Great Yarmouth
Third River Crossing

OUTLINE BUSINESS CASE

MARCH 2017

Supporting Document 10 – Active Modes Appraisal Report

Norfolk County Council

Great Yarmouth Borough Council

New Anglia Local Enterprise Partnership for Norfolk and Suffolk

1 Technical Note – Active Mode Appraisal

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1.1 Introduction

1.1.1 Overview

This technical note details the economic appraisal of the impact on active modes, i.e. pedestrians and cycle users, resulting from the proposed third river crossing in Great Yarmouth. Included within this note are details on the approach used to appraise the scheme, the sources of data used and assumptions applied, as well as a summary of 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 1.5 sets out the physical activity (health) impacts that are forecast to result from the scheme;

Section 1.6 describes the absenteeism impacts that are expected to be generated by the scheme;

Section 1.7 describes the journey quality/ambience impacts that are forecast to result from the scheme;

Section 1.8 details the Journey Time savings estimated from a new crossing

Section 1.9 presents the overall active mode benefits over the appraisal period; and

Section 1.10 details the high and low demand sensitivity testing.

1.2 Overview

1.2.1 Great Yarmouth Third River Crossing Scheme

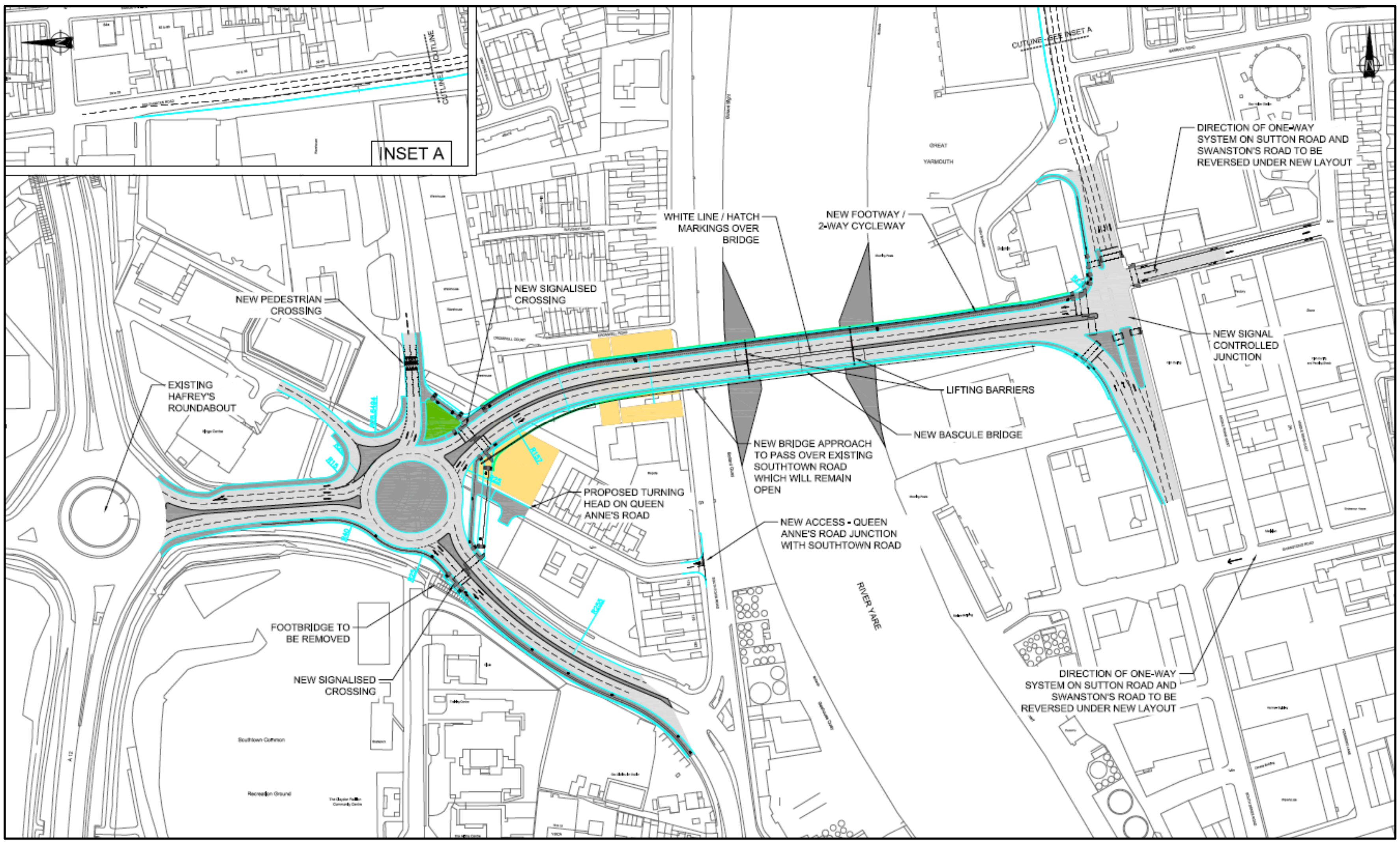
The proposal is for a new (third) crossing over the River Yare, Great Yarmouth. The town itself is geographically constrained, bounded by the North Sea to the east and both the River Yare and the River Bure to the west. Currently there are only two road crossing points over the River Yare. The Haven Bridge crosses the River Yare along the A1243, linking in with the Strategic Road Network (SRN) to the south. The Breydon Bridge crosses the River Yare along the A47 (previously the A12) forming a north-south route, providing a direct route to and from Norwich.

Great Yarmouth's town centre and its riverfront have, for many years been subject to industrial decline and under-utilisation, exacerbated by limited road access to the peninsula and the congestion which this causes.

Great Yarmouth is highlighted as a key growth location within the New Anglia LEP's Strategic Economic Plan and is a key area for regeneration. The proposed scheme will support regeneration by improving access to the industrial area, south of the peninsula, 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 river 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 shows the alignment of the proposed third river crossing, which is located south of the two existing bridges. The bridge features an off-road segregated pedestrian and cycle path on the northern side of the carriageway and pedestrian path on the southern side; at-grade crossings are also provided at the west and east junction.

Figure 1-1 – Great Yarmouth Third River Crossing Proposal



1.3 Accessibility

Accessibility analysis was carried out using Visography TRACC, a multi-modal transport accessibility analysis tool developed by Basemap Ltd in conjunction with DfT. The tool is designed to generate travel times for origin and destination pairs based upon public transport timetable data, road network information and a range of user-defined parameters which can then be represented in thematic maps and the creation of contours. Figures 1-2 and 1-3 show the difference in walking accessibility under 30 minutes between 2017 and 2023.

Figure 1-2 - Walking accessibility 2017

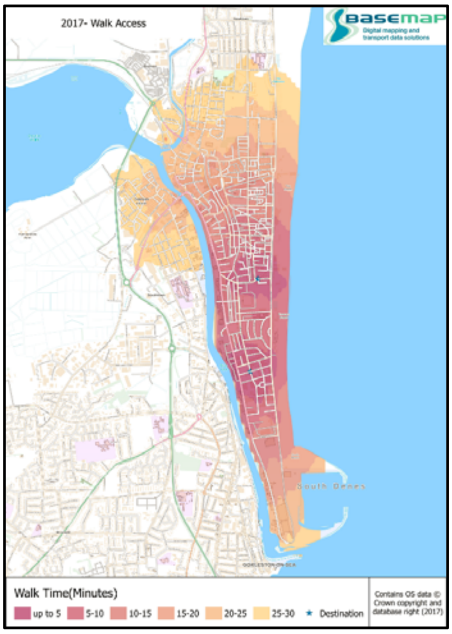


Figure 1-3 - Walking accessibility 2017

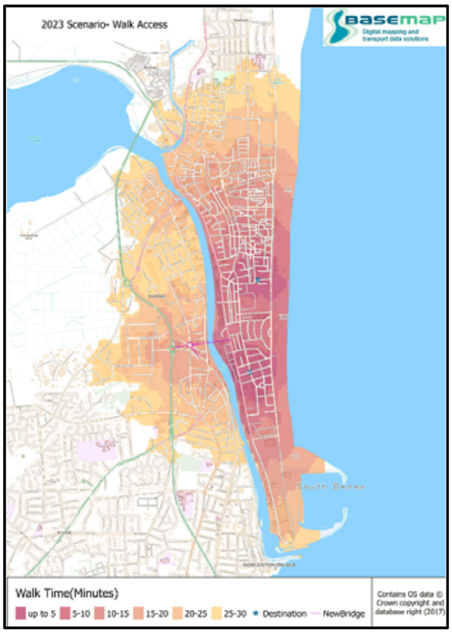


Figure 1-3 - Cycling accessibility 2017

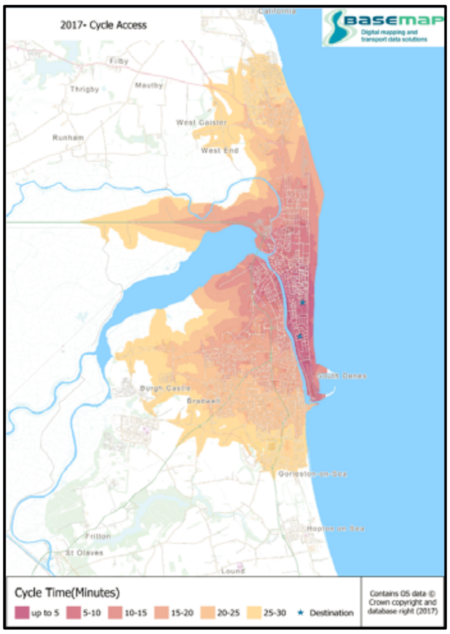
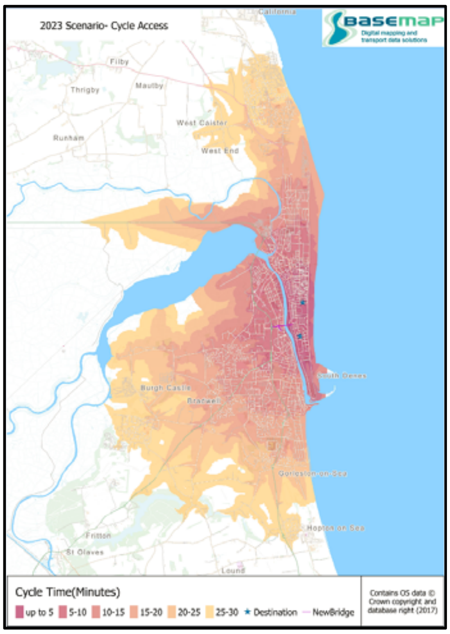


Figure 1-4 - Cycling accessibility 2023



Figures 1-3 and 1-4 similarly show the distance that can be cycled in under 30 minutes, providing a visual representation of the cycling accessibility in the local area. In both instances, for pedestrians and cycle users, it can be seen that accessibility to the south is significantly improved in 2023 with the provision of a third river crossing, particularly around Burgh Castle, Bradwell and Gorleston. This analysis of active mode benefits seeks to quantify (in-part) the economic value of this improved connectivity.

1.4 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 River 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 River Crossing, and A1243 Haven Bridge	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 River Crossing, and A1243 Haven Bridge	Pedestrians & Cycle users	
Journey Quality	Third River Crossing, and A1243 Haven Bridge	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 River Crossing New toucan crossings*	Pedestrians & Cycle users	The provision of a third river crossing 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. The replacement of the existing footbridge with at-grade Toucan crossings at Williams Adams Way will help to reduce journey length and distance whilst improving accessibility for all users.

** It should be noted that physical activity, absenteeism and journey quality benefits were only calculated for the proposed bridge crossing and not the proposed toucan crossings on William Adams Way to avoid the possibility of double counting. Only journey time benefits were calculated to quantify the benefit of replacing the footbridge with at-grade crossings, this presents a conservative level of benefits but is considered a sufficiently robust method for this appraisal.*

1.4.1 *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 latest available count data (June 2016) on the existing Haven bridge as shown in Table 1-2. The survey counted the number of pedestrians and/or cyclists observed crossing at this location during a 12 hour (7am – 7pm) period. Surveys taken at the A12 Breydon Bridge were not assessed due to the nature of the road (50mph) with no facilities for walking or cycling.

Table 1-2 - Summary of Pedestrian and Cycle Survey Counts (June 2016)

Date	Location	Ped Count	Cycle Count
30/06/2016	Haven Bridge	5453	1214

Additional surveys were undertaken in February 2017 at four locations, listed in Table 1-3. This survey data was used to supplement the June 2016 count data, mainly for assessing the impact of replacing the footbridge on William Adams Way with a toucan crossing.

Table 1-3 – Summary of Pedestrian and Cycle Survey Counts (February 2017)

Date	Location	Ped Count	Cycle Count
21/02/2017	Suffolk Road/Queen Anne's Road/William Adams Way	466	159
21/02/2017	William Adams Way Footbridge	386	79
21/02/2017	South Denes Road	45	59
21/02/2017	William Adams Way/Beccles Road/Southtown Road	527	258

1.4.2 *TEMPro Growth Factors*

The Department for Transport's (DfT) Trip End Model Presentation Program (TEMPro) takes account of local planning data including population, employment and car ownership, together with traffic growth factors to provide local traffic projection factors.

The growth factors obtained from TEMPro, detailed in
Table 1-4, provide an uplift factor for estimated growth in walking and cycling numbers for the Great Yarmouth District. Factors were identified to enable the count years (2016 and 2017) to be uplifted to the expected opening year of 2023 and the average figures for the two modes were used to calculate the uplift in pedestrian and cycle numbers.

Table 1-4 – TEMPRO Uplift Factors

Count Yr	Opening Yr	Walk			Cycle		
		Origin	Destination	Average	Origin	Destination	Average
2016	**2023**	1.0542	1.0538	**1.0540**	1.0438	1.0437	**1.0438**
2017	**2023**	1.0453	1.045	**1.0451**	1.037	1.037	**1.037**

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

1.4.3 *User Base Demand*

Demand for cycling across the River Yare has been calculated using count data for the A1243 Haven Bridge. The recorded number of cyclists crossing the bridge over a 12 hour period (7am-7pm) is detailed in Table 1-3. The count data included counting cyclists on-carriageway as well as off-carriageway.

A 'reference demand' figure for cycle user activity has been selected based on the 12 hour survey counts. The two-way count was 1,056 on the A1243 Haven Bridge and this flow was uplifted by a factor of 1.15 to give a 24hr flow value, equal to 1,214.

The 'reference demand' figure for pedestrian user activity has also been based on the 12 hour survey counts. The two-way count was 4,742 and has been uplifted by a factor of 1.15 to give a 24hr flow value of 5,453.

The same method was employed for the survey counts taken at the four locations in February 2017 to capture the walking and cycling demand for the proposed toucan crossing. The counts were again uplifted by a factor of 1.15 giving a 24hr flow value of 69 cycle trips and 271 pedestrian trips.

1.4.4 *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:

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

1.4.5 *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 2023 (as per

Table 1-4). The number of individuals was calculated using the formula detailed in the paragraph above. This gave the following total trip and individual numbers:

- Cycle users on bridge: 1,272 trips and 700 individuals
- Pedestrians on bridge: 5,748 trips and 3,161 individuals
- Cycle users at William Adams Way crossing: 72 trips and 39 individuals
- Pedestrians at William Adams Way crossing: 284 trips and 156 individuals

1.4.6 *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 forecasts 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 will become a more viable and attractive mode (Section 1.4.7 details the methodology for calculating this uplift).

It was assumed a proportion of the existing (and additional) pedestrians and cyclists would cross a third bridge in the proposed location if it was available. The proportion of existing pedestrians and cyclists diverting to the new bridge was assumed to be the same as the vehicular proportional change from Haven Bridge to the new crossing.

This method was adopted using the traffic model outputs which project that in 2023, 60% of AADT vehicular traffic would transfer over to the new crossing from the Haven Bridge. This figure was therefore applied to the proportion of pedestrians and cyclists that would divert from the existing Haven Bridge to use the new crossing.

1.4.7 *Estimation of Uplifts resulting from the Third River Crossing*

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 conversely, a 'High' Scenario tested an increased uplift. Table 1-5 details a summary of the uplifts used to test the different scenarios for the scheme.

Table 1-5 – 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 uplifts referred to above, it was also assumed that the provision of a third crossing 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) that fall within a 5km radius of the alignment of the scheme.

Actual walking and cycling distances were calculated for each LSOA pair on either side of the River Yare under current road network conditions (in the absence of the new crossing). The new bridge was then added to the road network layer and the distances were re-calculated. It was assumed that where the distance was shorter and journey was quicker in the 'do-something' scenario, then the commuter would divert on to the new crossing.

The proportion of commuters for each mode of travel is available via the 2011 census data. This was used to calculate the expected number of commuters travelling by each mode. A 5% modal shift to active modes was also applied to the number of people travelling by car, taxi and bus to generate an estimated number of 78 new active mode users as a result of modal shift brought about by the new crossing opportunity. This number was then 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 conservative yet 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.

1.5 Physical Activity Impacts (Health)

1.5.1 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 on parts of the existing network, namely Haven Bridge.

1.5.2 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 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].

The physical activity impacts have been calculated using the assumptions set out in Table 1-6.

Table 1-6 – Physical Activity Assumptions

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

Variable	Value	Source
Number of new pedestrians (assuming 10% uplift of without scheme and modal shift of existing commuters)	368	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)	148	
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[1]
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

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;

[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.

- **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

1.5.3 *Physical Activity (Health) Impact Results*

The forecast physical activity (health) impacts, based on the HEAT assessment are summarised in Table 1-7 for the Core Scenario for the opening year in 2010 prices.

Table 1-7 – Summary of Physical Activity (Health) Impacts (2010 prices)

Impact	Pedestrians	Cycle users	Total
Core Scenario: Physical Activity (Health) benefit per annum	£127,032	£45,838	£172,870

1.6 Absenteeism

1.6.1 *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.

1.6.2 *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; 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 1-8.

Table 1-8 – Absenteeism Impact Assumptions

[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

Variable	Value	Source
Number of new pedestrians (assuming 10% uplift of without scheme demand and calculation of modal change from existing commuters)	368	% 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)	148	
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

Table 1-9 – Summary of Absenteeism impacts (2010 prices)

Impact	Pedestrians	Cycle users	Total
Core Scenario: Absenteeism benefit per annum	£7,188	£2,961	£10,149

1.7 Journey Quality/Ambience

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 on both the new and existing Haven Bridge. The traffic modelling work forecasted that flows on the Haven Bridge would reduce by approximately 49%. A bespoke value for the benefit of reduced traffic was calculated using an average of the cycle benefit inputs taken from the TAG databook, 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. 60%) 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 60% of cycle trips in the ‘do something’ scenario.

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

The journey quality/ambience impacts for cycle users have been calculated using the assumptions set out in Table 1-10.

Table 1-10 – Journey Quality/Ambience Impact Assumptions for Cycle users

Variable	Value	Source
Number of existing users – rerouting to use third crossing	762	Based on uplifts and traffic modelling
Number of users	1,542	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)	0.40	Measurement of scheme
Scheme Improvement Value for off-road segregated path (pence/min)	7.03	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

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

1.7.1 *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 flows on the Haven Bridge would reduce by around 49%.

A segregated off-road footway/cycle track is to be provided on the northern side of the scheme. 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 made on the new crossing and 2.64p per journey made on the new toucan crossing on William Adams Way.

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 1-11.

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

Variable	Value	Source
Number of existing pedestrian trips on existing bridge (Do Minimum)	5,748	Based on survey data and Tempro uplifts.
Number of pedestrian trips on existing bridges (Do Something)	6,417	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
Number of existing pedestrian trips at crossing on WAW (Do Minimum)	284	Based on survey data and Tempro uplifts.
Number of pedestrian trips at crossing on WAW (Do Something)	312	Based on uplifts
Value of Toucan crossing (compared to footbridge)	2.64	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

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

1.7.2 *Journey Quality/Ambience Results*

The forecast journey quality/ambience impacts are detailed in Table 1-12 and show the opening year benefit in 2010 prices.

Table 1-12 – Summary of Journey Quality/Ambience Impacts (2010 prices)

Impact	Pedestrians	Cycle users	Total
Core Scenario: Journey Quality/Ambience benefit per annum	£40,586	£50,823	**£91,409**

1.8 Journey time

1.8.1 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 across both the new third crossing and existing Haven Bridge. The new infrastructure may allow cycle users to travel faster compared to the existing conditions due to less impediments/congestion on the existing routes. Journey times for cycle users may therefore be reduced, particularly for those starting or ending their trips in areas adjacent to or south of the new crossing, including Gorleston, as those journeys will be significantly shorter.

Similarly, the provision of a new crossing in the proposed location may also bring about journey time improvements for pedestrians in these areas due to a 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 within a 5km radius of the proposed third crossing location. These areas were selected as it is assumed that a significant proportion of people travelling to/from these areas would benefit from a new crossing in the proposed 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.

1.8.2 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 Great Yarmouth Third River Crossing improvements.

To calculate journey time improvements, the number of users benefitting from the new bridge at the proposed location needs to be 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 the census travel to work data, was undertaken to estimate users of active modes on both the proposed third crossing as well as the existing and new active mode users on the existing crossings. The analysis of census data for commuting trips involved cross referencing with 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) on one side of the river, travelling to the workplace in LSOAs within a 5km distance of the site (i.e. the destination) on the opposite side of the river were obtained from 2011 census data.

ii. The proportion of the travel to work mode 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 population weighted 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) using GIS. Where the distance was calculated to be shorter in the Do-Something scenario, it was assumed the commuter would use the new bridge crossing.

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 (5km/h and 20km/h respectively) and the differences in distances travelled. Average journey time savings for pedestrians and cyclists were then derived based on the sum of all the time savings calculated.

The calculation above provided the number of existing active mode users that would use the new bridge at the proposed location. This was converted to trips using the reverse of the formula previously described in paragraph 1.4.4. 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 those making leisure trips from outside of the local area for example. However, without data relating to all origin and destination movements, 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. The values derived from the application of these uplifts were used to represent 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. An annualisation factor is subsequently applied.

Table 1-13 details the assumptions and values used in formulating the level of benefits that could be derived by provision of the scheme.

Table 1-13 – Journey Time assumptions

Variable	Value	Source
Existing Number of Cyclists diverting to new bridge (trips)	212	Commuters from census data.
Core: Number of New Cyclists (new bridge)	37	Derived from census commuter data and assumed uplifts.
Existing Number of pedestrians diverting to new bridge (trips)	585	Based on survey data and Tempro growth factors
Core: Number of new pedestrians (trips)	59	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.
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 over bridge (hr)	0.112	Based on 2011 Census Travel to work data and journey length measurements
Average pedestrian journey time savings over new toucan crossing (hr)	0.015	Based on Actual Pedestrian Survey Counts and journey length measurements
Average cyclist journey time savings over bridge (hr)	0.017	Based on 2011 Census Travel to work data and

Variable	Value	Source
		journey length measurements
Average cyclist journey time savings over new toucan crossing (hr)	0.012	Based on Actual Pedestrian Survey Counts and journey length measurements
Annualisation factor	365	7 days * 52 weeks

1.8.3 *Journey Time Results*

As described above, it was not possible to identify routes for all existing trips by active modes and therefore only an indication of the level of benefits relating to commuters is provided, given the availability of data. The estimate of journey time savings for the bridge was calculated using known commuting patterns based on census data to the LSOAs within a 5km radius of the new proposed scheme location. It is likely there will be other commuters and users of the scheme that would benefit from a third crossing in terms of a reduction in journey time, however, it is considered that it is not possible to robustly quantify this and as such, these are not included in the benefits forecasted.

Journey time savings were also calculated for a new proposed toucan crossing on Williams Adams Way (replacing the existing footbridge). This was calculated using actual 12hr pedestrian count data (February 2017) and journey length measurements (included within Table 1-14).

The forecast journey time impacts are presented in Table 1-14 showing the opening year benefit in 2010 prices.

Table 1-14 – Summary of journey time impacts (2010 prices)

Impact	Pedestrians	Cycle users	Total
Core Scenario: Journey Time benefit per annum	£182,479	£11,644	**£194,123**

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

1.9.1 *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 1-15 and the 30 year appraisal results in Table 1-16.

Table 1-15 – Summary of Opening Year Active Mode Impacts Core Scenario (2010 prices)

Impact	Pedestrian	Cycle user	Total
Physical Activity (Health)	£127,032	£45,838	£172,870
Absenteeism	£7,188	£2,961	£10,149
Journey Quality/Ambience	£50,823	£40,586	£91,409
Journey Time	£182,479	£11,644	£194,123
Total	**£367,522**	**£101,029**	**£468,551**

1.9.2 *Assumptions*

As outlined above, a 30 year appraisal period has been assumed for the active mode benefits with an opening year of 2023. 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 2017, 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.

1.9.3 *Overall Results*

Table 1-16 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 1-16 – Summary of Active Mode Impacts over 30Yr Appraisal Period (2010 prices and value)

Impact	Pedestrian	Cycle user	Total
Physical Activity (Health)	£2,535,628	£914,949	£3,450,577
Absenteeism	£143,482	£59,106	£202,588
Journey Quality/Ambience	£1,014,452	£810,129	£1,824,581
Journey Time	£3,642,393	£232,412	£3,874,805
Total	**£7,335,955**	**£2,016,597**	**£9,352,552**

1.10 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 have been considered.

1.10.1 *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 1-17 summarises the proportions used in the sensitivity tests and resulting benefits.

A further sensitivity test was carried out using the traffic model output variable demand flows for the core scenario including Harfrey's roundabout. This resulted in the proportion of pedestrians and cycle users transferring to the new bridge increasing to 62%.

Table 1-17 – Low and High Uplift and Core including Harfrey's Roundabout Sensitivity Test Results (rounded to nearest £1)

Assumptions and Results	**Scenario Tests**			
	Core	**Harfrey's Roundabout Sensitivity Test**	**Low**	**High**
Pedestrian Uplifts	10%	10%	5%	15%
Cycle user Uplift	17.5%	17.5%	5%	30%
Pedestrians Benefits	£7,335,955	£7,351,227	£6,081,101	£8,082,136
Cycle users Benefits	£2,016,597	£2,034,680	£1,396,060	£2,637,588
Total Benefits	**£9,352,552**	**£9,385,907**	**£7,477,161**	**£10,719,724**

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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				
2019	1.363	1.142				
2020	1.411	1.163				
2021	1.460	1.185				
2022	1.511	1.207				
2023	1.564	1.230	£6,490	£110,534	£58,447	£124,123
2024	1.619	1.254	£7,860	£133,870	£70,787	£150,328
2025	1.675	1.278	£7,740	£131,824	£69,705	£148,031
2026	1.734	1.302	£7,623	£129,832	£68,652	£145,794
2027	1.795	1.328	£7,509	£127,892	£67,626	£143,615
2028	1.857	1.354	£7,398	£126,002	£66,627	£141,493
2029	1.923	1.381	£7,290	£124,162	£65,654	£139,426
2030	1.990	1.408	£7,184	£122,368	£64,705	£137,413
2031	2.059	1.437	£7,082	£120,620	£63,781	£135,449
2032	2.132	1.466	£6,982	£118,914	£62,879	£133,534
2033	2.206	1.496	£6,884	£117,249	£61,998	£131,664
2034	2.283	1.527	£6,788	£115,621	£61,138	£129,836
2035	2.363	1.559	£6,695	£114,028	£60,295	£128,047
2036	2.446	1.591	£6,603	£112,467	£59,470	£126,294
2037	2.532	1.625	£6,513	£110,936	£58,660	£124,574
2038	2.620	1.659	£6,425	£109,439	£57,869	£122,894
2039	2.712	1.694	£6,339	£107,963	£57,088	£121,236
2040	2.807	1.729	£6,253	£106,506	£56,318	£119,600
2041	2.905	1.766	£6,169	£105,069	£55,558	£117,987
2042	3.007	1.803	£6,087	£103,670	£54,818	£116,416
2043	3.112	1.841	£6,006	£102,290	£54,088	£114,866
2044	3.221	1.880	£5,926	£100,928	£53,368	£113,336
2045	3.334	1.920	£5,847	£99,584	£52,657	£111,827
2046	2.898	1.961	£6,868	£116,971	£61,851	£131,352
2047	2.985	2.003	£6,811	£116,006	£61,341	£130,269
2048	3.075	2.046	£6,755	£115,049	£60,835	£129,194
2049	3.167	2.090	£6,699	£114,101	£60,334	£128,128
2050	3.262	2.135	£6,644	£113,159	£59,836	£127,072
2051	3.360	2.181	£6,589	£112,226	£59,342	£126,024
2052	3.461	2.228	£6,535	£111,300	£58,853	£124,984
Sum			**£202,588**	**£3,450,577**	**£1,824,581**	**£3,874,805**

Overall Total	**£9,352,552**