value of 4.33p/min.

The number of new users was derived by assuming the same proportion of cycle users as traffic (i.e. 36%) would use the new bridge and 17.5% of these (i.e. the assumed uplift) are new users as a result of the provision of the bridge.

The number of existing cycle users was derived by subtracting the number of new users from the assumed number of cycling trips on the new bridge i.e. the 36% of cycle trips in the do something scenario.

The number of trips on all three bridges expected to benefit from a reduction in traffic is the number of new cyclists derived from the uplifts explained previously.

The journey quality/ambience impacts for cycle users have been calculated using the assumptions set out in Table 1-11.

Table 1-11 – Journey Quality/Ambience Impact Assumptions for Cycle users

Variable	Value	Source
Number of existing users – rerouting to use third crossing	893	Based on uplifts and traffic modelling
Number of new users	189	Based on Census analysis
Number of users – Bascule Bridge, Bridge Road and 3rd crossing	3,047	Based on uplifts and traffic modelling
Average Cycle Trip Length (km)	4.8	National Travel Survey 2014 (average of 2008–2014)
Average Cycling Speed (kph) (DS)	20.0	Based on DfT / Sustrans Commuter Route
Average Cycle Time (mins) (DS)	14.4	(Avg. Trip length / Avg. Speed)
Scheme length (km)	0.66	Drawing Measurement
Scheme Improvement Value for segregated path (pence/min)	2.03	Derived from TAG Databook
Bespoke value for reduced traffic on existing bridges	4.33	Derived and adapted from TAG Databook
Annualisation factor	365	7 days * 52 weeks

In order to calculate the journey quality/ambience impact for cycle users, the following calculations are undertaken:

Time Spent Cycling on New Crossing

$$(Average\ Cycle\ Time\ /\ Average\ Trip\ Length) * Scheme\ length$$

Total Improvement Value (Assuming Cycle users use Route for Half Their Journey)

$$(Improvement\ Value * Time\ Spent\ Cycling)$$

Existing User Benefit

$$Total\ Improvement\ Value * No. of Existing\ Users$$

New Users Benefit

$$Total\ Improvement\ Value * No. of\ New\ Users) * 0.5$$

Total Benefit

$$(Existing\ Users\ Benefit + New\ Users\ Benefit) * Annualisation\ Factor$$

1.5.4 *Pedestrian Impact Assumptions*

The proposed third crossing is expected to improve the quality of the route for pedestrians by offering an alternative route on a modern bridge with appropriate pedestrian facilities as well as an improved environment resulting from overall reductions in vehicular traffic flow over the existing bridges. The traffic modelling work forecasted that the flows on the Bascule Bridge and Bridge Road (Mutford Lock) bridges would reduce by around 25% and 19% respectively.

Segregated off-road footway/cycleways are to be provided on both sides of the proposed third crossing. A specific value for these improvements is not included in the TAG data book however, a bespoke value based on the crowding value and pavement evenness multiplied by the average walking trip length was used to estimate the level of benefit afforded. Additionally, to account for the potential variation in the value, a rule of half has been applied to the calculated value providing a final value of 1.64p per journey.

Similarly, there is no specific value for a reduction of vehicles on the road adjacent to the pedestrian routes. Therefore a bespoke improvement value has been calculated based on the crowding values and the average walking trip length. This is considered appropriate considering the type of benefits anticipated. As per the segregated path value, to account for the potential variation in the value, a rule of half has been applied to the calculated value providing a final value of 1.12p per journey. As a check against this value, the ambience values included within Transport for London's Business Case Development Manual were reviewed, the value for 'light traffic, easy to cross' generates a higher, but comparable value per journey.

The journey quality/ambience impacts for pedestrians have been calculated using the assumptions set out in Table 1-12.

Table 1-12 – Journey Quality/Ambience Impact Assumptions for Pedestrians

Variable	Value	Source
Number of existing pedestrian trips (Do Minimum)	9,271	Based on survey data and Tempro uplifts.
Number of existing pedestrian trips on new crossing (Do Something)	3,269	Based on uplifts and traffic modelling
Number of new pedestrian trips on new crossing (Do Something)	363	Based on Census 'Travel to Work' analysis

Variable	Value	Source
Number of pedestrian trips on existing bridges (Do Something)	10,223	Based on uplifts and traffic modelling
Segregated path benefit (p/journey)	1.64	Bespoke Value derived from TAG Databook
Overall Improvement Value on existing bridges (p/journey)	1.12	Bespoke Value derived from TAG Databook
Annualisation Factor	365	7 Days * 52 Weeks

In order to calculate the journey quality/ambience impact for pedestrians, the following calculations are undertaken:

Existing User Benefit

$$Total\ Improvement\ Value * No.of\ Existing\ Users$$

New Users Benefit

$$Total\ Improvement\ Value * No.of\ New\ Users) * 0.5$$

Total Benefit

$$(Existing\ Users\ Benefit + New\ Users\ Benefit) * Annualisation\ Factor$$

1.5.5 *Journey Quality/Ambience Results*

The forecast journey quality/ambience impacts are detailed in Table 1-13 and show the opening year benefit in 2010 prices.

Table 1-13 – Summary of Journey Quality/Ambience Impacts (2010 prices)

Impact	Pedestrians	Cycle users	Total
Core Scenario: Journey Quality/Ambience benefit per annum	£62,356	£62,164	£124,520

1.6 Journey time

1.6.1 *Overview*

This section provides an overview of the journey time benefits that are forecast to result from the scheme.

The provision of a segregated off-road cycleway/footway and reduction in traffic will provide a safe and convenient route for cycle users along the new road crossing and existing bridges. The new infrastructure may allow cycle users to travel faster compared to the existing conditions due to less impediments/congestion on the current routes. Journey times for cycle users may therefore be reduced, particularly for those starting or ending their trips in areas adjacent to the central area of the lake as those journeys will be shorter.

The provision of a new crossing location may also bring about journey time improvements for pedestrians, particularly those starting or ending their trips at the central area of the lake again due to the reduction in distance to be travelled.

It is difficult to quantify the number of pedestrians and cyclists that would benefit from a reduction in journey time, however, a calculation using census data was undertaken. Pedestrian and cycle journey time calculations have been undertaken for journeys related to commuters travelling to and from the census LSOAs adjacent to the proposed third crossing location. These areas were selected as it is assumed most people travelling to/from these areas would benefit from a new crossing in that location. Although this is not comprehensive for all potential pedestrian and cycle users of the new bridge it provides an indication, albeit a conservative estimate, of benefits that could be achieved. Therefore, it could be considered the level of benefit calculated may be an underestimation and greater benefits may be possible.

1.6.2 Methodology and assumptions

The calculation of journey time benefits follows the guidance set out in TAG Unit A5.1 and uses the data contained within the TAG Databook to quantify the impact of the Lake Lothing third crossing improvements.

To calculate journey time improvements the number of users benefiting from the new bridge at the proposed location needs to estimated. Census data relating to method and locations of travel to work were interrogated to establish existing travel patterns. A calculation of the pedestrian and cyclist numbers, based on census travel to work data, was undertaken to estimate users of active modes on both the proposed third crossing as well as the resulting existing and new active mode users on the existing crossings. The analysis of census data for commuting trips cross referenced the location of usual residence and place of work together with the method of travel to work. The calculation that was undertaken is summarised below:

i. The total number of commuters residing in LSOAs, within a 5km distance of the site, (i.e. the origin), travelling to the workplace in LSOAs adjacent to the landing point of the bridge (i.e. the destination) on the opposite side of the lake were obtained from 2011 census data.

ii. The proportions of modes of travel to work for each LSOA was also obtained from Census 2011 data.

iii. Using the figures in (i and ii) the number of commuters for each mode of travel can be calculated.

iv. The travel distances from a centroid of each 'origin' LSOA to the centroid of the corresponding 'destination' LSOA was measured for a Do-Minimum scenario (without the scheme) and the Do-Something scenario (with the scheme). Where the distance was calculated to be shorter in the Do-Something scenario it was assumed the commuter would use the new bridge.

v. The number of commuting pedestrians and cyclists that would benefit from the shorter travel distances were then totalled.

vi. Journey Time Savings could then be calculated using the average walk and cycle speeds and the differences in distances travelled. Average journey time savings for pedestrians and cyclists were then derived based on all the time savings calculated.

The calculation above provided the number of existing active mode users that would use a new bridge at the proposed location. This was converted to trips using the formula previously described in paragraph 1.2.2. It is also considered that as a result of providing a new bridge there are other people that will benefit from reduced journey lengths as a result of the new crossing, such as leisure trips for example. However, without data relating to all origin and destination movements in this area it is difficult to quantify. An estimate was derived using the uplifts previously mentioned for pedestrian and cyclist numbers, i.e. 17.5% uplift for cyclists and 10% uplift for pedestrians. Therefore, the amount of increase following the application of these uplifts were used for the 'new' cyclists and pedestrians.

To calculate the level of benefits the value of non-working time per person by commuting trip person (derived from the TAG Databook) is multiplied by the time saved and the number of users, existing and new, then annualised.

Table 1-14 details the assumptions and values used in formulating the level of benefits that could be derived by provision of the scheme.

Table 1-14 – Journey Time assumptions

Variable	Value	Source
Existing Number of Cyclists diverting to new bridge (trips)	45	Commuters from census data.
Core: Number of New Cyclists (new bridge)	8	Derived from census commuter data and assumed uplifts.
Existing Number of pedestrians diverting to new bridge (trips)	75	Based on survey data and Tempro growth factors
Core: Number of new pedestrians (trips)	7	Derived from census commuter data and assumed uplifts.
Proportion of commuting journeys	100%	The data was travel to work data so all trips were commuting journeys.

Variable	Value	Source
Average cycling speed (kph)	20	DMRB 11.3.8 - Pedestrian, Cyclist, Equestrian and Community Effects
Average walking speed (kph)	5	Based on DMRB 11.3.8 - Pedestrian, Cyclist, Equestrian and Community Effects
Value of non-working Time per person by 'commuter' trip purpose	6.81	TAG Databook - Table A1.3.1 - Value of Time per Person (2010 prices and values)
Value of non-working Time per person by 'other' trip purpose	6.04	TAG Databook - Table A1.3.1 - Value of Time per Person (2010 prices and values)
Average pedestrian journey time savings (hr)	0.073	Based on 2011 Census Travel to work data and journey length measurements
Average cyclist journey time savings (hr)	0.012	Based on 2011 Census Travel to work data and journey length measurements
Annualisation factor	365	7 days * 52 weeks

1.6.3 *Journey Time Results*

As described above it was not possible to identify routes for all existing trips by active modes so an indication of the level of benefits relating to commuters is provided given the availability of data. The estimate of journey time savings was calculated using known commuting patterns based on census data to the LSOAs adjacent to the lake. It is likely there will be other commuters and users of the proposed crossing that would benefit from a third crossing in terms of a reduction in journey time but it is considered it is not possible to robustly quantify this, as such these are not included in the benefits forecasted.

The forecast journey time impacts are presented in Table 1-15 showing the opening year benefit in 2010 prices.

Table 1-15 – Summary of journey time impacts (2010 prices)

Impact	Pedestrians	Cycle users	Total
Core Scenario: Journey Time benefit per annum	£14,204	£1,475	£15,679

1.7 Active Mode Benefits Over 30yr Appraisal Period (Core Scenario)

1.7.1 Overview

The active mode appraisal has been conducted over a 30 year appraisal period, in line with TAG. The opening year benefits for each active mode impact are summarised for the Core Scenario in Table 1-16 and the 30 year appraisal results in Table 1-17.

Table 1-16 – Summary of Opening Year Active Mode Impacts Core Scenario (2010 prices)

Impact	Pedestrian	Cycle user	Total
Physical Activity (Health)	£180,623	£78,836	£259,458
Absenteeism	£10,221	£5,093	£15,314
Journey Quality/Ambience	£62,356	£62,164	£124,520
Journey Time	£14,204	£1,475	£15,679
Total	**£267,404**	**£147,567**	**£414,970**

1.7.2 Assumptions

As outlined previously, a 30 year appraisal period has been assumed for the active mode benefits with an opening year of 2018. In line with TAG, the benefits have been discounted and reported in present values using the schedule of discount rates provided in the TAG Databook. As the appraisal has taken place in 2015, a discount rate of 3.50% per year has been applied until 2045, with a rate of 3.00% thereafter.

Again, in line with TAG, the values have included real growth in line with forecast GDP/capita.

1.7.3 Overall Results

Table 1-17 summarises the PVB for each of the active mode impacts outlined in the preceding sections of the report for the Core Scenario over the 30 year appraisal period. Appendix A provides a full summary of the discounted benefits.

Table 1-17 – Summary of Active Mode Impacts over 30Yr Appraisal Period (2010 prices and value)

Impact	Pedestrian	Cycle user	Total
Physical Activity (Health)	£3,699,115	£1,614,533	£5,313,648
Absenteeism	£209,319	£104,300	£313,620
Journey Quality/Ambience	£1,277,032	£1,273,103	£2,550,135
Journey Time	£290,894	£30,199	£321,093
Total	**£5,476,361**	**£3,022,135**	**£8,498,496**

1.8 Sensitivity Testing

As recommended in TAG Unit A5.1, the potential differences in uplift for pedestrians and cycle users as a result of the scheme has been considered.

1.8.1 Core, High and Low Scenarios

In order to sensitivity test the various assumptions and estimates used as part of the calculations, Core, High and Low Scenarios were tested.

The Core Scenario includes the main assumptions and estimates on the without scheme scenario. However, in order to test that the assumptions are appropriate, different levels of uplift were tested with reduced levels of uplift of pedestrians and cyclists being tested in the Low Scenario and greater levels of uplift in the High Scenario. Table 1-18 summarises the proportions used in the sensitivity tests and resulting benefits.

Table 1-18 – Low and High Uplift Sensitivity Test Results (rounded to nearest £1)

Assumptions and Results	Scenario Tests		
	Core	Low	High
Pedestrian Uplifts	10%	5%	15%
Cycle user Uplift	17.5%	5%	30%
Pedestrians Benefits	£5,476,361	£3,809,865	£6,842,421
Cycle users Benefits	£3,022,135	£2,406,688	£5,165,786
Total Benefits	**£8,498,496**	**£6,216,554**	**£12,008,207**

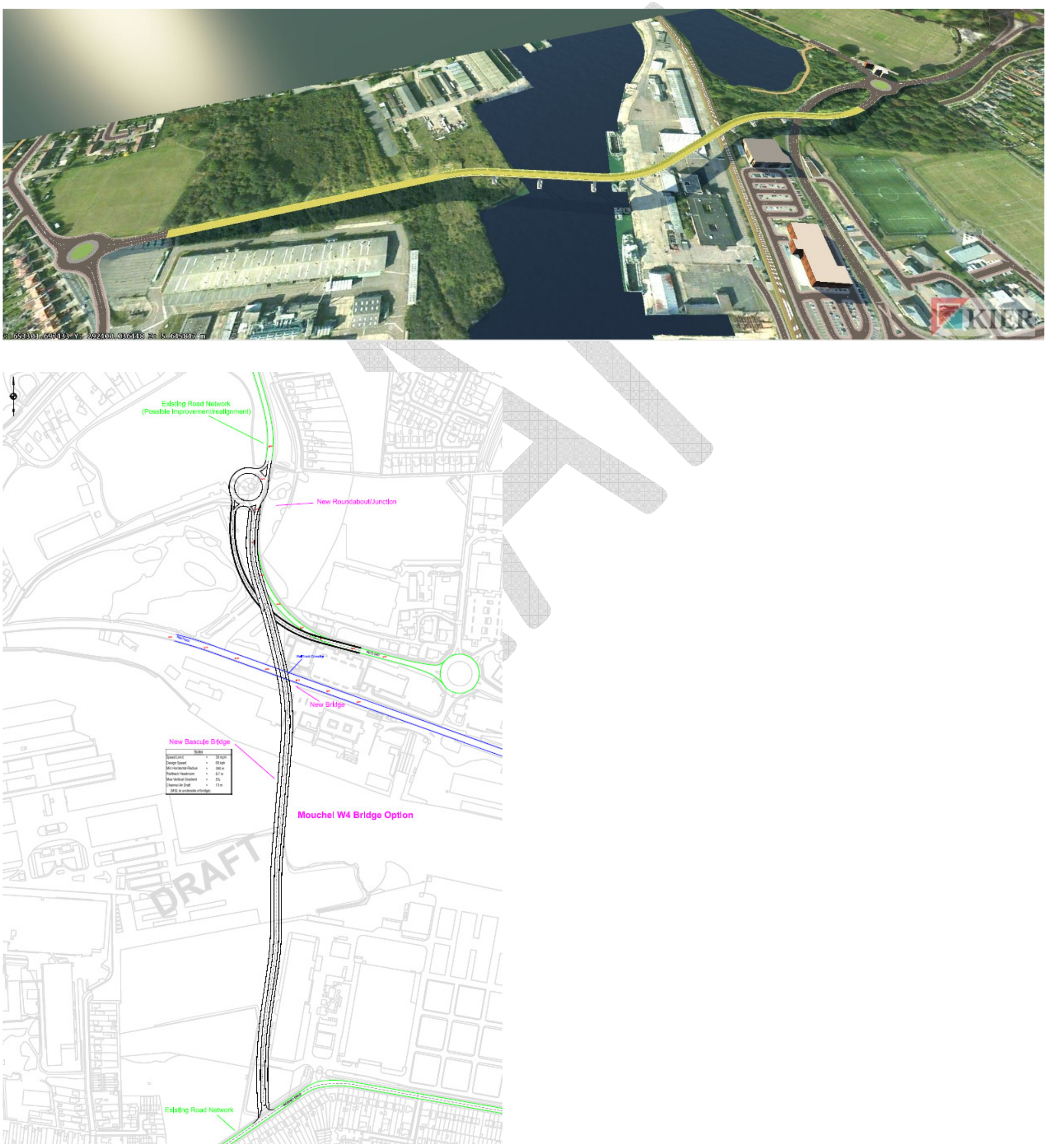
1.9 Alternative Crossing Option

As part of the scheme development and appraisal process a number of crossing locations were considered prior to determining the preferred option of a crossing in a central location. The optioneering exercise was undertaken to ensure the best possible alignment could be provided and a robust level of assessment of value for money could be achieved. Options towards the eastern and western ends of the lake as well as central options were considered at the outset.

One of the alignment options that was considered in greater detail was a bridge crossing towards the western end of the lake. An extract of the proposal is shown in Figure 1-2. The western option illustrated in Figure 1-2 includes the same type of infrastructure as the central option, i.e. segregated off-road pedestrian/cycleway on both sides of the carriageway.

An Active Mode Appraisal assessment of this option was also undertaken to assess the level of benefits that could be achieved by different options.

Figure 1-2 – Lake Lothing Third Crossing Western Crossing Proposal



1.9.1 *Summary of Benefits for the Western Option*

The level of benefits provided by the western option is illustrated in Table 1-19 for the opening year in 2010 prices. Table 1-20 details the level of benefits over the 30 year appraisal period in 2010 prices.

Table 1-19 – Summary of Active Mode Impacts in Opening Year (2010 prices and value)

Impact	Pedestrian	Cyclist	Total
Physical Activity (Health)	£177,104	£77,301	£254,405
Absenteeism	£10,022	£4,994	£15,015
Journey Quality/Ambience	£55,097	£60,821	£115,918
Journey Time	£8,380	£870	£9,250
Total	**£250,603**	**£143,986**	**£394,589**

Table 1-20 – Summary of Active Mode Impacts over 30Yr Appraisal Period (2010 prices and value)

Impact	Pedestrian	Cyclist	Total
Physical Activity (Health)	£3,627,055	£1,583,102	£5,210,157
Absenteeism	£205,242	£102,270	£307,511
Journey Quality/Ambience	£1,128,372	£1,245,602	£2,373,974
Journey Time	£171,628	£17,817	£189,445
Total	**£5,132,297**	**£2,948,791**	**£8,081,088**

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Appendix A – Benefits over 30 Year Appraisal Period

Year	Discount Factor	GDP per Capita Growth Factor	Absenteeism PVB	Physical Activity PVB	Journey Quality PVB	Journey Time PVB
2010	1.000	1.000				
2011	1.035	1.008				
2012	1.071	1.008				
2013	1.109	1.019				
2014	1.148	1.040				
2015	1.188	1.057				
2016	1.229	1.078				
2017	1.272	1.099				
2018	1.317	1.120	£10,856	£183,935	£88,274	£11,115
2019	1.363	1.142	£12,431	£210,619	£101,081	£12,727
2020	1.411	1.163	£12,236	£207,306	£99,491	£12,527
2021	1.460	1.185	£12,045	£204,075	£97,940	£12,332
2022	1.511	1.207	£11,859	£200,924	£96,428	£12,141
2023	1.564	1.230	£11,678	£197,854	£94,954	£11,956
2024	1.619	1.254	£11,501	£194,864	£93,519	£11,775
2025	1.675	1.278	£11,329	£191,952	£92,122	£11,599
2026	1.734	1.302	£11,162	£189,115	£90,761	£11,428
2027	1.795	1.328	£10,999	£186,353	£89,435	£11,261
2028	1.857	1.354	£10,840	£183,661	£88,143	£11,098
2029	1.923	1.381	£10,685	£181,037	£86,884	£10,940
2030	1.990	1.408	£10,534	£178,477	£85,655	£10,785
2031	2.059	1.437	£10,386	£175,978	£84,456	£10,634
2032	2.132	1.466	£10,242	£173,534	£83,283	£10,486
2033	2.206	1.496	£10,101	£171,143	£82,135	£10,342
2034	2.283	1.527	£9,963	£168,801	£81,011	£10,200
2035	2.363	1.559	£9,827	£166,502	£79,908	£10,061
2036	2.446	1.591	£9,695	£164,256	£78,830	£9,926
2037	2.532	1.625	£9,564	£162,040	£77,767	£9,792
2038	2.620	1.659	£9,435	£159,854	£76,717	£9,660
2039	2.712	1.694	£9,308	£157,697	£75,682	£9,529
2040	2.807	1.729	£9,184	£155,598	£74,675	£9,402
2041	2.905	1.766	£9,061	£153,526	£73,680	£9,277
2042	3.007	1.803	£8,941	£151,481	£72,699	£9,154
2043	3.112	1.841	£8,822	£149,464	£71,731	£9,032
2044	3.221	1.880	£10,362	£175,561	£84,255	£10,609
2045	3.334	1.920	£10,276	£174,113	£83,560	£10,521
2046	2.898	1.961	£10,192	£172,677	£82,871	£10,434
2047	2.985	2.003	£10,108	£171,252	£82,188	£10,348
2048	3.075	2.046	£313,620	£5,313,648	£2,550,135	£321,093
2049	3.167	2.090	£0	£5	£3	£0
Sum			**£313,620**	**£5,313,648**	**£2,550,135**	**£321,093**
					Overall Total	**£8,498,496**