Appendix H – Transport User Benefits Appraisal (TUBA) Report

REPORT N^{O} 5

LAKE LOTHING THIRD CROSSING

TUBA BENEFITS REPORT

CONFIDENTIAL

DECEMBER 2015

LAKE LOTHING THIRD CROSSING

TUBA BENEFITS REPORT

Suffolk County Council

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1 INTRODUCTION

1.1 STUDY OVERVIEW

1.1.1 WSP | Parsons Brinckerhoff has been commissioned by Suffolk County Council (SCC) to undertake traffic modelling in support of a Transport Business Case (TBC) for a third crossing of Lake Lothing in Suffolk.

1.1.2 WSP | Parsons Brinckerhoff have rebuilt and validated the Lowestoft Traffic Model (LTM) to a base year of 2015. The development of this model is outlined in the associated Local Model Validation Report (LMVR), dated December 2015. The base year model is compliant with the latest Department for Transport (DfT) Transport Analysis Guidance (TAG). Forecast models were built for 2020, representing the proposed opening year for the third crossing, and the design year. The forecast are discussed in the Traffic Forecasting Report (December 2015).

1.1.3 This report sets out the appraisal of user benefits undertaken using the DfT's TUBA software. This crucially relies on outputs from the model forecasts, and applies standard values to generate an estimate of scheme benefits. These benefits will be incorporated into the overall economic assessment of the scheme in the Transport Business Case, but this report is focused solely on the direct assessment of user benefits.

1.2 REPORT STRUCTURE

1.2.1 This Forecasting Report sets out information relating to the development and assignment of the updated highway assignment model. It is structured as follows:

- Section 2 – Project background
- Section 3 – Input assumptions
- Section 4 – Results
- Section 5 – Sensitivity testing

1.3 DISCLAIMER

1.3.1 This report, and information or advice which it contains, has been prepared for the purposes set out in the instructions commissioning it (June 2015) and has been prepared with reasonable skill, care and diligence. This report has been prepared by WSP | Parsons Brinckerhoff in their professional capacity as Consultants and in performance of WSP | Parsons Brinckerhoff's duties and liabilities under its contract with Suffolk County Council. Any advice, opinions, or recommendations within this report should be read and relied upon only in the context of the report as a whole. The advice and opinions in this report are based upon the information made available to WSP | Parsons Brinckerhoff at the date of this report and on current UK standards, codes, technology and construction practices as at the date of this report. The contents of the report do not, in any way, purport to include any manner of legal advice or opinion.

1.3.2 The transport modelling that has been carried out under the terms of our appointment (June 2015) and described in this report has been carried out using SATURN (version 11.3.12F). Transport modelling software of this type provides predictions of transport flows on the basis of a number of assumptions. The assumptions made in developing the transport model have been identified within this report.

1.3.3 The liability of WSP | Parsons Brinckerhoff in respect of the information contained in the report will not extend to any third party. WSP | Parsons Brinckerhoff accept no responsibility for any costs or losses howsoever incurred as a result of the use of the output from this report unless it is proved to have failed to exercise the degree of skill and care embodied in the terms and conditions of the governing appointment (June 2015) having regard to the use of the software and the assumptions made.

2 PROJECT BACKGROUND

2.1 STUDY AREA

2.1.1 This model has been developed and validated for the sole purpose of assessing a third crossing of Lake Lothing in Lowestoft. The town centre currently has two river crossings, as shown in Figure 2.1 below.

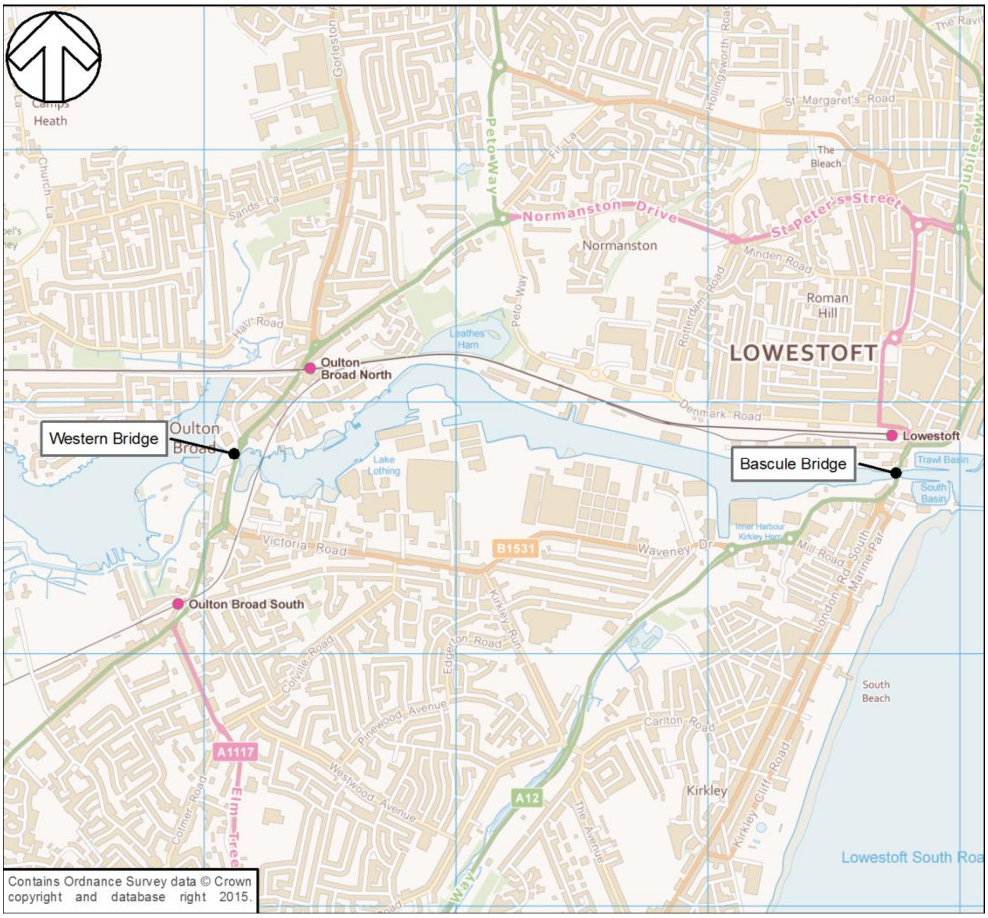


Figure 2.1 - Bridge locations

2.2 SCHEME OPTIONS

2.2.1 Four different options were put forward for the third crossing. The options were:

- Tunnel in the centre of the existing bridges (T3)
- Swing bridge near the existing western bridge (W4)
- Swing bridge in the centre of the existing bridges (C6)
- Swing bridge in the centre of the existing bridges (C11)

2.2.2 For the purpose of this report each scheme will be referred to using the numeric-alpha codes T3, W4, C6 and C11. Scheme drawings of each option can be seen in Appendix A.

2.2.3 Initial assessments for each option have been undertaken with the core growth forecast scenario as described in the Traffic Forecasting Report (December 2015).

3 INPUT ASSUMPTIONS

3.1 APPRAISAL PERIOD

3.1.1 Scheme benefits have been assessed using the Department for Transport's TUBA (Transport Users Benefit Appraisal) software. This is an industry-standard tool for undertaking economic appraisal in accordance with guidelines published in TAG Unit A1 (November 2014). The full economic assessment methodology adopted including choice of parameters, definition of inputs, discounting and reporting is compliant with TAG Unit A1.

3.1.2 The current version of the TUBA software is Version 1.9.5 which is consistent with parameters published in TAG Unit A1 (November 2014).

3.1.3 The third crossing, like most road projects, is considered to be an asset with an indefinite life, with maintenance and renewal taking place as required. Scheme appraisal has therefore been undertaken for a 60-year period in accordance with HM Treasury's Green Book, from the assumed scheme opening in 2017 to 2076.

3.1.4 Forecasts have been developed for 2020 and 2035, and outputs from these models have been input into the software. TUBA extrapolates growth between these years, and after 2035 the default TUBA assumption of no growth beyond this point has been retained, in the absence of more detailed information. Calculated benefits are therefore likely to represent a conservative estimate.

3.2 MODELLED PERIODS

3.2.1 The Lowestoft traffic model covers the following time periods:

- AM peak hour (0800-0900)
- Average interpeak hour (1000-1600)
- PM peak hour (1700-1800)

3.2.2 In order to provide a more realistic estimate of benefits throughout the year, and to fulfil the requirement of TAG Unit A3 paragraph 4.3.1 – that all 8760 hours in a year if TUBA is used to estimate the change in carbon dioxide – it was necessary to develop models of additional time periods.

3.2.3 Guidance contained in the TUBA manual (November 2014) was followed, in that factors derived from traffic counts were applied to the existing modelled time periods to generate new modelled time periods. The additional modelled periods are set out in Table 3.1.

3.2.4 Taken as an average, the off peak and weekend periods represent an oversimplification of these periods, as there is likely to be significant variation within the period, such as peak Saturday shopping periods. However, these periods do not contribute a significant element of the benefits, so this methodology is considered a proportional approach to representing these time periods without overcomplicating the analysis. As such, benefits from these time periods are likely to be underestimated.

Table 3.1 - Additional modelled time periods

Time Period	Source	Car Factor	LGV Factor	HGV Factor
AM Pre-Peak (0700-0800)	AM Peak (0800-0900)	0.667	0.760	0.789
AM Post-Peak (0900-1000)	AM Peak (0800-0900)	0.885	0.936	0.971
PM Pre-Peak (1600-1700)	PM Peak (1700-1800)	0.899	0.983	1.369
PM Post-Peak (1800-1900)	PM Peak (1700-1800)	0.721	0.781	0.684
Average Off Peak (1900-0700)	Average Interpeak (1000-1600)	0.267	0.225	0.152
Average Weekend (0000-0000)	Average Interpeak (1000-1600)	0.212	0.521	0.259

3.2.5 The car user class is divided into three journey purposes: commuting, business and other. For the weekday shoulder peaks, the purpose split was retained from respective peak hours, as it is unlikely that these will change significantly in a short period of time. For the off peak and weekend models, the car matrices were adjusted so that the TAG default purpose splits were applied in these periods, in the absence of any more detailed local information.

3.3 ANNUALISATION FACTORS

3.3.1 In keeping with TAG guidance, the base weekday models represent an average Monday-Thursday weekday. In order to annualise these periods to average Monday-Friday weekdays, an adjustment factor was derived based on average Automatic Traffic Counts (ATCs) in the study area. Bank holidays were represented with the weekend modelled time period. The annualisation factors applied are shown in Table 3.2.

Table 3.2 - Annualisation factors

Time Slice	Time Period	Factor	No. in Year	Annualisation Factor
TS1	AM 0700-0800 M-Fr	0.990	253	250.57
TS2	AM 0800-0900 M-Fr	0.996	253	252.08
TS3	AM 0900-1000 M-Fr	1.012	253	256.11
TS4	IP Ave 1000-1600 M-Fr	1.003	1518	1522.90
TS5	PM 1600-1700 M-Fr	1.002	253	253.52
TS6	PM 1700-1800 M-Fr	0.981	253	248.28
TS7	PM 1800-1900 M-Fr	0.999	253	252.82
TS8	OP Ave 1900-0700 M-Fr	1.000	3036	3036
TS9	WE Ave 0000-0000 Sa-Su	1.000	2688	2688

3.4 USER CLASSES

3.4.1 The TUBA user classes are largely the same as the SATURN user classes, with splits applied to separate out LGV journey purpose and OGV1/OGV2 as described in the LMVR (December 2015). The input TUBA user classes are set out in Table 3.3.

Table 3.3 - TUBA user classes

UC	TUBA User Class	SATURN User Class	Vehicle Type	Purpose	Person
UC1	Commuting	Commuting	Car	All	Commuting
UC2	Business	Business	Car	All	Business
UC3	Other	Other	Car	All	Other
UC4	LGV Freight	LGV	LGV Freight	Driver	Business
UC5	LGV Personal	LGV	LGV Personal	All	All
UC6	OGV1	HGV	OGV1	Driver	Business
UC7	OGV2	HGV	OGV2	Driver	Business

3.4.2 The TAG default for LGV journey purpose has been applied. Local data from traffic counts has been used to separate out OGV1 and OGV2 matrices, with an additional factor of 0.5 applied to these user classes to convert them from passenger car units (pcu) to vehicles. Factors applied to the input trip matrices are set out in Table 3.4.

Table 3.4 - Trip matrix factors

	TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9
UC1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UC2	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UC3	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UC4	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880	0.880
UC5	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120
UC6	0.390	0.390	0.390	0.385	0.355	0.355	0.355	0.385	0.385
UC7	0.110	0.110	0.110	0.115	0.145	0.145	0.145	0.115	0.115

3.4.3 Since the time and distance skims were extracted from SATURN in the correct format, no further factoring was required.

4 RESULTS

4.1 RESULTS CHECKS

4.1.1 Warnings reported by TUBA were checked to verify that none indicated an issue in the models that required corrective action. A summary of TUBA warnings is given in Table 4.1. The second figure quoted in brackets is the number of warnings TUBA classes as serious.

Table 4.1 - Summary of TUBA warnings

	C6	C11	T3	W4
Ratio of DM to DS travel time lower than limit	5307 (872)	381 (36)	64 (0)	35 (0)
Ratio of DM to DS travel time higher than limit	91249 (536)	124618 (1872)	63575 (36)	59544 (36)
Ratio of DM to DS travel distance lower than limit	10839 (863)	830 (0)	592 (0)	482 (0)
Ratio of DM to DS travel distance higher than limit	4349 (4349)	17243 (17243)	5387 (5387)	7607 (7607)
DM speeds less than limit	877 (0)	877 (0)	877 (0)	877 (0)
DM speeds greater than limit	324 (0)	324 (0)	324 (0)	324 (0)
DS speeds less than limit	363 (0)	319 (0)	347 (0)	352 (0)
DS speeds greater than limit	324 (0)	324 (0)	324 (0)	324 (0)

4.1.2 User benefits were checked to ensure that they are in line with expectations. Trip matrices were checked to ensure that they were consistent across scenarios and forecast years, and benefits in each time period were checked to ensure they were consistent with expectations.

4.1.3 As a further check, the sensitivity values reported by TUBA of each modelled forecast year were checked to ensure that they are not significantly large. These are calculated as the total user benefits in each year as a percentage to the total Do Minimum costs. The reported sensitivity values for each scenario are shown in Table 4.2.

Table 4.2 - TUBA sensitivity check

YEAR	C6	C11	T3	W4
2020	0.95%	1.23%	0.84%	0.85%
2035	1.59%	1.88%	1.34%	1.34%

4.2 TEE BENEFITS

4.2.1 Total benefits for each scheme option are presented in the Economic Efficiency of the Transport System (TEE) table. Costs have not been assessed in TUBA, as these are being assessed separately by Mouchel as part of the Transport Business Case, so the Public Accounts (PA) and Analysis of Monetised Cost and Benefits (AMCB) tables have not been included.

4.2.2 TEE benefits for each option are presented in Table 4.3.

Table 4.3 - TEE benefits (£, 2010 prices, discounted to 2010)

Benefit		C6	C11	T3	W4
Consumer - commuting user benefits	Travel time	£42,985,000	£48,158,000	£37,347,000	£36,868,000
	Vehicle operating costs	£1,410,000	£2,925,000	£1,848,000	£2,283,000
	Subtotal	£44,396,000	£51,082,000	£39,195,000	£39,151,000
Consumer - other user benefits	Travel time	£122,247,000	£143,324,000	£100,115,000	£99,109,000
	Vehicle operating costs	£5,994,000	£11,298,000	£8,072,000	£9,303,000
	Subtotal	£128,242,000	£154,622,000	£108,187,000	£108,413,000
Business benefits	Travel time	£180,914,000	£207,343,000	£147,927,000	£146,246,000
	Vehicle operating costs	£8,775,000	£14,868,000	£9,480,000	£10,826,000
	Subtotal	£189,689,000	£222,211,000	£157,408,000	£157,073,000
Total TEE benefit		£362,327,000	£427,915,000	£304,790,000	£304,637,000
Greenhouse gases		£2,369,000	£3,916,000	£2,622,000	£2,953,000
Indirect tax revenues		-£6,648,000	-£10,603,000	-£7,385,000	-£8,231,000
Present Value of Benefits (PVB)		**£358,048,000**	**£421,228,000**	**£300,027,000**	**£299,359,000**

4.3 BENEFITS BY TIME PERIOD

4.3.1 Total benefits have also been presented by time period in Table 4.4.

Table 4.4 - Benefits by time period

TIME PERIOD	C6	C11	T3	W4
AM peak	£59,555,000	£65,257,000	£49,126,000	£49,658,000
PM peak	£74,688,000	£87,969,000	£68,188,000	£65,691,000
Inter peak	£189,830,000	£212,539,000	£157,366,000	£155,681,000
Off peak	£10,571,000	£17,530,000	£9,428,000	£9,422,000
Weekend	£21,073,000	£34,072,000	£13,326,000	£15,984,000

5 SENSITIVITY TESTING

5.1 INTRODUCTION

5.1.1 Three separate sets of sensitivity tests have been undertaken to assess specific areas of uncertainty. In all instances, results should be compared to the core benefits in Table 4.3. The tests are:

- Alternative growth scenarios
- National Trip End Model constraint
- Non-modelled time periods

5.2 ALTERNATIVE GROWTH SCENARIOS

5.2.1 As set out in, the Traffic Forecasting Report (December 2015), traffic forecasts have been developed for a core growth scenario, as well as high and low growth scenarios. The economic assessments presented in section 4 have been undertaken for the core scenario. For a number of reasons set out in the Transport Business Case, For the preferred option, C11, assessments have also been undertaken using the high and low growth scenarios. The results are presented in Table 5.1.

Table 5.1 - C11 benefits with alternative growth scenarios

Benefit		Low Growth	Core Scenario	High Growth
Consumer - commuting user benefits	Travel time	£33,008,000	£48,158,000	£63,973,000
	Vehicle operating costs	£2,022,000	£2,925,000	£3,794,000
	Subtotal	£35,030,000	£51,082,000	£67,767,000
Consumer - other user benefits	Travel time	£97,959,000	£143,324,000	£188,180,000
	Vehicle operating costs	£6,474,000	£11,298,000	£12,777,000
	Subtotal	£104,433,000	£154,622,000	£200,957,000
Business benefits	Travel time	£139,523,000	£207,343,000	£274,045,000
	Vehicle operating costs	£8,714,000	£14,868,000	£25,861,000
	Subtotal	£148,238,000	£222,211,000	£299,906,000
Total TEE benefit		£287,701,000	£427,915,000	£568,630,000
Greenhouse gases		£2,141,000	£3,916,000	£6,027,000
Indirect tax revenues		-£5,548,000	-£10,603,000	-£14,580,000
Present Value of Benefits (PVB)		**£284,294,000**	**£421,228,000**	**£560,077,000**

5.3 NATIONAL TRIP END MODEL CONSTRAINT

5.3.1 As discussed in the Traffic Forecasting Report (December 2015), the quanta of development, particularly with regards to employment, anticipated in the area by Waveney Borough Council and Suffolk County Council do not in any way align with the assumptions in the National Trip End Model (NTEM), which has not been updated to reflect recently changes in planning assumptions, so consequently there is a significant discrepancy when considering the growth in traffic shown by TEMPRO. This is shown in Table 5.2.

Table 5.2 – Local change in planning data from 2015 in Waveney District

YEAR	METRIC	NTEM	DISTRICT	DIFFERENCE
2020	Households	1878	3070	1192
	Jobs	174	3157	2983
2035	Households	5891	3304	-2587
	Jobs	-611	3157	2546

5.3.2 In developing the core growth scenario, we have followed the guidance in TAG unit M4 (November 2014) relating to forecasting, and have controlled background growth to NTEM totals through the Alternative Planning Assumptions tool in TEMPRO. Since there is insufficient planned growth in Waveney District, the balance was removed from the wider Suffolk County TEMPRO zone. However, since the model does not cover the whole of Suffolk, the impact on growth within the study of adjusting the county-wide planning assumptions is minimal.

5.3.3 TAG Unit M4 paragraph 7.3.7 (November 2014) sets out a step-by-step guide on producing Reference Case matrices. The final point says “check and report the total trip ends. These should be very close to the NTEM total for the given NTEM zone”. Due to a combination of the discrepancy between NTEM forecasts and planned developments, the adjustment made at a higher level than that covered by the model, and the use of development-specific trip rates, growth in trips in the model forecasts is significantly different to the growth in trips predicted by NTEM, despite constraining growth in planning data to NTEM totals.

5.3.4 Given these points, the core scenario as developed is considered to be the most accurate and realistic forecast of future growth within the study area. However, to demonstrate the robustness of the scheme, we have created a series of alternative Reference Case matrices where growth in trips is constrained to NTEM forecasts.

5.3.5 The component elements of the Reference Case matrices are shown in Table 5.3, compared against target totals from NTEM calculated by applying factors extracted from TEMPRO without applying any alternate planning assumptions.

Table 5.3 - Core scenario Reference Case matrix totals and NTEM targets

Year	Time Period	Base	Background Growth	Modelled Developments	Reference Case Total	NTEM Target
2020	AM	13,267	13,900	3,909	17,809	14,042
	IP	12,052	12,803	2,214	15,017	12,932
	PM	14,680	15,395	3,656	19,052	15,565
2035	AM	13,267	15,986	4,216	20,202	16,155
	IP	12,052	15,303	2,347	17,650	15,468
	PM	14,680	17,772	3,820	21,592	17,985

5.3.6 There are three principal methods to constrain total growth to match the NTEM target:

- Factor background growth only, preserving development trip totals
- Factor development trips only, preserving background growth totals
- Apply equal factor to both background and development trips

5.3.7 Since each of the three methods of adjusting the matrices has a very different impact on trip patterns, all three methods were tested. Separate factors were applied to each user class based on the relevant user class totals to create a series of alternate Reference Case matrices. These were then input into the DIADEM model in the same manner as the other forecast scenarios to generate the relative Do Minimum and Do Something models. C11 was chosen as the Do Something scenario, since it is the preferred option. TUBA analysis was then undertaken for the three alternative NTEM-constrained forecasts.

5.3.8 Results of the TUBA analysis are presented in Table 5.4. These show that even though these alternative NTEM-constrained forecasts do not align with the expectations of Waveney District Council or Suffolk County Council, the scheme still generates a significant benefit far in excess of the scheme cost.

Table 5.4 - C11 user benefits from NTEM-constrained forecasts (£, 2010 prices, discounted to 2010)

Benefit		Factor Background Growth	Factor Development Trips	Factor Whole Matrix
Consumer - commuting user benefits	Travel time	£25,189,000	£20,211,000	£23,939,000
	Vehicle operating costs	£1,512,000	£1,546,000	£1,569,000
	Subtotal	£26,702,000	£21,758,000	£25,508,000
Consumer - other user benefits	Travel time	£88,282,000	£80,324,000	£85,965,000
	Vehicle operating costs	£5,755,000	£5,476,000	£5,711,000
	Subtotal	£94,037,000	£85,799,000	£91,676,000
Business benefits	Travel time	£140,523,000	£126,047,000	£136,941,000
	Vehicle operating costs	£8,384,000	£8,135,000	£8,310,000
	Subtotal	£148,906,000	£134,182,000	£145,251,000
Total TEE benefit		£269,645,000	£241,739,000	£262,435,000
Greenhouse gases		£1,856,000	£1,792,000	£1,848,000
Indirect tax revenues		-£4,737,000	-£4,535,000	-£4,712,000
Present Value of Benefits (PVB)		**£266,764,000**	**£238,996,000**	**£259,571,000**

5.4 NON-MODELLED TIME PERIODS

5.4.1 As discussed in section 3.2, TUBA results have included all 8,760 hours in a year based on factors applied to existing matrices to generate models for the non-modelled time periods. In part, this is to comply with TAG Unit A3 (November 2014). However, in the case of the off-peak and weekend periods, it is possible that applying a simple factor to the interpeak to represent what may be a significantly different and varied set of traffic conditions may be considered an oversimplification.

Since there are no validated models for these time periods, this cannot be determined with any certainty. Benefits from the core TUBA results disaggregated into the separate time periods have been presented in Table 4.4, but for completeness, an alternative set of TUBA results has been undertaken that excludes the off peak and weekend periods completely. These are shown in

5.4.2 Table 5.5, and should be compared to the full version in Table 4.3.

Table 5.5 - TEE benefits excluding off peak and weekends (£, 2010 prices, discounted to 2010)

Benefit		C6	C11	T3	W4
Consumer - commuting user benefits	Travel time	£40,675,000	£44,707,000	£35,474,000	£34,866,000
	Vehicle operating costs	£1,585,000	£2,753,000	£1,857,000	£2,170,000
	Subtotal	£42,260,000	£47,460,000	£37,332,000	£37,037,000
Consumer - other user benefits	Travel time	£107,781,000	£120,767,000	£90,010,000	£88,082,000
	Vehicle operating costs	£5,532,000	£8,839,000	£6,496,000	£7,185,000
	Subtotal	£113,313,000	£129,605,000	£96,507,000	£95,266,000
Business benefits	Travel time	£165,656,000	£184,193,000	£137,871,000	£135,500,000
	Vehicle operating costs	£9,625,000	£13,902,000	£10,125,000	£10,840,000
	Subtotal	£175,281,000	£198,094,000	£147,996,000	£146,340,000
Total TEE benefit		£330,854,000	£375,159,000	£281,835,000	£278,643,000
Greenhouse gases		£2,450,000	£3,471,000	£2,584,000	£2,762,000
Indirect tax revenues		-£6,799,000	-£9,415,000	-£7,165,000	-£7,623,000
Present Value of Benefits (PVB)		**£326,505,000**	**£369,215,000**	**£277,254,000**	**£273,782,000**

5.4.3 These results demonstrate that the off peak and weekend do not contribute a significant level of benefits to the overall scheme assessment. The analysis therefore does not rely heavily on time periods using unvalidated models.

Appendix A

SCHEME OPTION DRAWINGS

APPENDIX A-1

SCHEME OPTION C6

Mouchel C6 Option

Notes		
Speed Limit	=	30 mph
Design Speed	=	60 kph
Min Horizontal Radius	=	180 m.
Railtrack Headroom	=	8.3 m.
Max Vertical Gradient	=	5%
Riverside Rd Headroom	=	6.5 m.
Channel Air Draft	=	12 m
(MSL to underside of bridge)		

Lake Lothing
C6 Option
(Working Option 26/10/15)

Scale 1:2000

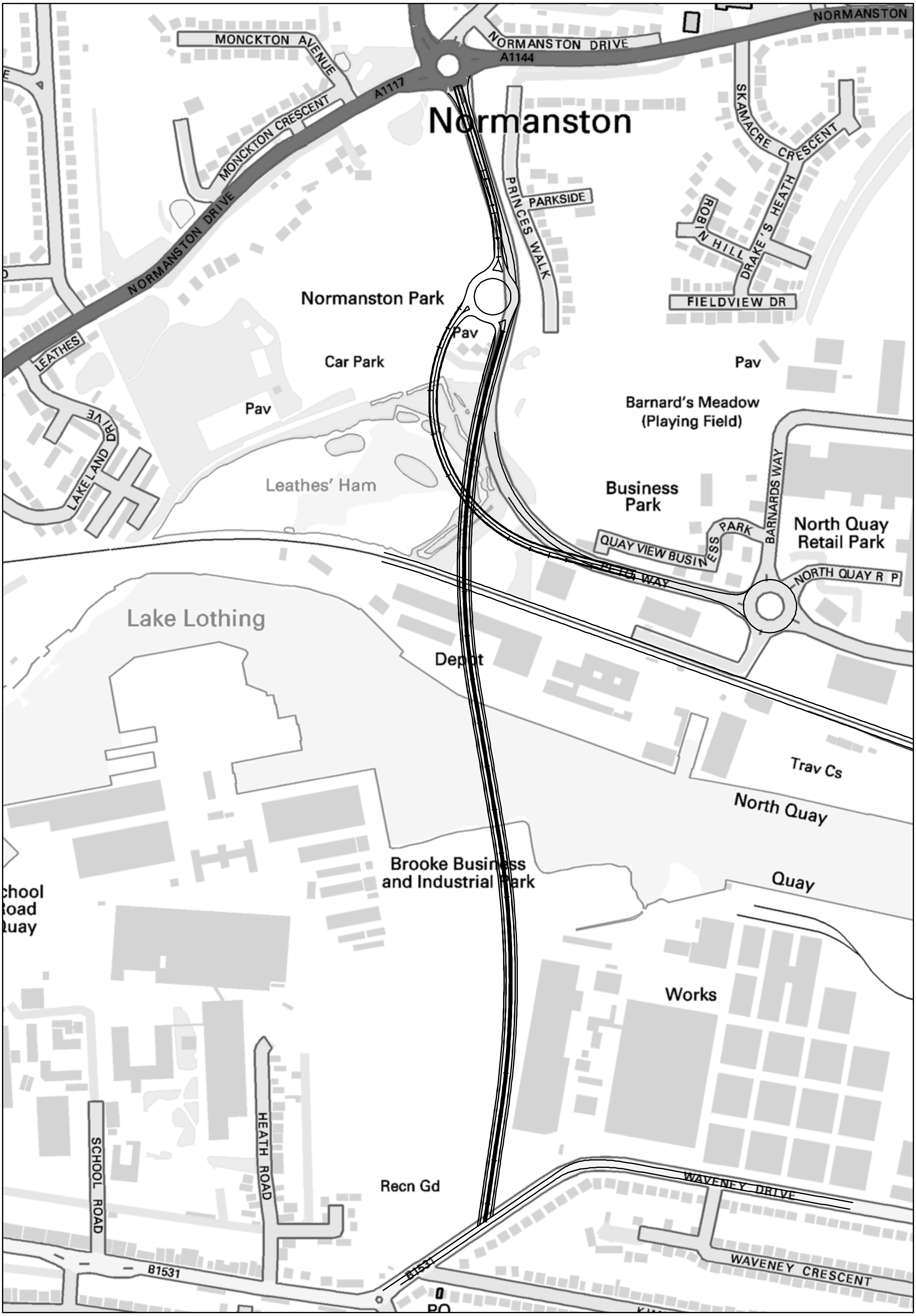
APPENDIX A-2

SCHEME OPTION C11


New Roundabout
DENMARK ROAD
RailTrack
RailTrack Crossing
DENMARK ROAD
RailTrack
New Bridge
New Bascule Bridge
DRAFT
C11 Option
TURNING AREA
Access to car showroom
(subject to RSA)
New Roundabout
New junction at Waveney Drive
WAVENEY DRIVE
A12
A12 TOM CRISP WAY
New access with extension onto Riverside Road
Lake Lothing
C11 Option
(Working Option 19/11/15)
Scale 1:1000

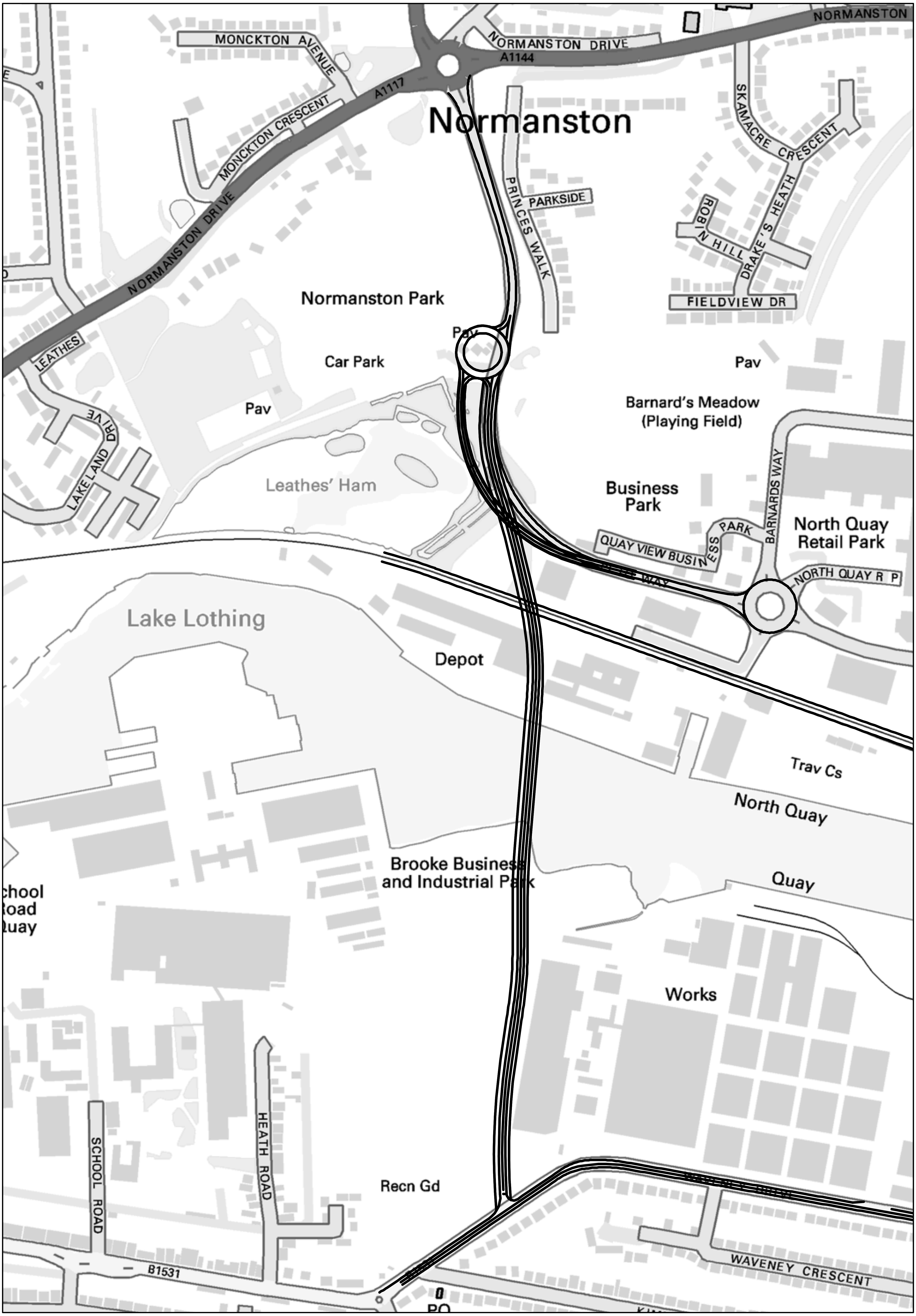
APPENDIX A-3

SCHEME OPTION T3


Normanston
NORMANSTON
NORMANSTON DRIVE
A1144
A1117
MONCKTON AVENUE
MONCKTON CRESCENT
NORMANSTON DRIVE
SKAMACRE CRESCENT
PRINCES WALK
PARKSIDE
ROBIN HILL
DRAKE'S HEATH
FIELDVIEW DR
LEATHES
LAKELAND DRIVE
Normanston Park
Pav
Car Park
Pav
Pav
Barnard's Meadow
(Playing Field)
Leathes' Ham
Business
Park
BARNARDS WAY
North Quay
Retail Park
QUAY VIEW BUSINESS PARK
PETO WAY
NORTH QUAY R P
Lake Lothing
Depot
Trav Cs
North Quay
Brooke Business
and Industrial Park
Quay
School
Road
Quay
Works
SCHOOL ROAD
HEATH ROAD
Recn Gd
WAVENEY DRIVE
WAVENEY CRESCENT
B1531
B1531
PO

APPENDIX A-4

SCHEME OPTION W4


Normanston
NORMANSTON DRIVE
NORMANSTON
A1144
A1117
MONCKTON AVENUE
MONCKTON CRESCENT
PRINCES WALK
PARKSIDE
SKAMACRE CRESCENT
DRAKE'S HEATH
ROBIN HILL
FIELDVIEW DR
Normanston Park
Pav
Car Park
LEATHES
LAKELAND DRIVE
Barnard's Meadow
(Playing Field)
Business
Park
Leathes' Ham
BARNARDS WAY
North Quay
Retail Park
QUAY VIEW BUSINESS PARK
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Depot
Trav Cs
North Quay
Quay
Brooke Business
and Industrial Park
Works
SCHOOL ROAD
HEATH ROAD
Recn Gd
B1531
WAVENEY CRESCENT
PO