



Longwater and Easton Transport Strategy

Final Report

May 2014

Norfolk County Council

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description	Standard
1/A	16 April 2014	Sean Finney	Graeme Corden	Gerry Kelly	1st Draft	
1/B	30 May 2014	Sean Finney	Graeme Corden	Gerry Kelly	Final	

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1 Introduction

1.1 Brief

The Joint Core Strategy for greater Norwich (JCS) identifies significant development in the vicinity of Longwater and Easton. The Longwater Interchange and nearby junctions are already known to experience congestion which is expected to worsen in the future with the development growth. To address these issues Norfolk County Council (NCC) prepared a brief for a feasibility study to consider strategies for addressing the future network performance issues. This report has been prepared in response to the brief, issued by NCC in March 2013, which requires development of transport strategies to address:

- existing peak hour traffic congestion at the A47/A1074 Longwater Interchange, on the A1074 Dereham Road and A47 Easton roundabout; and
- additional traffic demands arising from committed and planned land use development in the Longwater and Easton area, as set out in the adopted JCS.

This brief includes the development of objectives to enable an initial sifting of improvement options, with reference to guidance in the Department for Transport's 'Early Assessment and Sifting Tool (EAST)'. Through the course of the work regular meetings have been held with a Developer Forum to provide updates on progress and gain feedback on the results of initial option sifting and subsequent capacity analysis.

1.2 Scope of Report

This study is chiefly concerned with assessing potential improvement options to enable the junctions to operate satisfactorily. Further work will be needed to take forward and refine the strategy, including additional work to develop and refine options for sustainable transport: walking, cycling and public transport.

The structure of this report is as follows:

- **Study Area and Future Development** – identifies the area under consideration, and details the proposed developments as set out in the Joint Core Strategy;
- **Traffic Conditions** – describes existing traffic conditions with the benefit of peak hour surveys carried out in 2013, and existing public transport provision in the study area. It also presents forecasts of future traffic demand and potential changes to public transport services;
- **Improvement Options** – describes all improvements options identified, the development of objectives in line with EAST and the results of an initial sifting process identifying those for further assessment;
- **Potential Strategies** – presents the results of capacity assessment work and development of two potential transport strategies, together with outline costings; and
- **Conclusions** – summarises the main findings of the study.

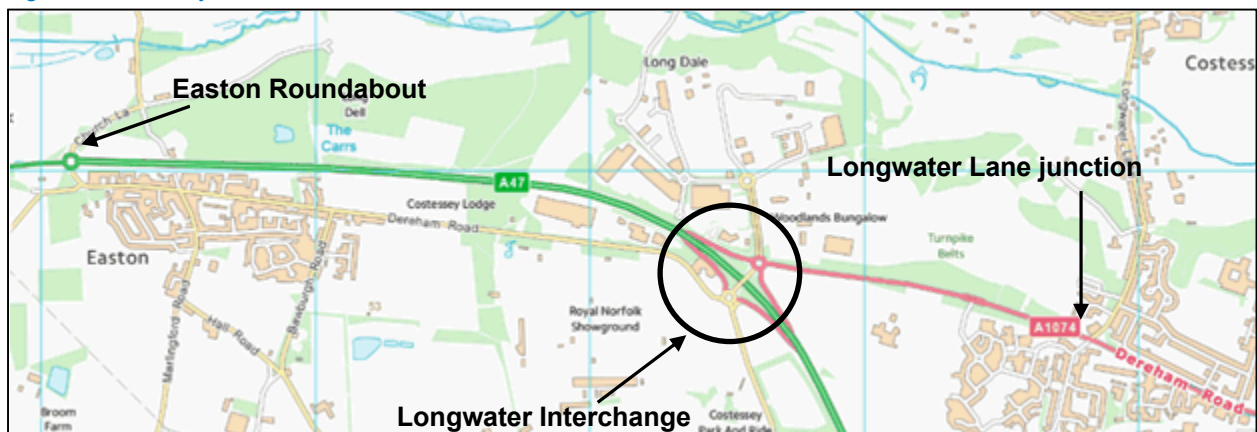
2 Study Area and Future Development

2.1 Study Area

The study area considered in this strategy is shown below, covering:

- the A47 through Longwater Interchange and on to the Easton Roundabout;
- Dereham Road from its junction with Longwater Lane to the east, through the village of Easton and on to the Easton roundabout to the west;
- The local access roads to the Longwater retail and employment areas and Queens Hills.

Figure 2.1: Study Area



Source: Contains Ordnance Survey data © Crown copyright and database right [2014]

2.2 Future Development

The Joint Core Strategy (JCS) for Norwich, South Norfolk and Broadlands was adopted in March 2011, with modifications adopted in January 2014¹ following an examination in 2013. The JCS identifies the Easton/Costessey area as the location for substantial new development in the period up to 2026, with 1,000 new dwellings proposed and employment development by “consolidation of activity at Longwater through intensification and completion of the existing allocation” (Policy 9).

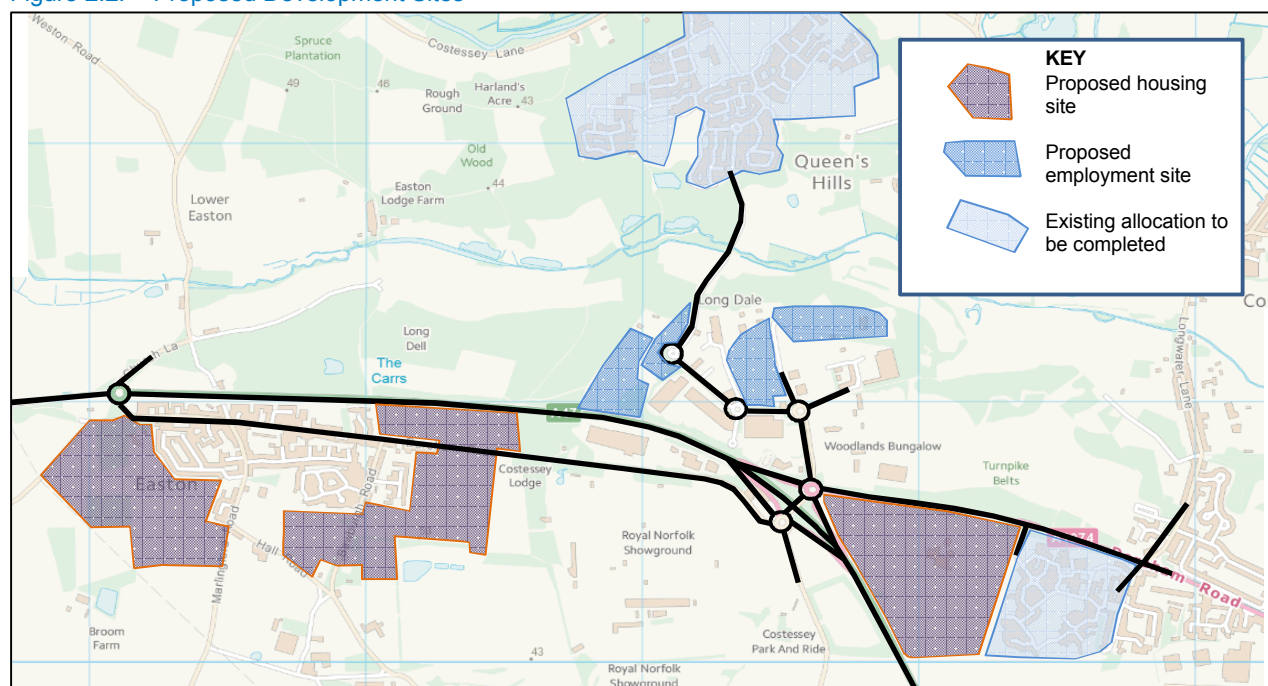
In the JCS it is recognised that strategic improvements are required at junctions on the A47 Norwich Southern Bypass (Policy 9), and that development at Easton/Costessey “is dependent on capacity expansion of the A47 Longwater junction” (Policy 10).

Preferred sites for development in Longwater and Easton are identified in South Norfolk Local Plan through the Site Specific Allocations & Policies - Proposed Submission Document (November 2013) as illustrated in Figure 2.2 and listed below:

¹ http://www.gndp.org.uk/content/wp-content/uploads/downloads/2014/01/JCS_adopted_doc_2014.pdf

- Housing south of the A1074 Dereham Road (Lodge Farm Phase 2);
- Housing to the west, south and east of the village of Easton (900 units); and
- Employment sites at Longwater, to the north of the existing developments.

Figure 2.2: Proposed Development Sites



Source: Contains Ordnance Survey data © Crown copyright and database right [2014]

There is the potential for a 'Food Hub' in the area for which a draft Supplementary Planning Document (SPD) has been produced jointly by Broadland and South Norfolk district Councils ('Guidance for the delivery of a food and agriculture hub for Broadland and South Norfolk', Consultation Draft August 2013). The SPD does not specify a location for the Food Hub but for the sake of this study it has been assumed that a Food Hub would be developed to the west of Easton, of a scale in line with the SPD.

3 Traffic Conditions

3.1 Existing Conditions

Traffic Demand

The Longwater Interchange is a strategically important junction (Figure 3.1), with relatively high volumes on three of the five roads that converge at the Interchange:

- A47 (via the eastbound and westbound off-slip roads)
- A1074 Dereham Road to/from Norwich city centre to the east
- William Frost Way to/from the Longwater Employment Area and Queens Hills to the north.

The other two roads mainly serve local destinations:

- Long Lane to/from the Costessey Park & Ride site and village of Bawburgh to the south
- Dereham Road to/from the village of Easton to the west.

Figure 3.1: Longwater Interchange



Source: Contains Ordnance Survey data © Crown copyright and database right [2014]

West of the Longwater Interchange, the next junction on the A47 is the at-grade Easton Roundabout, connecting to Easton via Dereham Road to the south and Ringland via Church Lane to the north. This is also the location where the standard of the dual two-lane carriageway A47 around Norwich changes to a single carriageway standard to the west.

A transport model for Greater Norwich has been developed for the assessment of the Northern Distributor Road (NDR) and Norwich Area Transportation Strategy (NATS). An update to NATS has proceeded during the course of this commission and therefore, for the purposes of this feasibility study, it was decided not to use the NATS model to determine future traffic demand but instead to use a simplified approach of using recent count data with forecast growth manually assigned in the study area.

Figure 3.2 and Figure 3.3 show the traffic volumes entering and exiting the Longwater Interchange for the morning and evening peak hours (08:00-09:00 and 17:00-18:00 respectively). Turning movement volumes at the Interchange roundabouts are detailed in Table 3.2 and 3.2.

The traffic data were determined from counts undertaken on Tuesday 30 April 2013, with vehicle demands converted to passenger car units (pcus) which are used for capacity analysis (to take into account that a bus is equivalent to two cars, for example). Table 3.1 details the pcu factors used.

Table 3.1: pcu factors

Vehicle class	pcu factor
Car	1.0
Light goods vehicle	1.0
Heavy goods vehicle (2 or 3 axles)	1.5
Heavy goods vehicle (articulated or 4+ axles)	2.3
Bus/coach	2.0
Motorcycle	0.4
Pedal cycle	0.2

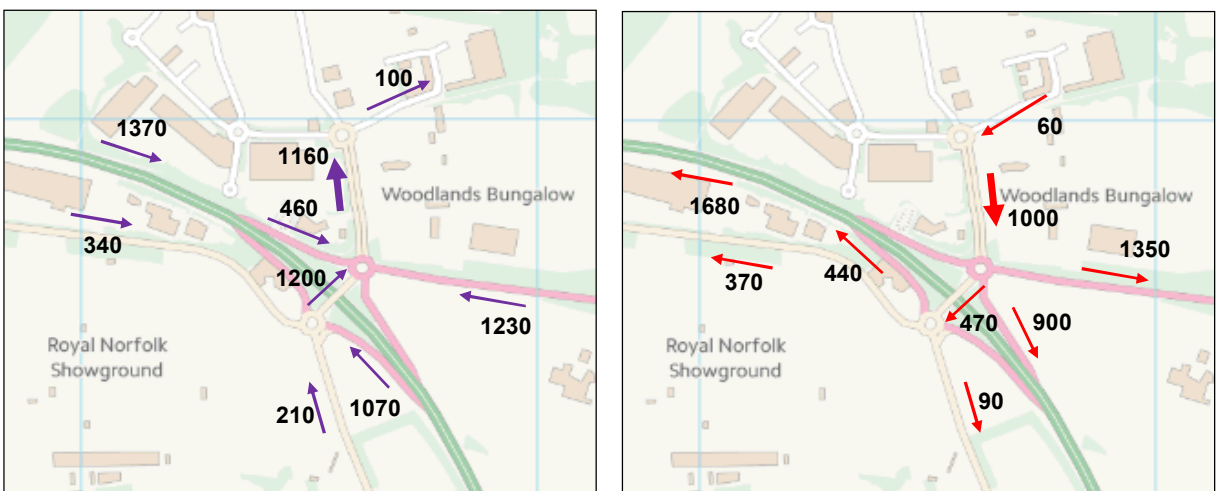
The counts were undertaken on a typical weekday in a neutral month. As such, the data are considered to be representative of existing conditions and suitable for use as baseline traffic demand. Unfortunately, there are no local automatic traffic counts (ATCs) available to assess long term traffic demand patterns and to confirm that the counts represent an average weekday in a neutral month. (ATC data are available for the A47 east of Longwater but this site is not suitable to assess the daily and monthly variation encountered at the Longwater Interchange, as profiles are likely to be different for local traffic).

Figure 3.2: 2013 AM Peak Hour Traffic Volumes (pcus/hour)



Source: Traffic count 30 April 2013

Figure 3.3: 2013 PM Peak Hour Traffic Volumes (pcus/hour)



Source: Traffic count 30 April 2013

Table 3.2: 2013 Northern Roundabout Peak Hour Turning Movements (pcus/hour)

0800-0900	A	B	C	D	E	
A - A47 Off-slip	0	134	267	0	20	420
B - William Frost Way	0	2	340	398	146	887
C - A1074	0	349	8	591	450	1398
D - A47 On-slip	0	0	0	0	0	0
E - Overbridge	0	247	450	91	0	787
	0	731	1065	1080	616	3492
1700-1800						
A - A47 Off-slip	0	158	297	0	6	461
B - William Frost Way	0	1	457	354	186	998
C - A1074	0	564	0	382	282	1228
D - A47 On-slip	0	0	0	0	0	0
E - Overbridge	0	439	596	162	0	1196
	0	1163	1349	897	474	3883

Source: Traffic count 30 April 2013

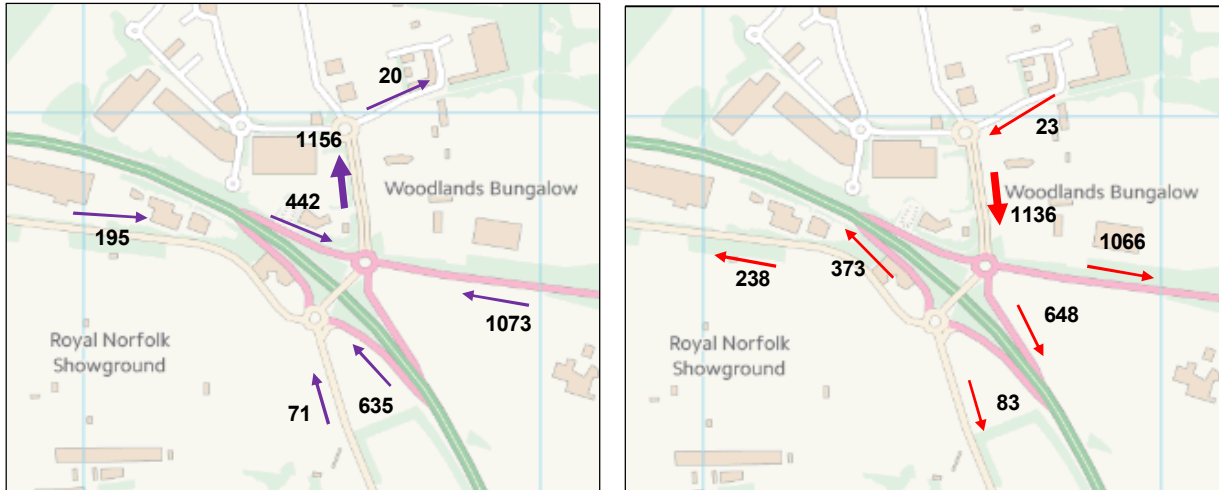
Table 3.3: 2013 Southern Roundabout Peak Hour Turning Movements (pcus/hour)

0800-0900	A	B	C	D	E	
A - Overbridge	0	0	125	159	332	616
B - A47 Off-slip	520	0	74	228	66	888
C - Long Lane	63	0	0	11	8	82
D - Dereham Road	204	0	14	0	10	228
E - A47 On-slip	0	0	0	0	0	0
	787	0	213	398	416	1814
1700-1800						
A - Overbridge	0	0	58	118	298	474
B - A47 Off-slip	723	0	20	226	97	1065
C - Long Lane	158	0	0	22	26	206
D - Dereham Road	315	0	8	0	19	342
E - A47 On-slip	0	0	0	0	0	0
	1196	0	86	366	440	2088

Source: Traffic count 30 April 2013

The Interchange is also busy at weekends, associated with the retail development accessed via William Frost Way. Traffic counts are also available covering the Saturday lunch time period on 8 June 2013, with the highest volumes from 12:15-13:15, as shown in Figure 3.4.

Figure 3.4: 2013 Saturday Peak Hour Traffic Volumes (pcus/hour)



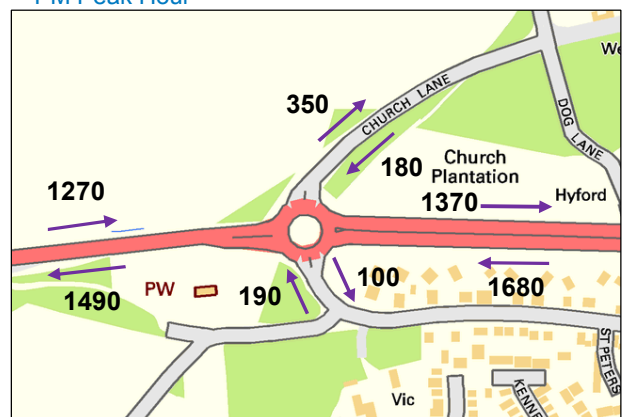
Source: Traffic count 8 June 2013

The existing traffic volumes experienced at Easton roundabout are shown in Figure 3.5.

Figure 3.5: 2013 Peak Hour Traffic Volumes (pcus/hour)
AM Peak Hour



PM Peak Hour



Source: Traffic count 2 July 2013

Traffic Congestion

The Longwater Interchange currently experiences limited traffic congestion and generally congestion only occurs during the peak hours. Queue surveys were undertaken at the same time as the traffic counts and showed minimal queuing in the AM peak period. During the PM peak period, there was consistently a queue of around 80m on southbound William Frost Way from 16:30-17:30 and up to 60m on the A47 eastbound off-slip.

From observations on site, under 'normal' operation there is limited queuing on the approach roads. However, congestion and slow-moving traffic on the eastbound A1074 (Figure 3.6) often presents a constraint to traffic exiting the Interchange in this direction. When this occurs, long queues can then develop on the eastbound A47 off-slip (Figure 3.7) and southbound William Frost Way (Figure 3.8).

Figure 3.6: Queuing on Eastbound A1074 Obstructing Movements at Longwater Interchange



Source: MM Photo

Figure 3.7: Queuing on A47 Off-slip



Source: MM Photo

Figure 3.8: Queuing on William Frost Way



Source: MM Photo

At the southern roundabout of the Interchange, queuing occurs on the westbound A47 off-slip during the PM peak period. The volume of traffic circulating past this arm is relatively low but the queuing is a result of the majority of traffic on the slip road wanting to travel to the north of the Interchange and only using one lane of the slip road (Figure 3.9). This is despite the layout being changed recently to encourage use of the two lanes on the slip road for this movement.

Minimal queuing occurs on the Dereham Road entry to the southern roundabout in both peak periods and queuing only occurs on Long Lane for short periods after a bus has dropped off drivers at the Park & Ride site in the evening peak period (Figure 3.10).

Figure 3.9: Queuing on A47 Westbound Off-Slip



Source: MM Photo

Figure 3.10: Queuing on Long Lane Due to Traffic Exiting Park & Ride Site



Source: MM Photo

Although queue data are only available for one day and on-site observations were limited to another weekday, anecdotal evidence suggests that the congestion reported above is typical for weekday peak hours in neutral months.

During weekday inter-peak and off-peak periods, it is understood that congestion and queuing at the Interchange is not significant, other than under abnormal conditions, such as an event at the nearby Norfolk Showground. However, limited queuing also occurs during the peak periods on Saturday.

At Easton roundabout, limited queuing was recorded in both the AM and PM peak hours. The approach from Church Lane to the north had some queuing between 08:15-08:50 but this was limited to 3-6 vehicles.

Public Transport

The local bus services currently operating within the study area (excluding school and college services) are summarised in the table below.

Table 3.4: Existing Bus Services

Operator	Service No.	Route	Service Frequency (buses/hour)		
			Mon-Fri Daytime	Saturday Daytime	Evenings/ Sunday
Konectbus	4	Swanton Morley – Dereham – Mattishall – Easton – NNUH – Earlham Road – Norwich	1	1	- (Eves) 0.5 (Sun)
	5	Queen’s Hills – Longwater – Dereham Road – City Centre	2	2	-
	8	Toftwood - Dereham – direct via A47 – Norwich	2	2	-
	10	Costessey Park & Ride – NNUH	2	-	-
	604	Costessey Park & Ride – UEA – City Centre	3	-	-
First	23, 23A, 23B	Queen’s Hills (23B) or Lodge Farm (23, 23A) – Costessey – Dereham Road – City Centre – Heartsease	4	4	2
	24, 24A	Queen’s Hills – Longwater – Dereham Road – City Centre – Thorpe St Andrew	4	4	-
	X1	Peterborough – Wisbech – King’s Lynn – Swaffham – Dereham – Easton – Newmarket Road – Norwich – Great Yarmouth – Lowestoft	2	2	1

Services 5, 24 and 24A provide a combined 6 buses per hour (Monday to Saturday daytime) from Queen’s Hills, approaching the Longwater Interchange northern roundabout from William Frost Way and then operating over the full length of Dereham Road to/from Norwich city centre.

Services 23 and 23A provide a combined 4 buses per hour (Monday to Saturday daytime) from Lodge Farm to Norwich city centre. These services operate in a one way terminal loop from the Dereham Road / Longwater Lane junction, proceeding westbound on Dereham Road, turning left into Lord Nelson Drive and then returning to Longwater Lane via Bawburgh Lane. This routing is dictated by the restriction of the Dereham Road / Lord Nelson Drive junction to left-in, left-out movements, with buses approaching from the Longwater direction currently unable to serve Lodge Farm.

From Longwater Lane the route splits, with service 23 serving Costessey village (Townhouse Road and Norwich Road) and service 23A serving New Costessey (Grove Avenue and Breckland Road) before joining together at the Dereham Road / Norwich Road junction.

Service 23B is an evening and Sunday variant of service 23, serving Queen’s Hills rather than Lodge Farm.

Services 5, 23/23A/23B and 24/24A provide a combined 10 buses per hour on Dereham Road east of Norwich Road.

Services 4 and X1 (combined 3 buses per hour Monday to Saturday daytime) approach the Longwater Interchange southern roundabout from Easton and join the A47 eastbound. Westbound services take the A47 westbound off-slip and the Easton exit from the southern roundabout.

Services 10 and 604 provide a combined 5 buses per hour (Monday to Friday daytime) from the Costessey P&R site, approaching the Longwater Interchange southern roundabout from Long Lane and joining the A47 eastbound. Buses returning to the Park & Ride site take the A47 westbound off-slip and the Long Lane exit from the southern roundabout.

Service 8 remains on the A47 and does not stop within the study area.

3.2 Future Conditions

Future traffic demand in the study area has been estimated for 2026, in line with the end of the plan period for the JCS. The trip generation of potential new developments in the area has been calculated using trip rates from the TRICS database for the following sites that either already have planning permission or are allocated in the JCS and Local Plan:

- Lodge Farm housing - Phase 1 (completion) and Phase 2 (allocated)
- Queens Hill housing (completion)
- South and east of Easton housing (allocated)
- Longwater employment areas (allocated)

Allowance has also been made for a recently consented NEXT superstore, re-occupation of the former Uniglaze industrial warehouse, as well as for a potential 'Food Hub' development to the west of Easton (on a scale that is in line with the draft SPD).

As the trips from all potential development in the area have been added specifically, it is not appropriate to use the full traffic growth for the area as predicted by TEMPRO. However, existing trips in the area are predicted to grow in the future due to higher levels of car ownership and relative fuel costs. By using the 'alternative development' scenario within TEMPRO, and setting the increase in housing and jobs to zero, the background growth is estimated as:

- AM peak period 5.9% growth
- PM peak period 6.7% growth

The above is based on Urban Principal Roads for the Rural South Norfolk area in TEMPRO (as the Longwater/Easton area is outside of the TEMPRO Norwich built-up area).

For trips passing straight through the Longwater Interchange on the A47, using the full TEMPRO growth is appropriate as this will account for increases in traffic demand associated with development over a much wider area. These trips were factored as follows (based on growth on rural Trunk Roads for the Norwich built-up area):

- AM peak period 25.2% growth
- PM peak period 24.8% growth.

The distribution of new developments trips onto the road network around Longwater has been estimated, using separate data sources for housing and employment trips. Travel to work data from the Census 2001 was used (2011 data on detailed travel to work trips are not yet published) to estimate the home origin of trips to the proposed employment area. Given that the number of people currently working at Longwater is relatively low and the existing employment types (industrial and retail) are different from that proposed (Business Parks), the ‘University’ Census area was used. Note that the ‘University’ area covers more than just the University itself, with other major employment zones included such as the Norwich Research Park, representing around 3,400 employees in total in 2001.

An assumed route for travel to Longwater from each of the various Census home areas in and around Norwich was allocated, resulting in the overall distribution shown in Table 3.5:

Table 3.5: Distribution of Employment Trips to and from Longwater

From	Route Used	A47 West	A47 East	A1074	Longwater Lane	Total
Breckland		117	52	0	0	169
South Norfolk		27	514	48	36	625
Broadland		0	90	192	120	402
Norwich		0	962	1007	0	1969
Rest of Norfolk		18	23	65	0	106
Suffolk and Cambs		3	102	0	0	105
Total		165	1743	1312	156	3376
Proportion		4.9%	51.6%	38.9%	4.6%	100.0%

Source: 2001 Census Data for University area with MM allocation of assumed route to Longwater

The distribution of new housing trips was based on a recent survey of existing residents of the Lodge Farm Phase 1 development (Table 3.6).

Table 3.6: Distribution of Housing Trips

Trip	Route Used	A47 West	A47 East	A1074	Longwater Lane	William Cross Way
AM Peak from site		11%	35%	27%	17%	10%
AM Peak to site		8%	29%	46%	14%	3%
PM Peak from site		8%	28%	30%	28%	6%
PM Peak to site		9%	30%	32%	15%	14%

Source: Survey of Lodge Farm Residents from Lodge Farm Phase 2 Transport Assessment, March 2013

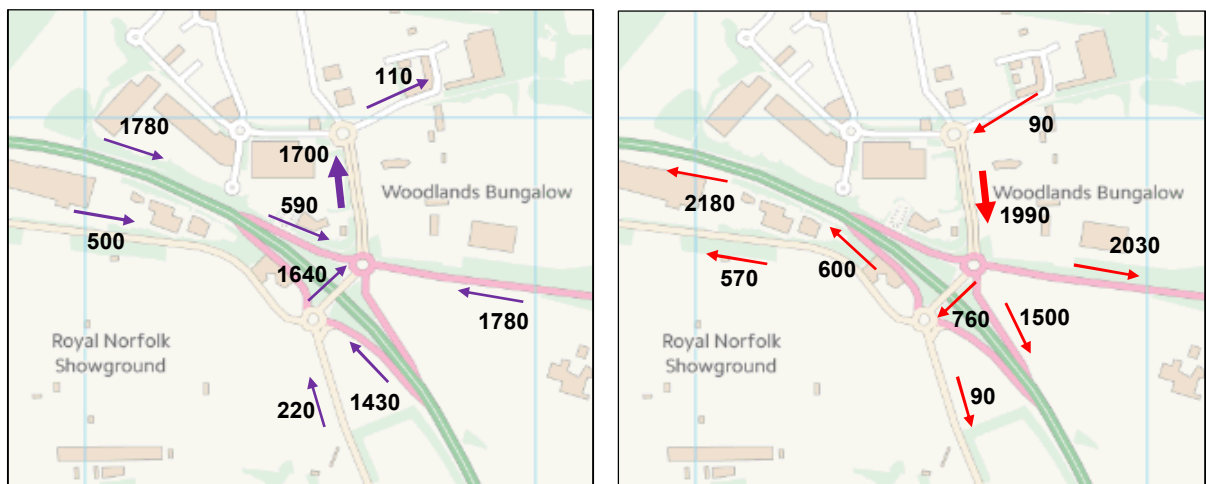
Using the above distributions, the predicted trips generated by the future developments were assigned onto the existing road network. With the addition of background traffic growth applied to existing trips, this resulted in the predicted 2026 volumes shown in Figure 3.11 and Figure 3.12. Table 3.7 and Table 3.8 detail the changes in individual movements, as well as the overall growth predicted for each link as a percentage increase over the observed 2013 demand.

Figure 3.11: 2026 AM Peak Hour Traffic Volumes (pcus/hour)



Source: MM analysis

Figure 3.12: 2026 PM Peak Hour Traffic Volumes (pcus/hour)



Source: MM analysis

Table 3.7: 2026 Northern Roundabout Peak Hour Turning Movements (pcus/hour)

0800-0900	A	B	C	D	E		
A - A47 Off-slip	0	203	346	0	21	570	36%
B - William Frost Way	0	2	548	602	192	1344	52%
C - A1074	0	828	8	693	622	2152	54%
D - A47 On-slip	0	0	0	0	0	0	0%
E - Overbridge	0	768	579	164	0	1510	92%
	0	1801	1481	1459	835	5576	60%
1700-1800							
A - A47 Off-slip	0	203	385	0	7	594	29%
B - William Frost Way	0	1	895	835	256	1987	99%
C - A1074	0	838	0	439	501	1778	45%
D - A47 On-slip	0	0	0	0	0	0	0%
E - Overbridge	0	654	753	230	0	1637	37%
	0	1696	2032	1504	764	5996	54%

Source: MM analysis

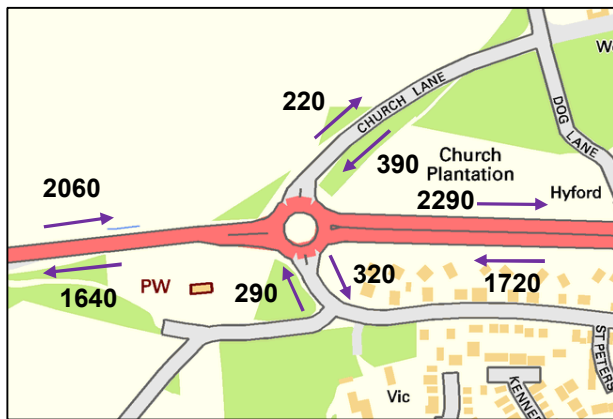
Table 3.8: 2026 Southern Roundabout Peak Hour Turning Movements (pcus/hour)

0800-0900	A	B	C	D	E		
A - Overbridge	0	0	132	235	467	834	35%
B - A47 Off-slip	1058	0	78	288	70	1495	68%
C - Long Lane	67	0	0	12	8	87	6%
D - Dereham Road	385	0	15	0	10	410	80%
E - A47 On-slip	0	0	0	0	0	0	0%
	1510	0	225	534	556	2826	56%
1700-1800							
A - Overbridge	0	0	62	246	453	761	60%
B - A47 Off-slip	999	0	21	302	103	1426	34%
C - Long Lane	169	0	0	23	28	220	7%
D - Dereham Road	469	0	9	0	20	497	45%
E - A47 On-slip	0	0	0	0	0	0	0%
	1637	0	92	572	604	2904	39%

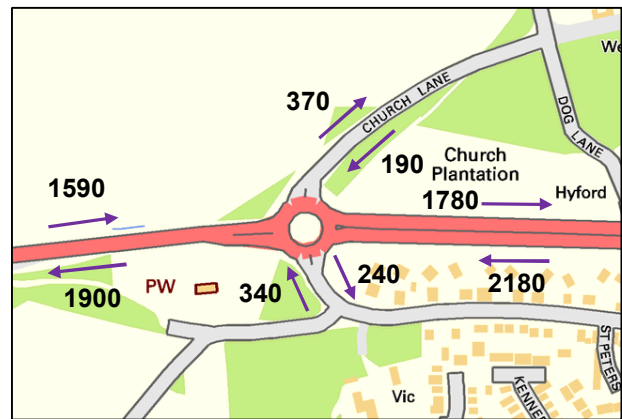
Source: MM analysis

The predicted flows at Easton roundabout are shown below:

Figure 3.13: 2026 Peak Hour Traffic Volumes (pcus/hour)
AM Peak Hour



PM Peak Hour



Source: MM analysis

Traffic Congestion

The predicted increase in traffic demand at the Longwater Interchange and Easton Roundabout will cause the junction capacities to be exceeded in the future. Capacity analysis of the existing layouts shows that this will lead to severe congestion, causing long queues and delays to traffic, if no interventions are made to either reduce traffic demand or increase capacity.

Table 3.9 details the existing and predicted future performance of the main junctions, in terms of the maximum queue and delay experienced on the arms feeding the junction. For the existing situation at the Longwater Interchange, the capacity analysis does not take into account the blocking back from eastbound Dereham Road that causes increased queuing at the north roundabout. By 2026, long queues and delays are predicted at all of the junctions, confirming that the junctions will be significantly over capacity.

Table 3.9: Junction Performance

Junction		2013 AM	2013 PM	2026 AM	2026 PM
Longwater North	Maximum Queue (pcus)	13	7	270	478
Roundabout	Maximum Delay (mins)	0.5	0.4	7.0	42.4
Longwater South	Maximum Queue (pcus)	1	5	76	263
Roundabout	Maximum Delay (mins)	0.1	0.7	10.4	29.7
Easton	Maximum Queue (pcus)	6	2	134	229
Roundabout	Maximum Delay (mins)	0.8	0.1	27.2	6.7
Longwater Lane	Maximum Queue (pcus)	17	25	113	118
Signals	Maximum Delay (mins)	1.0	1.2	8.6	6.2

Source: MM analysis

Public Transport

It is expected that bus operators will respond to the proposed development of around 1,000 homes at Easton by introducing new services between Easton and Norwich city centre, rather than relying on the diversion of existing inter-urban routes serving Easton, which would be to the detriment of journey times for existing customers travelling to/from points beyond Easton. A one way terminal loop is likely to be formed within the new Easton development with services routed via either Newmarket Road or Dereham Road. Early phases of the Easton development may be served through adaptation of existing services to the Costessey Park and Ride facility.

Further service alterations will be introduced for development at Lodge Farm Phase 2 and the creation of a bus gate onto Ringland Lane, at the northern end of Queen's Hills.

The development of Dereham Road as a Bus Rapid Transit (BRT) corridor forms part of the Norwich Area Transportation Strategy although operators have made no commitments to the introduction of a BRT service on this corridor. However, the concept of BRT operations on Dereham Road corridor is that it would continue to be served by frequent city services stopping at all existing bus stops, with the BRT service originating from the major housing growth locations to the west of Norwich and stopping at less frequent intervals of 600-800m along Dereham Road. In combination these services would offer fast, direct services from the major housing growth areas to Norwich city centre while maintaining public transport accessibility for the existing population along the corridor.

The most likely origins for a future BRT service along the Dereham Road corridor are Easton and Queen's Hills and to make it successful measures that minimise the risk of delays to services passing through the Longwater Interchange will need to be introduced. A previous study, the Dereham Road BRT Placemaking and Landscape Strategy, identified a potential off-line route (Option 1 in this study) commencing in Easton, serving the Costessey Park and Ride site then continuing on a new bus, pedestrian and cycle bridge over the A47 to join the disused and severed section of Long Lane, providing a link to Barnard Road and the A1074 Bowthorpe roundabout.

4 Improvement Options

4.1 Options Considered

Through consultation with South Norfolk and Broadland Councils, Easton and Costessey Parish Councils and the Developer Forum, a number of improvement options have been identified and these are described in Table 4.1. Figure 4.1 shows the location of each of the possible improvements:

Figure 4.1: Location of Possible Improvement Options

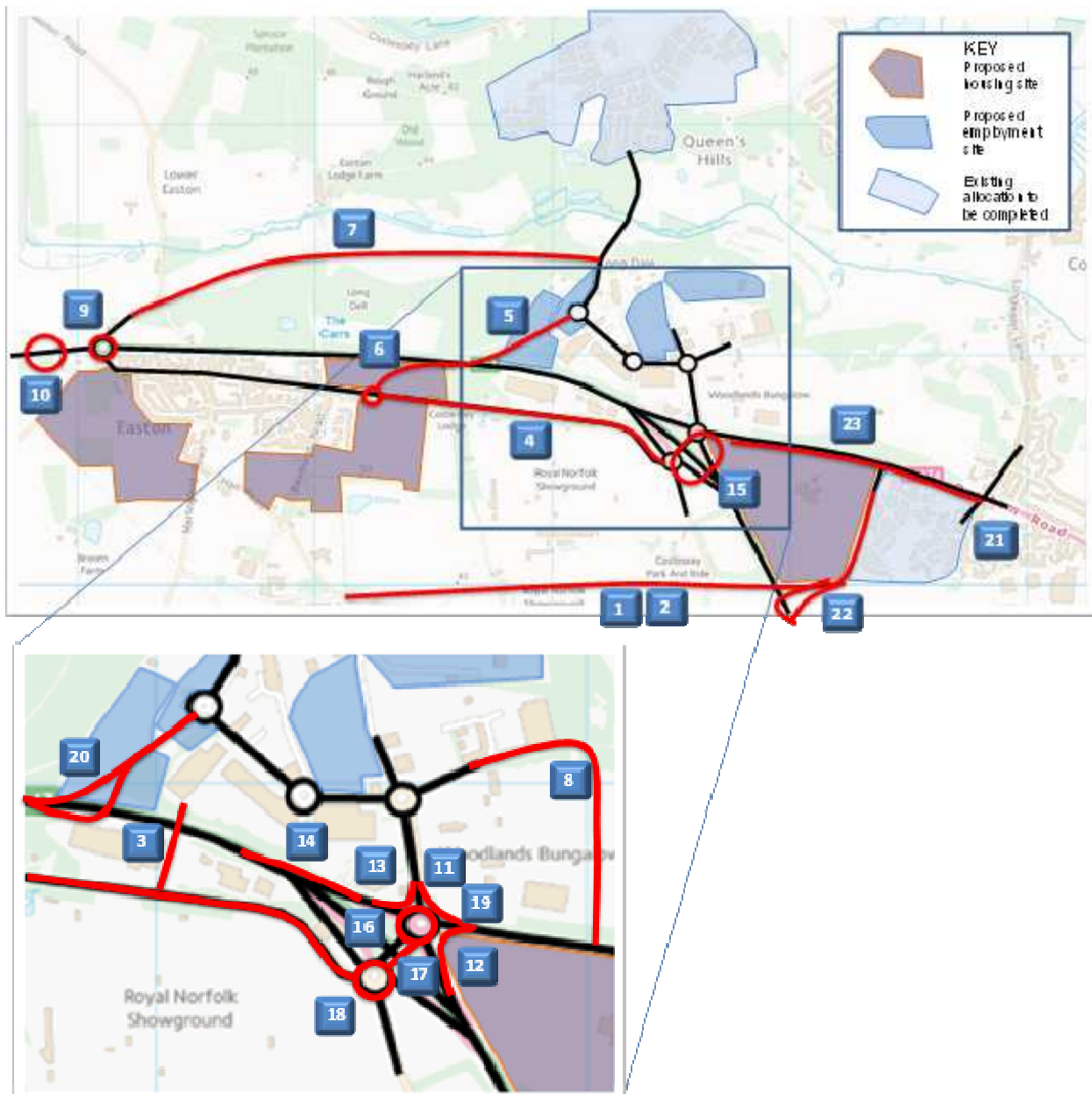


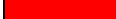
Table 4.1: List of Options Considered

Ref	Scheme	Description
1	Easton College to Long Lane Bus/Cycle Link	A public transport/pedestrian/cycle corridor from Easton College running south of the Showground, crossing A47 into Long Lane
2	Easton College to Long Lane Pedestrian /Cycle Link	as 1. but for cyclists and pedestrians only
3	Cycle and Pedestrian Bridge over A47 from Easton	A pedestrian/cycle bridge over the A47 linking Easton with the Longwater Retail Park
4	Easton village Public Transport Corridor	A new bus/cycle lane between Easton village and the existing Longwater junction south roundabout
5	New A47 eastbound off slip to Longwater	A new eastbound off slip from the A47 linking into the Alex Moorhouse Way/Sir Alfred Munnings Road roundabout
6	New A47 westbound off slip to Easton	A new westbound off slip from the A47 linking into Easton village near Bawburgh Road
7	Easton to Longwater Link Road	A new two-way link road from the A47 Easton roundabout tying into Sir Alfred Munnings Road roundabout
8	A1074 to Longwater Link Road	A new two-way link road between the A1074 Dereham Road (near the Lodge Farm access) to the William Frost Way/Ernest Gage Avenue roundabout
9	Improvements to Easton Roundabout	Improvements to at-grade Easton Roundabout, possible signalised 'throughabout'
10	New grade separated junction west of existing Easton roundabout	New junction to include access to possible Food Hub
11	Free flow left turn lane from Longwater to A1074 Dereham Road	Free flow left turn lane from William Frost Way to Dereham Road eastbound
12	Free flow left turn lane from Dereham Road to A47 eastbound	Free flow left turn lane from Dereham Road westbound to A47 eastbound on-slip
13	Free flow left turn lane from eastbound A47 to Longwater	Free flow left turn from A47 eastbound off-slip into William Frost Way
14	Extending the A47 eastbound off-slip	Providing two lanes for full length of the A47 eastbound off-slip
15	Additional bridge and gyratory for Longwater Interchange	An additional bridge over the A47 and gyratory arrangement above the trunk road
16	Longwater enlargement of roundabouts	Enlarging the existing north and south roundabouts at the Interchange
17	Longwater double bridge	An additional parallel bridge or widening of the existing bridge with enlarged north and south roundabouts
18	Longwater 'Tear drop' at southern roundabout	Development proposal to signalise Longwater Interchange south Roundabout
19	Longwater 'Tear drop' at both roundabouts	Expand signalisation to include A47 eastbound off slip approach. Requires new Link Road as in Option 8
20	A47/ Sir Alfred Munnings Road Link	Expand Option 5 to provide westbound on slip to A47 via new bridge
21	Longwater Lane Traffic Signal Improvements	Improvements to A1074 / Longwater Lane Traffic Signals.
22	A47 Link Road to Lord Nelson Drive	Link Road from A1074 Dereham Road with east facing slips to A47 and new bridge
23	A1074 Dereham Road widening	Two lanes in each direction from Longwater Interchange to Longwater Lane Traffic Signals

4.2 Initial sifting

The 23 options identified were subjected to a process of sifting to produce a shortlist of options to be considered further within the study. The objectives utilised in the sifting process are described in Table 4.2 and were adapted from the Department for Transport’s Early Assessment and Sifting Tool (EAST)².

Table 4.2: Objectives Used for Sifting Process

Technical	
Potential to relieve traffic congestion (and hence promote economic growth and help deliver housing)	
	Scheme would greatly reduce congestion at peak periods
	Scheme would reduce congestion at peak periods
	Scheme would result in minimal reduction in congestion at peak periods
Satisfies Design Standards and Guidance	
	Scheme is fully compliant with design standards
	Scheme is at the limit of minimum design standards
	Scheme will require approval of departures from standards
Scale and Level of Complexity to deliver	
	Construction will cause minimal disruption to existing roads and infrastructure
	Construction will have a significant impact on existing traffic flows but implementation programme is likely to be short
	Construction will have a significant impact on existing traffic flows and implementation programme is likely to be long
Strategic	
Fit with wider transport and government objectives- Public Transport	
	This scheme will complement existing policies and proposals in the local area, providing benefits to the wider network
	The scheme will fit well in policy terms, however will have limited benefit to the wider network
	Scheme undermines policy and provides no benefit to the wider network
Fit with wider transport and government objectives- Cycling	
	This scheme will complement existing policies and proposals in the local area, providing benefits to the wider network
	The scheme will fit well in policy terms, however will have limited benefit to the wider network
	Scheme undermines policy and provides no benefit to the wider network
Local Environment	
Landscape and urban environment	
	Scheme will have minimal impact on the landscape and/or urban environment
	Scheme would have some negative impact on landscape and/or urban environment
	Scheme would have a significant negative impact on landscape and/or urban environment
Air quality and noise	
	Intervention will have a positive or neutral impact in terms of air quality and/or noise
	Small number of dwellings will experience deterioration in air quality and/or noise due to traffic
	Large number of dwellings will experience deterioration in air quality and/or noise due to traffic
Managerial	
Implementation timetable	
	Short term intervention e.g. Developer funded
	Medium term intervention requiring accumulation of Local Government and Developer funding
	Long term intervention due to time required to raise funds from Government Agencies
Financial	
Potential Cost	
	up to £500k
	£500k to £5million
	Over £5million
Value for Money	
	High level of benefits relative to the construction cost
	Reasonable level of benefits relative to the construction cost
	Low level of benefits relative to the construction cost

² https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4475/east-guidance.pdf

The results of the option assessments using the criteria detailed above are shown Figure 4.2 and Figure 4.3 (overleaf). Each option was given a RAG (red, amber, green) score against each of the objectives, allowing the higher performing options to be easily identified. A brief note is included to summarise why each option was either taken forward or rejected. During the sifting process it was recognised that the number of options that had the potential to significantly relieve the predicted congestion problems was limited. Given that achieving this objective was seen as an essential part of the strategy, this was also taken into account when selecting options to consider further.

Some capacity analysis of smaller schemes was undertaken initially but it was clear that they would not provide sufficient capacity, given the very high Ratio of Flow to Capacity values predicted for the future base case, as detailed in Table 3.9 earlier. Therefore, a systematic assessment of each option and combination of options is not included in this report.

Through the sifting process, the initial list of 23 options was reduced to 13 to be taken forward for further assessment and these are detailed in Table 4.3.

Option 1, a new bus/cycle link and bridge over the A47, is not recommended for taking forward as part of this work, but may warrant further re-examination in the future as part of consideration of development of options for BRT on the Dereham Road corridor.

Options involving a new access to Longwater and Queens Hill from the west (Option 5), combined with a new egress route via a bridge over the A47 and westbound on-slip (Option 20), were rejected for a number of reasons. In terms of capacity, it was considered that they would not relieve the existing Longwater Interchange sufficiently given the relatively low proportion of traffic to/from the A47 to the west that uses the Interchange. For example, of all traffic entering William Frost Way only 18% is from the west in the AM peak hours and 14% in the PM peak hour.

With the predicted level of congestion at the Longwater Interchange in the future base case, some drivers travelling from the east could choose to carry on to Easton roundabout and double-back to access Longwater via a new junction (albeit increasing their journey by around 3 miles). It is difficult to assess what proportion of drivers would choose to do this, but it is very unlikely that it would be high enough to relieve the congestion at the existing Interchange, so Option 20 alone could not solve the congestion problems.

A significant number of u-turners at Easton would probably also mean the proposed improvements at Easton would then be over capacity. Such movements would also have major disbenefits in terms of economic cost-benefit analysis, which would make it very difficult to secure external funding for such a scheme.

Table 4.3: Options for Further Assessment

Option Number	Description
3	Cycle and Pedestrian Bridge over A47 from Easton
4	Easton village Public Transport Corridor
8	A1074 to Longwater Link Road
9	Improvements to Easton Roundabout
11	Free flow left turn lane from Longwater to A1074 Dereham Road
12	Free flow left turn lane from Dereham Road to A47 eastbound
14	Extending the A47 eastbound off-slip
15	Additional bridge and gyratory for Longwater Interchange
17	Longwater Double Bridge
18	Longwater 'Tear drop' at southern roundabout
19	Longwater 'Tear drop' at both roundabouts
21	Longwater Lane Traffic Signal Improvements
23	A1074 Dereham Road widening

These options were analysed further in terms of their ability to meet the objectives, either as a 'standalone' scheme or combined with other options. Where appropriate, junction capacity analyses were undertaken to ascertain if the options could provide adequate capacity to meet the predicted future demand.

Figure 4.2: Initial Sifting (1)

Ref	Scheme	Description	Technical			Strategic		Local Environment		Manage	Finance		Assess Further?	
			Potential to relieve traffic congestion	Satisfies Design Standards	Scale and Level of Complexity to deliver	Fit with wider transport and government objectives - Public Transport	Fit with wider transport and government objectives - Cycling	Landscape and urban environment	Air quality and noise	Implementation timetable	Potential Cost	Value for Money		
1	Easton College to Long Lane Bus/Cycle Link	A public transport/pedestrian/cycle corridor from Easton College running south of Showground, crossing A47 into Long Lane	Red	Green	Green	Green	Green	Yellow	Yellow	Red	Red	Red	NO	Expensive new road bridge, limited demand, would not be used by Longwater & Queens Hill buses
2	Easton College to Long Lane Pedestrian /Cycle Link	as 1. but for cyclists and pedestrians only	Red	Green	Green	Red	Green	Green	Red	Red	Yellow	Red	NO	Expensive new bridge, limited demand, remote pedestrian route
3	Cycle and Pedestrian Bridge over A47 from Easton	A pedestrian/cycle bridge over the A47 linking Easton with the Longwater Retail Park	Red	Green	Green	Red	Green	Green	Red	Red	Yellow	Red	YES	A good ped/cycle route between Easton and Longwater is essential, may not be achievable as part of junction schemes
4	Easton village Public Transport Corridor	A new bus/cycle lane between Easton village and the existing Longwater junction south roundabout	Yellow	Green	Green	Red	Green	Green	Red	Red	Yellow	Red	YES	Relatively low cost scheme, minimise delay to buses, improved cycle facilities
5	New A47 eastbound off slip to Longwater	A new eastbound off slip from the A47 linking into the Alex Moorhouse Way/Sir Alfred Munnings Road roundabout	Red	Green	Green	Red	Green	Green	Red	Red	Yellow	Red	NO	Limited demand for this movement, other options are better at addressing congestion problems
6	New A47 westbound off slip to Easton	A new westbound off slip from the A47 linking into Easton village near Bawburgh Road	Red	Green	Green	Red	Green	Yellow	Red	Red	Yellow	Red	NO	Limited demand for this movement, southern roundabout is not main congestion problem
7	Easton to Longwater Link Road	A new two-way link road from the A47 Easton roundabout tying into Sir Alfred Munnings Road roundabout	Green	Green	Yellow	Red	Green	Green	Red	Red	Yellow	Red	NO	Very expensive road scheme with negative environmental impacts, other options are better at addressing congestion problems
8	A1074 to Longwater Link Road	A new two-way link road between the A1074 Dereham Road (near the Lodge Farm access) to the William Frost Way/Ernest Gage Avenue roundabout	Green	Green	Yellow	Red	Green	Green	Red	Red	Yellow	Green	YES	Expensive scheme but will provide significant relief to northern roundabout
9	Improvements to Easton Roundabout	Improvements to at-grade Easton Roundabout, possible signalised 'throughabout'	Green	Green	Yellow	Red	Green	Green	Red	Red	Yellow	Green	YES	Relatively low cost, should cater for expected traffic growth
10	New grade separated junction west of existing Easton roundabout	New junction to include access to possible Food Hub	Green	Green	Red	Red	Red	Green	Red	Red	Red	Red	NO	Major scheme that is not justified without dualling of A47 to west, also relatively low demand to/from side roads
11	Free flow left turn lane from Longwater to A1074 Dereham Road	Free flow left turn lane from William Frost Way to Dereham Road eastbound	Yellow	Yellow	Green	Red	Green	Green	Red	Red	Green	Yellow	YES	Relatively low cost, would provide some relief - consider as part of other schemes
12	Free flow left turn lane from Dereham Road to A47 eastbound	Free flow left turn lane from Dereham Road westbound to A47 eastbound on-slip	Yellow	Yellow	Green	Red	Green	Green	Red	Red	Green	Green	YES	Relatively low cost, would provide some relief - consider as part of other schemes

Figure 4.3: Initial Sifting (2)

Ref	Scheme	Description	Technical			Strategic		Local Environment		Manage	Finance		Assess Further?	
			Potential to relieve traffic congestion	Satisfies Design Standards	Scale and Level of Complexity to deliver	Fit with wider transport and government objectives - Public Transport	Fit with wider transport and government objectives - Cycling	Landscape and urban environment	Air quality and noise	Implementation timetable	Potential Cost	Value for Money		
13	Free flow left turn lane from eastbound A47 to Longwater	Free flow left turn from A47 eastbound off-slip into William Frost Way	Red	Red	Yellow	Red	Red	Green	Green	Green	Yellow	Red	NO	Limited demand, geometry/safety problems due to left turn to Sainsburys
14	Extending the A47 eastbound off-slip	Providing two lanes for full length of the A47 eastbound off-slip	Yellow	Green	Green	Red	Red	Green	Green	Green	Green	Yellow	YES	Width for 2 lanes already, improved signs/lines to use 2 lanes fully as part of another scheme
15	Additional bridge and gyratory for Longwater Interchange	An additional bridge over the A47 and gyratory arrangement above the trunk road	Green	Yellow	Red	Red	Yellow	Green	Red	Red	Red	Yellow	YES	Major scheme but potential to solve congestion problems. Must consider ped/cycle improvements
16	Longwater enlargement of roundabouts	Enlarging the existing north and south roundabouts at the Interchange	Yellow	Yellow	Red	Red	Yellow	Green	Yellow	Yellow	Yellow	Red	NO	Very unlikely to be capable of solving congestion problems or improving peds/cycles
17	Longwater double bridge	An additional parallel bridge or widening of the existing bridge with enlarged north and south roundabouts	Green	Yellow	Red	Red	Yellow	Green	Red	Red	Red	Yellow	YES	Major scheme but potential to solve congestion problems. Must consider ped/cycle improvements
18	Longwater 'Tear drop' at southern roundabout	Development proposal to signalise Longwater Interchange south Roundabout	Yellow	Green	Green	Red	Yellow	Green	Green	Green	Green	Green	YES	Relatively low cost, should solve southern roundabout capacity problems. Could combine with other schemes
19	Longwater 'Tear drop' at both roundabouts	Expand signalisation to include A47 eastbound off slip approach. Requires new Link Road as in Option 8	Green	Green	Green	Red	Yellow	Green	Red	Green	Green	Green	YES	Relatively low cost, should be able to provide required capacity if combined with other schemes. Must consider ped/cycles
20	A47/ Sir Alfred Munnings Road Link Road	Expand Option 5 to provide westbound on slip to A47 via new bridge	Red	Red	Red	Red	Yellow	Yellow	Green	Red	Red	Red	NO	Major scheme but new on-slip not in line with Design Standards, limited benefits
21	Longwater Lane Traffic Signal Improvements	Improvements to A1074 / Longwater Lane Traffic Signals.	Green	Green	Green	Red	Yellow	Green	Green	Green	Yellow	Green	YES	Relatively low cost, will provide large benefits. Should be able to provide required capacity if combined with Dereham Road widening
22	A47 Link Road to Lord Nelson Drive	Link Road from A1074 Dereham Road with east facing slips to A47 and new bridge	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	NO	Would relieve Longwater but transfer problem to Dereham Road. New on-slip not in line with Design Standards, impact on Lodge Farm residents
23	A1074 Dereham Road widening	Two lanes in each direction from Longwater Interchange to Longwater Lane Traffic Signals	Green	Green	Yellow	Red	Green	Red	Red	Yellow	Yellow	Green	YES	Partly being delivered by Developer, required to achieve full capacity at junctions. Scope for off-road cycleway for full length

5 Potential Strategies

5.1 Capacity Analysis

The options taken forward were assessed to determine if they could provide adequate traffic capacity to meet the predicted demand in 2026, with outline layouts produced to confirm that they should be feasible, in terms of geometry, number of lanes that can be provided etc. Appendix A contains these outline drawings.

A summary of the capacity analysis for the main junction options is given below, in terms of the ratio of flow to capacity (RFC), taking the highest value of all arms feeding into each junction. Signalised junctions are considered to operate adequately if the RFC is 90% or less. Therefore, it is concluded that all of the options would be able to provide sufficient capacity, apart from a signalised crossroads layout for Option 8.

Table 5.1: Summary of Capacity Analysis

Option	Description	Scenario	Ratio of Flow to Capacity	
			AM Peak	PM Peak
Option 21	Longwater Lane Signals	Existing 2013	90%	93%
		Existing 2026	128%	119%
		Improved 2026	81%	85%
Option 8	Link Road / Lodge Farm Signal Junction	Staggered 2026	82%	87%
		Crossroads 2026	141%	148%
Option 9	Easton Roundabout 'Throughabout' Layout	Improved 2026	82%	82%
Option 19	Double 'Tear Drop' Layout in combination with Option 8	Improved 2026	81%	78%
Option 17	Longwater Double Bridge	Improved 2026	85%	87%

Source: MM analysis

5.2 Alternative Strategies

From consideration of the above analysis it is apparent that there are two principal options to develop capacity of the road network in the Longwater-Easton area and meet predicted demands in 2026. These are essentially the same in improving the capacity of the A1074 Dereham Road, the signal junction with Longwater Lane, Easton roundabout and provision of a dedicated pedestrian/cycle bridge across the A47. The key difference is in the treatment of Longwater Interchange itself and can be summarised as,

- **Strategy 1** which reduces traffic demand at Longwater Interchange through creation of an alternative access to the Longwater Employment Area, in the form of Option 8 - Longwater Link Road. A double 'tear drop' arrangement (Option 19) would be provided at Longwater Interchange itself
- **Strategy 2** which maximises the capacity of Longwater Interchange through provision of a second bridge (Option 17).

Both strategies assume that Option 11 (free-flow left turn from Longwater to eastbound Dereham Road) is in place. This improvement has been accepted by the highway authority as mitigation for traffic impacts arising from the recently consented NEXT superstore and would improve the capacity of the William Frost Way to Longwater Interchange, alleviating some of the current problems.

The components of both strategies are shown in Figures 5.1 and 5.2, and listed, in descending order of priority, in Tables 5.2 and 5.3.

Figure 5.1: Strategy 1 Overview

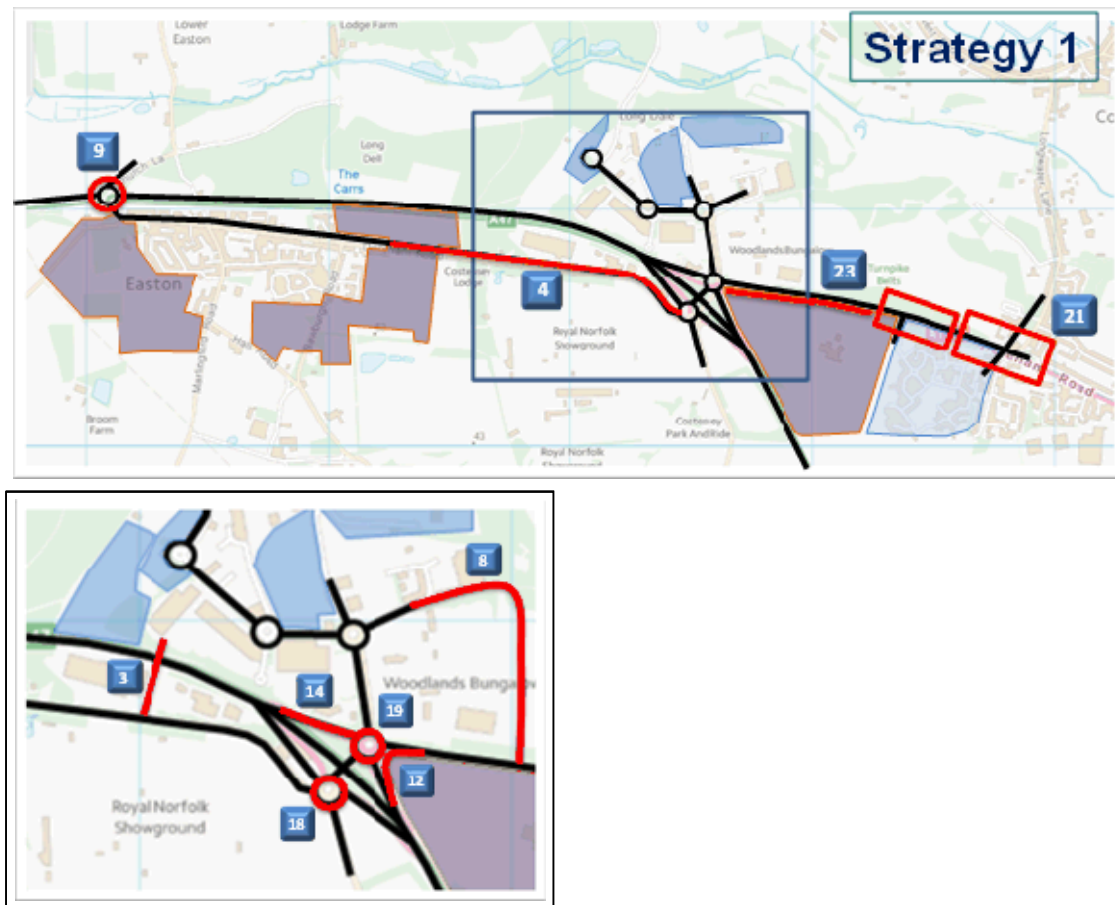


Table 5.2: Strategy 1 Components

Component Number	Description	Cost estimate
21	Longwater Lane Traffic Signals	£0.78m
12	Free flow from Dereham Road to A47 EB	£0.77m
18	Longwater 'Tear drop' at South roundabout	£0.85m
23	A1074 Dereham Road widening (west section)	£4.67m
14	A47 EB off-slip 2 lanes to Dereham Rd	£0.58m

Component Number	Description	Cost estimate
8	A1074 to Longwater Link Road	£3.57m (excluding costs of ground remediation)
4	Easton village Public Transport Corridor	Uncosted at present
3	Cycle and Pedestrian Bridge	Uncosted at present
9	Improvements to Easton Roundabout	£3.56m
19	Longwater 'Tear drop' at North roundabout	£0.46m
23	A1074 Dereham Road widening (mid section)	£4.67m

Figure 5.2: Strategy 2 Overview

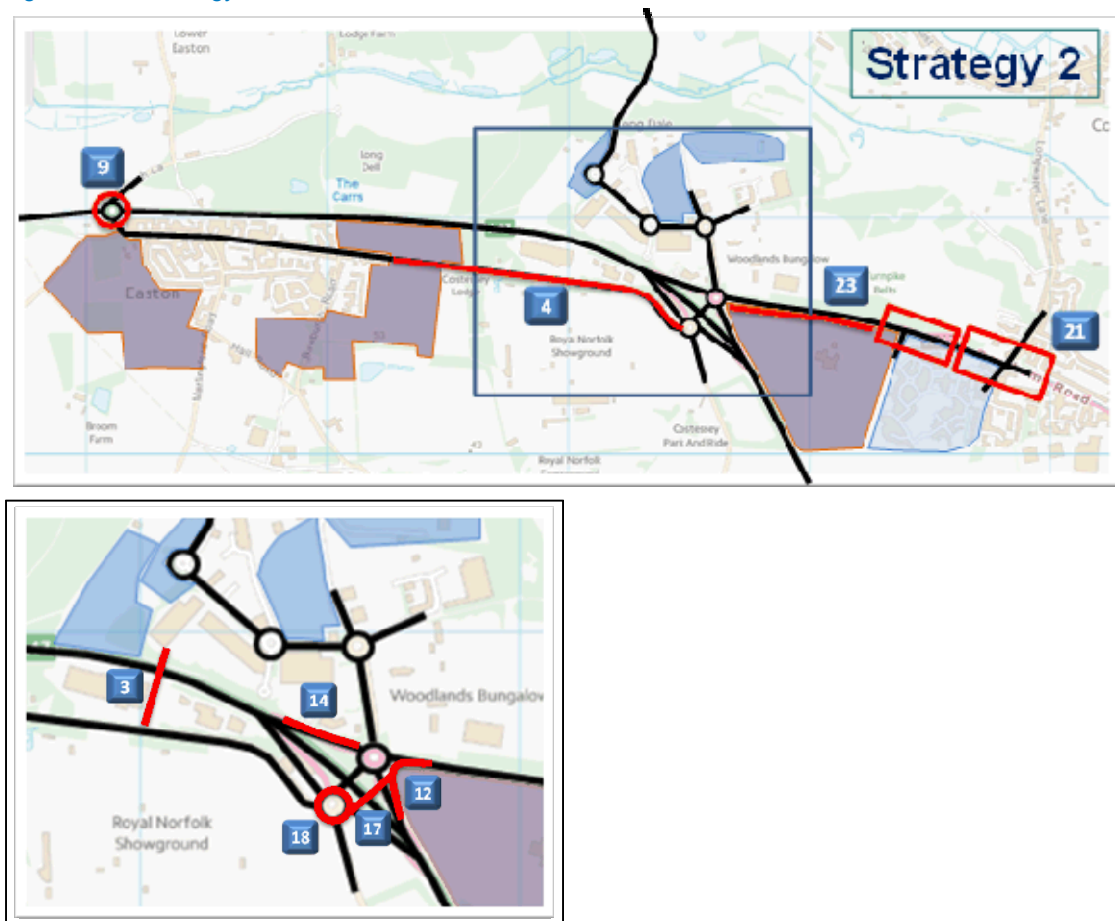


Table 5.3: Strategy 2 Components

Component Number	Component Description	Cost estimate
21	Longwater Lane Traffic Signals	£0.78m
12	Free flow from Dereham Road to A47 EB	£0.77m
18	Longwater 'Tear drop' at South roundabout	£0.85m
23	A1074 Dereham Road widening (west section)	£4.67m
14	A47 EB off-slip 2 lanes to Dereham Rd	£0.58m
4	Easton village Public Transport Corridor	Uncosted at present
3	Cycle and Pedestrian Bridge	Uncosted at present
9	Improvements to Easton Roundabout	£3.56m
17	Longwater Double Bridge	£13.34m
23	A1074 Dereham Road widening (mid section)	£4.67m

5.3 Cost Estimates

Preliminary cost estimates have been developed for the components of each strategy, based on the NCC's Partnership Contract Rates for the 2013/14 financial year, and are included in the Tables 5.2 and 5.3. The total cost for each strategy is estimated to be:

- **Strategy 1** - £19.9m
- **Strategy 2** - £29.2m

Please note that Strategy 1 costs for Option 8 are taken from the Longwater Link Road Stage 1 Assessment – October 2013. This scheme would require construction either through or towards the edge of an existing landfill site which, whilst technically feasible, has considerable uncertainty in respect of its cost. **Costs for Option 8 exclude any ground remediation works required to address geotechnical and geo-environmental issues associated with the landfill site (see para 7.1 of the above report).**

For both strategies, land acquisition costs have been excluded from these estimates and no allowance has been made for uplifts generated from a Quantified Risk Assessment (QRA) and/or Stage 1 optimism bias of 44% (ref DfT's TAG Unit 3.5.9 'The Estimation and Treatment of Scheme Costs').

6 Conclusions

This report summarises the outputs of a study which has been carried out to develop a Transport Strategy for Longwater and Easton. The need to develop a Strategy is driven by peak hour traffic congestion at the A47/A1074 Longwater Interchange, on the A1074 Dereham Road and A47 Easton roundabout, together with ongoing and planned land use development in the area, the latter forming part of the adopted Joint Core Strategy (JCS) for greater Norwich.

Surveys of existing peak period traffic flows and queue lengths were carried out in Spring 2013 and combined with projected additional demands from an agreed development schedule to produce forecasts for a 2026 'full-JCS' scenario.

For the purposes of this feasibility study, this simplified approach of adding predicted development trips onto the existing traffic demand was adopted instead of using the Norwich Area Transportation Study traffic model, as the model was in the process of being updated for use in assessing the Northern Distributor Road scheme (NDR). It should also be noted that the potential impact of the NDR on traffic demand in the Longwater/Easton area has not been taken into account, although the direct effect is likely to be limited.

Current public transport services in the area are described together with potential changes arising from new residential developments and a potential Bus Rapid Transit scheme on the Dereham Road corridor, as provided for in NATS.

A long list of potential transport interventions (23 in total) have been put forward through stakeholder events. Key parties in this process were local council members, Parish Councils and those developers with land interests in Longwater and Easton. A number of other interventions were put forward by County Council officers and Mott MacDonald in the course of this study. A set of objectives was adapted from the Department for Transport's Early Assessment and Sifting Tool and used in an initial sifting process to identify which options should be shortlisted. A total of 13 options were taken forward into a detailed capacity assessment and, where necessary, outline designs developed to assist the analysis.

The recommendation of this study is that there are two alternative transport strategies for the Longwater-Easton area. These are essentially the same in improving the capacity of the A1074 Dereham Road, the signal junction of Dereham Road with Longwater Lane and the A47 Easton roundabout. The key difference between the strategies is in the treatment of Longwater Interchange itself and can be summarised as:

- **Strategy 1** which reduces traffic demand at Longwater Interchange through creation of an alternative access to the Longwater Employment Area, in the form of Option 8 - Longwater Link Road. A double 'tear drop' arrangement (Option 19) would be provided at Longwater Interchange itself;
- **Strategy 2** which maximises the capacity of Longwater Interchange through provision of a second bridge (Option 17).

Preliminary cost estimates are **£19.9m** for Strategy 1 (excluding potentially very significant ground remediation works associated with Option 8) and **£29.2m** for Strategy 2.

The creation of additional highway capacity and further land use development in the Longwater-Easton area will provide opportunities for alteration to public transport service patterns but these are not identified in this report as they are, to a large extent, dependent on progress with a BRT scheme for the Dereham Road corridor. However, both strategies do include a new eastbound bus lane into the Longwater Interchange from Easton and the creation of a dedicated pedestrian/cycle bridge across the A47, in the vicinity of Longwater Interchange, in response to local concerns.

Appendices

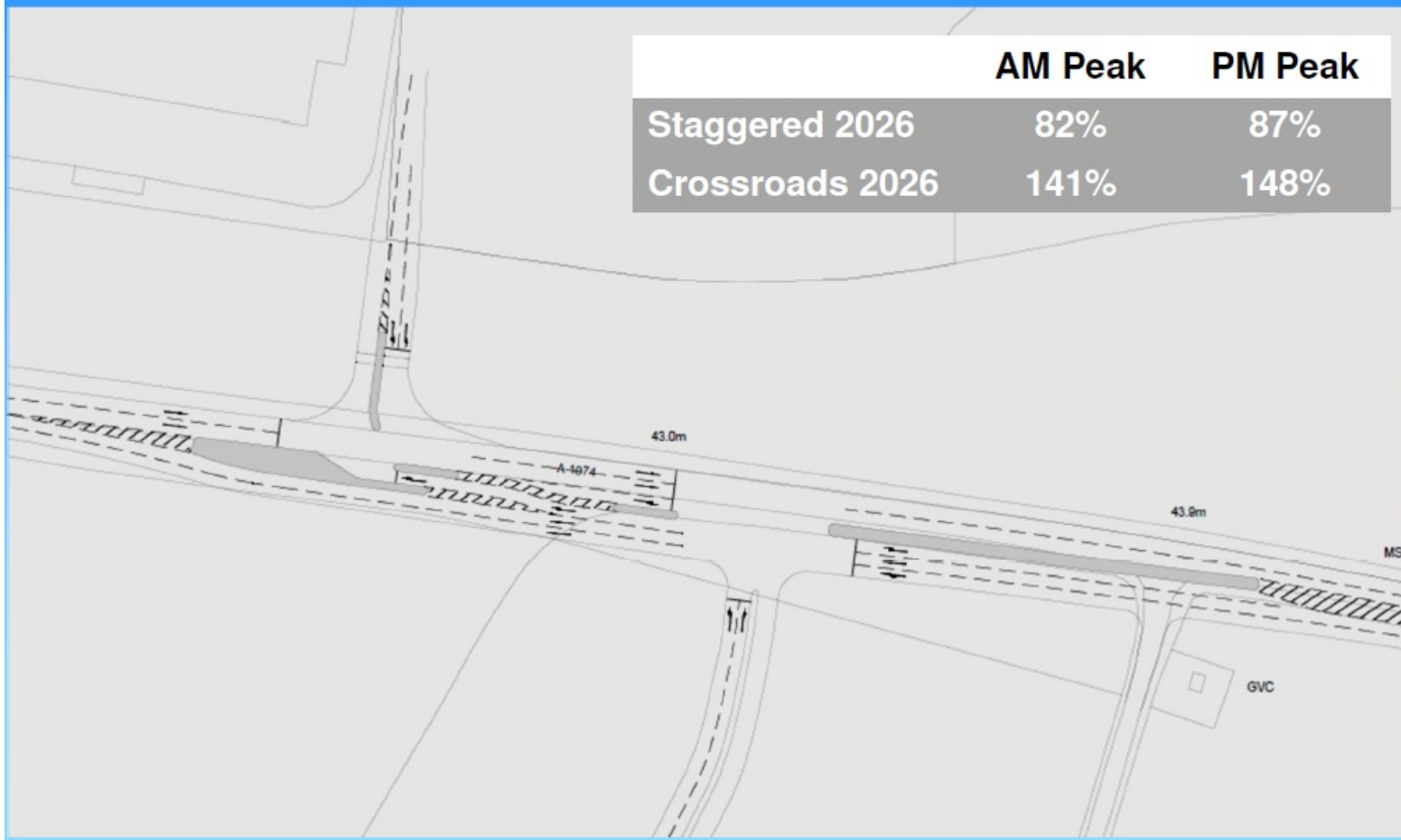
Appendix A. Outline Option Drawings	33
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Appendix A. Outline Option Drawings

A.1 Option 8

Option 8 Link Road / Lodge Farm Staggered Signals

	AM Peak	PM Peak
Staggered 2026	82%	87%
Crossroads 2026	141%	148%



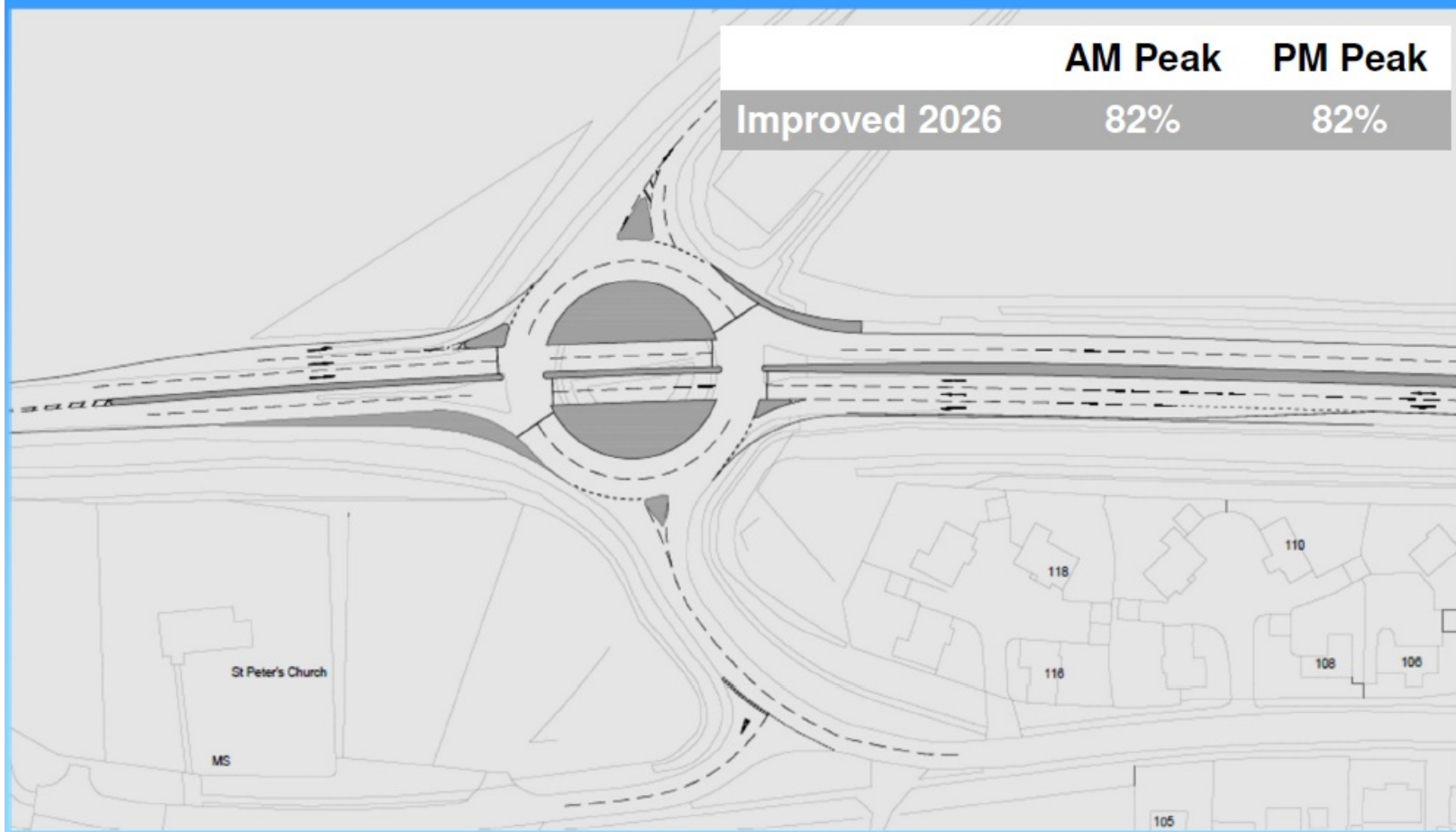


Option 8 Longwater to A1074 Link Road

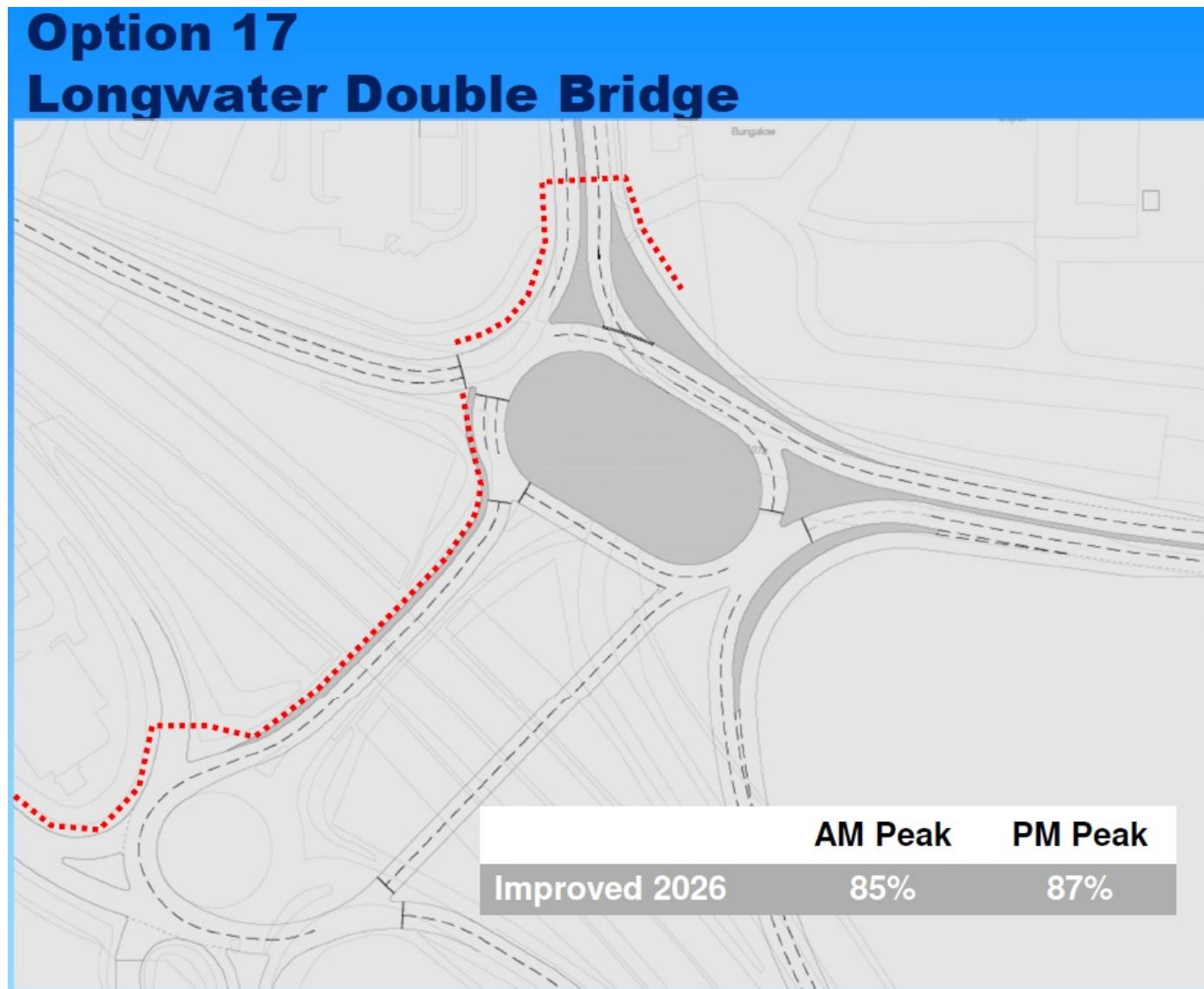


A.2 Option 9

Option 9 Easton Roundabout 'Throughabout' Layout

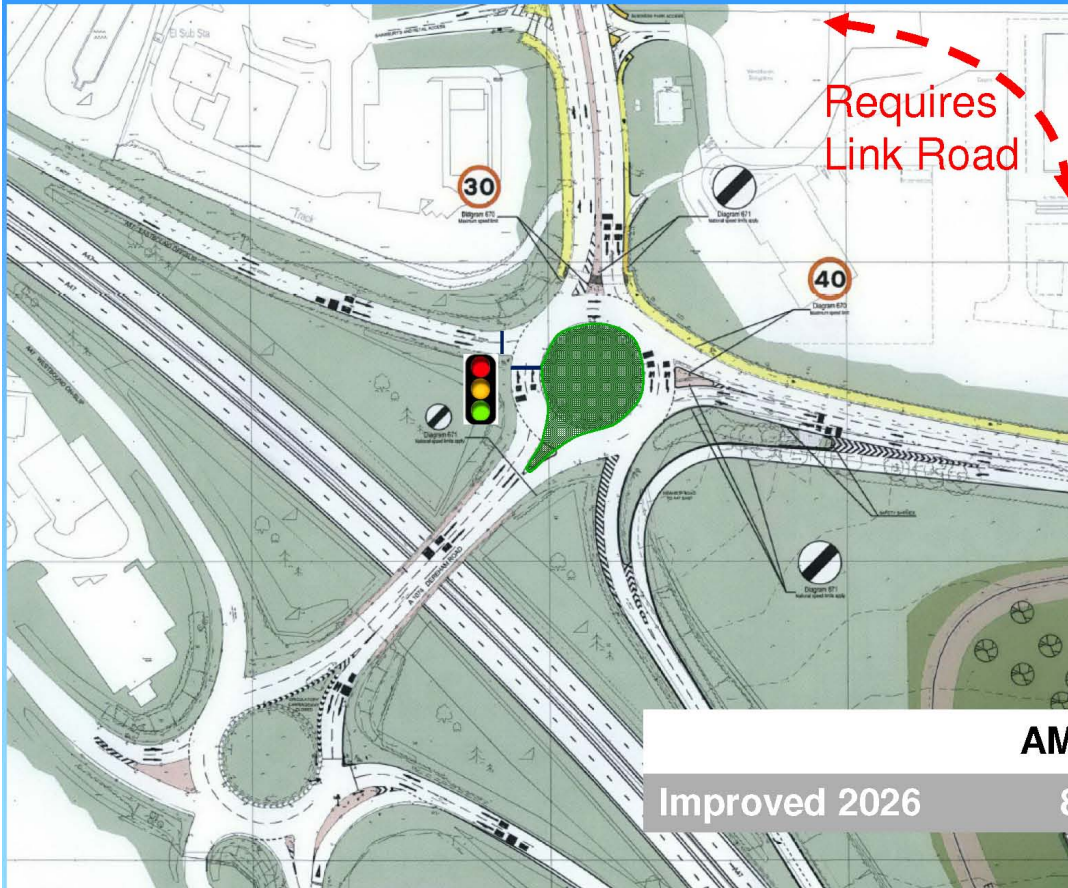


A.3 Option 17



A.4 Option 19

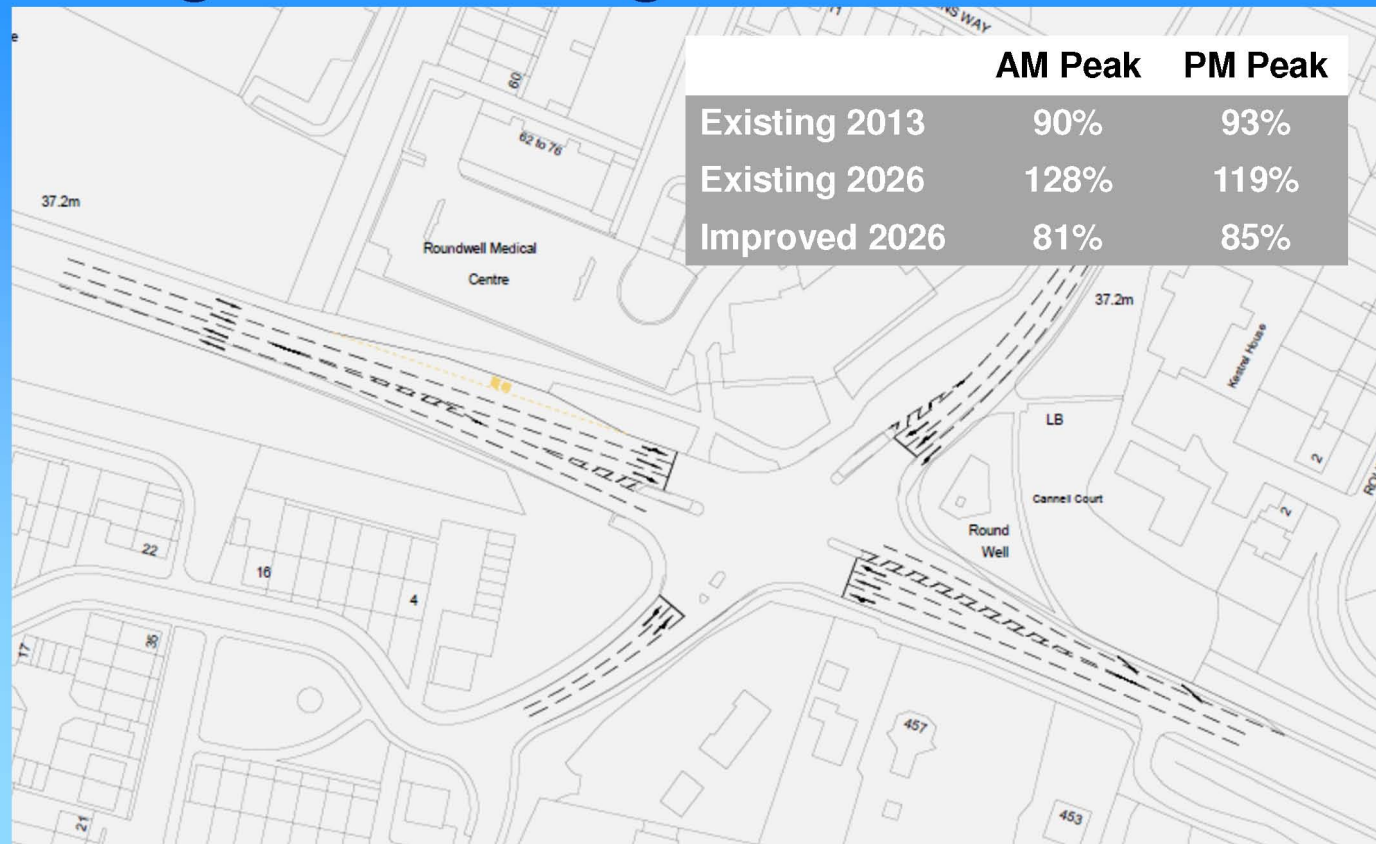
Option 19 Double 'Tear Drop' Layout



	AM Peak	PM Peak
Improved 2026	81%	78%

A.5 Option 21

Option 21 Longwater Lane Signals



A.6 Option 23

Option 23 Widening Dereham Road



