Appendix E Side Road Strategy Options Appraisal

SIDEROAD STRATEGY OPTIONS APPRAISAL GUIDANCE NOTES					Mott MacDonald Sweco
PROJECT	A47/A11 THICKTHORN JUNCTION - PCF STAGE 3				
PROJECT No.	119556	RATIONALE No	HE551492-MMSJV-GEN-000-SH-ZZ-00003		
SUBJECT	A47/A11 THICKTHORN CANTLEY LANE SIDEROAD STRATEGY OPTIONS APPRAISAL	APPROVAL DATE REQUIRED	Sheet 1 of 3		
MAIN DESIGN TEAM	HIGHWAYS	SUPPORT TEAM 1	ENVIRONMENT	SUPPORT TEAM 2	STRUCTURES
LOCATION	A47/A11 Thickthorn Interchange, Norwich, Norfolk			MAIN DISCIPLINE	
				Route Alignment and Junctions	
DESIGN RATIONALE	This Side Road Strategy Options Appraisal collects various information for each option assessed which are individually scored against the matrix below to give a quantitative assessment of each option. This provides evidence of the key considerations that have led to the decision of the preferred option including engineering, environmental, economic, operational, safety and other matters. Safety is a legal requirement under the CDM Regulations and is a crucial element of the design, therefore, Designers Risk Assessments have also been undertaken as per Design Risk Assessment HE551492-MMSJV-GEN-000-SH-CX-00011.				
APPLICATION	This Side Road Strategy Options Appraisal is used to evaluate differing options using a simple and standard scoring matrix.				
COMPLETING AND SCORING THE DESIGN RATIONALE FORMS	Each option is assessed in terms of engineering, environmental, economic, operational, safety and other matters. A qualitative assessment is given alongside a quantitative scoring system based on: Score of 0 = Unacceptable and is a "showstopper" with the option ruled out for the reasons given. Score of 1 to 5 = Option has adverse impact and quantified for the reasons given. Score of 6 to 10 = Option offers distinct advantages ranging from minor (7) to very significant (10)				
	DESIGN: Score of 0 is an unacceptable design with Departure from Standards resulting in operational safety concerns which cannot be mitigated. Score of 5 is an acceptable design with/without Departure from Standards. Score of 10 is a design above and beyond DMRB requirements with exemplary standards.				
	PROPOSED CONSTRUCTION METHODOLOGY: Score of 0 is unacceptable that requires extraordinary construction techniques. Score of 5 requires construction adjacent/above/below major constraints such as power lines, railway etc. Score of 10 has no major construction constraints and no significant residual risks.				
	OPERATIONAL SAFETY: Score of 0 is unacceptable that introduces significant safety risks to users. Score of 5 is an acceptable design with/without mitigation measures to maintain user safety. Score of 10 is a layout incorporating best practise/exemplary standards with no residual safety risks.				
	OPERATIONAL TRAFFIC: Score of 0 is unacceptable that introduces significant delays/diversions to users. Score of 5 is an acceptable level of delay no worse than currently exists Score of 10 is less delay than currently exists.				
	OPERATIONAL WALKING, CYCLING & HORSE RIDING (WCHR): Score of 0 is unacceptable design that provides an undesired route for walking, cycling & horse riding. Score of 5 is acceptable and provides a design to DMRB standard. Score of 10 is a design above and beyond DMRB standard that provides enhanced facilities for WCHR.				

COMPLETING AND SCORING THE DESIGN RATIONALE FORMS	**MAINTENANCE:** Score of 0 has significant maintenance requirements (additional structures/railway). Score of 5 has additional maintenance requirements but in line with Network Management Manual and routine/winter service codes. Score of 10 has minimal additional maintenance requirements.
	ENVIRONMENTAL: Score of 0 has significant environmental impacts which cannot be mitigated. Score of 5 impacts environmental for which mitigation can be provided to allow residual impacts to be acceptable. Score of 10 has no significant environmental impacts.
	CUSTOMER: Score of 0 appears to actively contradict the majority of known customer concerns and introduces significant risks to public perception re. the validity of the consultation process. Score of 5 addresses the majority of known customer concerns. Score of 10 addresses the majority of known customer concerns and provides enhanced facilities.
	LEGAL: Score of 0 has a high risk of Legal Challenge during the DCO Process. Score of 5 has low risk of Legal Challenge during the DCO Process. Score of 10 reduces the risk of Legal Challenge during the DCO Process.
	RISK: Score of 0 has major impacts on the scheme risk overall which is likely to lead to opposition and objection. Score of 5 has impacts on the scheme risk overall but opposition and objection can be mitigated. Score of 10 has no impacts on the scheme risk overall.
COMPLETING THE DESIGNERS RISK ASSESSMENT	The Designers Risk Assessment for each option is divided into different hazard groups. Each risk identified is put into the relevant group where the risk, the hazard and mitigation measures are described and given a Red/Amber/Green rating (post mitigation). The risk matrix below is be used to assist in the assessment of the risk ranking. An overall risk rating for each option is then given at the bottom of the Designers Risk Assessment.
RISK MATRIX for Design Risk Assessment	

	Severity				
Probability	5 - Catastrophic	4 - Critical	3 - Major	2 - Moderate	1 - minor
5 - Frequent	25	20	15	10	5
4 - Probable	20	16	12	8	4
3 - Occasional	15	12	9	6	3
2 - Remote	10	8	6	4	2
1 - Improbable	5	4	3	2	1

LOW MEDIUM HIGH

SIDEROAD STRATEGY OPTIONS APPRAISAL

Mott MacDonald Sweco

PROJECT	A47/A11 THICKTHORN JUNCTION - PCF STAGE 3				
PROJECT No.	119556	**RATIONALE No**	HE551492-MMSJV-GEN-000-SH-ZZ-00003		
SUBJECT	A47/A11 THICKTHORN CANTLEY LANE SIDEROAD STRATEGY OPTIONS APPRAISAL	**APPROVAL DATE REQUIRED**	**Sheet 2 of 3**		
MAIN DESIGN TEAM	HIGHWAYS	**SUPPORT TEAM 1**	ENVIRONMENT	**SUPPORT TEAM 1**	STRUCTURES
LOCATION	A47/A11 Thickthorn Interchange, Norwich, Norfolk			**MAIN DISCIPLINE**	Route Alignment and Junctions

DESCRIPTION SUMMARY

This Design Rationale and Design Risk Assessment has been produced to detail the preferred option to be taken forward.

The A47/A11 Thickthorn Junction scheme will provide link roads between the A11 Northbound to A47 Eastbound carriageways and the A47 Eastbound to A11 Southbound carriageways which remain the same for all Cantley Lane options. The only differences between the options identified within this design rationale.

Highways England (HE) undertook Non-Statutory Public Consultation in March 2017 on the A47/A11 Thickthorn Junction and announced Preferred Route Announcement in August 2017 where Cantley Lane Side Road Strategy was held in abeyance as options were still being assessed. Following this, Highways England announced the potential solutions for Cantley Lane (Options 3 and 4).

Feedback from the Public Consultation raised the following comments in relation to re-connection of Cantley Lane:

- Increased traffic along Cantley Lane, particularly associated with the recycling centre at Station Lane;
- Increased traffic and congestion in Cringleford;
- Cantley Lane becoming the main access route from South Norwich to Ketteringham;
- Rat-running to the A11 via. Station Lane;
- Underpass being unsafe for non-motorised users;
- Environmental impact on wildlife and trees;
- Increased noise/air pollution;
- Impacts upon landscape protection zone adjacent to the new development;
- Regular use of the footbridge;
- Land severance;

PCF Stage 3 Preliminary Design assessed the various options for the re-connection of Cantley Lane and report reference HETTNJCT-MMSJV-General-000-General-CH-00001 fully details the Cantley Lane options assessed that are considered within this design rationale.

Option 3	The alignment of this option was developed in response to concerns that were raised by the owner of the corner of land between Cantley Lane South, the A47, and the Breckland Railway Line (Plot 52A on the originally proposed Single Option land plans with the originally proposed local road link road shown at PIE), that the proposed link caused severe severance to his land. This option is routed through the Cringleford Residential Development Extension, via the developments road network, before connecting to Round House Roundabout.
Option 4	This option restores access to the main highway network for the properties along Cantley Lane South; which would be severed by the scheme, by connecting Cantley Lane South to the B1172 Norwich Road.
Option 5	The A11 Station Lane Junction was originally built as an at-grade, all movements junction, but has since been converted to a left-in, left out junction, presumably on the grounds of safety to stop motorists turning right across opposing traffic. This has prevented traffic from Station Lane, North and South of the A11, from turning right onto the A11. This option proposes improvements at the A11/Station Lane junction to the west of Thickthorn Interchange to link Station Lane (North and South of the A11) and requires 2 new structures across the existing A11 dual carriageway and Breckland Railway.

Option 6	The A11 Station Lane Junction was originally built as an at-grade, all movements junction, but has since been converted to a left-in, left out junction, presumably on the grounds of safety to stop motorists turning right across opposing traffic. This has prevented traffic from Station Lane, North and South of the A11, from turning right onto the A11. This option proposes improvements at the A11/Station Lane junction to the west of Thickthorn Interchange to provide a roundabout on the mainline carriageway to allow all movements between Station Lane and the A11.
Option 7	The A11 Station Lane Junction was originally built as an at-grade, all movements junction, but has since been converted to a left-in, left out junction, presumably on the grounds of safety to stop motorists turning right across opposing traffic. This has prevented traffic from Station Lane, North and South of the A11, from turning right onto the A11. This option was tabled by the public at a Parish Council meeting on 6th april 2017 which proposes improvements at the A11/Station Lane junction to the West of Thickthorn Interchange and requires a new roundabout and slip roads to connect Station Lane South to the A11 which requires a skewed underpass beneath the existing A11 dual carriageway.
REFERENCES:	
General	Cantley Lane Options Report: HE551492-MMSJV-General-000-General-CH-00001 GD04/12 Safety Risk Assessment: Cantley Lane Options: HE551492-MMSJV-GEN-000-HS-ZS-00003 Cringleford Developer Layout Drawing: 350/PL/003
Option 3	General Arrangement Drawing: HE551492-MMSJV-HGN-000-DR-CH-00001 Departure Summary Drawing: HE551492-MMSJV-HAC-000-DR-CH-00002
Option 4	General Arrangement Drawing: HE551492-MMSJV-HGN-000-DR-CH-00002 Departure Summary Drawing: HE551492-MMSJV-HAC-000-DR-CH-00001
Option 5	General Arrangement Drawing: HE551492-MMSJV-HGN-000-DR-CH-00007 Departure Summary Drawing: HE551492-MMSJV-HAC-000-DR-CH-00004
Option 6	General Arrangement Drawing: HE551492-MMSJV-HGN-000-DR-CH-00003 Departure Summary Drawing: HE551492-MMSJV-HAC-000-DR-CH-00005
Option 7	General Arrangement Drawing: HE551492-MMSJV-HGN-000-DR-CH-00004 Departure Summary Drawing: HE551492-MMSJV-HAC-000-DR-CH-00003
OPTION SELECTED	**Option 4:** This option restores access to the main highway network for the properties along Cantley Lane South, who otherwise would have their access restricted by this low bridge when the Cantley Lane (South) links to Thickthorn Roundabout are removed to implement the scheme.
SUMMARY OF REASONS	Option 4 scores 50 which has the best score of all options when compared to option 3 (38), Option 5 (29) Option 6 (30) and Option 7 (41). 1. Reduces the risk of objection or any potential compensation as a consequence of the proposed route through the Cringleford Residential Extension Development. 2. Reduces the risk of objection by local Cringleford residents, particularly those along Cantley Lane who were concerned at the route being used as a 'rat run'. 3. Avoids lengthy diversions for residents along Cantley lane. 4. Provides a continuous route for non-motorised users between Cantley lane and Cantley lane South via the new non motorised user bridge across the A47. 5. Provides a DMRB compliant design. 6. Generates less excavated materials and reduces the schemes export of surplus excavated material. 7. Norfolk County Council preferred option as set out during consultation meeting 05/12/17.
	APPROVERS COMMENTS:

STAKEHOLDERS CONSULTED	The following Stakeholders have been consulted on the options indicated in brackets: - Cringleford and Hethersett Parish Council (Options 3, 4 & 5) - Richard Bacon MP and various residents visiting his surgery (Options 3, 4 & 5) - Simon Mason, Fleet Maintenance Operator - Norfolk Fire Service - Emergency Service Co-ordinator (Norfolk Police Force and Fire Services NB. Ambulance Svc unable to attend meeting but rescheduled). Overall scheme discussed including communications during construction phase. - Norfolk County Council Highway Department (Options 3, 4, 5, 6 & 7). - Norfolk County Council LLFA (Option 3). - East Carlton and Ketteringham Parish Council (Options 3 & 4). - 5000 Local Residents (Optiosn 3 & 4). - Historic England (Option 3). - County Archaeologist (Option 3). - Environment Agency (Option 3). - Various affected landowners (Overall scheme plus any relevant Option information available at the time)

SIDEROAD STRATEGY OPTIONS APPRAISAL

Mott MacDonald Sweco

PROJECT	A47/A11 THICKTHORN JUNCTION - PCF STAGE 3				
PROJECT No.	119666	RATIONALE No:	HE551492-MMSJV-GEN-000-SH-ZZ-00003		
SUBJECT	A47/A11 THICKTHORN CANTLEY LANE SIDEROAD STRATEGY OPTIONS APPRAISAL	APPROVAL DATE REQUIRED:		Sheet 3 of 3	MAIN DISCIPLINE: Route Alignment and Junctions
MAIN DESIGN TEAM	HIGHWAYS	SUPPORT TEAM 1	ENVIRONMENT	SUPPORT TEAM 1	STRUCTURES
LOCATION	A47/A11 THICKTHORN INTERCHANGE, NORWICH, NORFOLK				

OPTION	Option 3	SCORE	Option 4	SCORE	Option 5	SCORE	Option 6	SCORE	Option 7	SCORE
DESIGN	1. **Design in accordance with Manual for Streets design requirements and not DMRB standards;** would require agreement from Local Authority. 2. This option requires several geometric relaxations which are compounded and combined. There are **8 Departure from Standards**. 3. **Reduced 6.0m carriageway width** requires agreement with Local Authority. 4. **All the departures are a combination of departures and relaxations in horizontal curvature (3 steps below), vertical curvature (2 steps below) and Stopping Sight Distance (3 steps below) in close proximity to an 8.0% gradient.** These departures should be mitigated by way of signage / road markings etc. 5. **The steep 8% gradient on the east side of the existing A47 is also on the approach to a significant Stopping Sight Distance departure** and to mitigate this departure requires a wider structure below the existing A47 dual carriageway to enable acceptable stopping sight distance through the alignment. 6. This option will introduce a **1.2km diversion** for residents along Cantley Lane South. 7. The vertical alignment on the east side of the existing A47 requires a **steep gradient of 8%** to tie in outside of the Cringleford Development. 8. The underpass and cutting side slopes **further impact on the earthworks balance** for the scheme which is likely to require additional material to be disposed of to a tip off site. 9. Drainage of this option will require **approx. 8m deep drainage** from the underpass low point towards Cringleford rail bridge to allow a discharge	5	1. Layout design **primarily in accordance with DMRB.** 2. This option requires several geometric relaxations which are compounded and combined. There are **7 Departure from Standards and 3 Relaxations** which form part of combination departures. 3. **Reduced 6.0m carriageway width** requires agreement with Local Authority. 4. **A key departure is a combination of relaxations in Vertical Curvature (2 steps below) and Stopping Sight Distance (2 steps below)** on the approach to the junctions. These departures should be mitigated by way of signage / road markings etc. 5. **A key departure is a combination of relaxations in vertical curvature (1 step below) and Stopping Sight Distance (1 step below)** along the new southbound link road. 6. **A key departure is relaxations in "v" distance (visibility to the right)** from the new link road onto Cantley Lane South due to existing vegetation. However Cantley Lane traffic speeds will be low because of the existing low standard highway approaching the junction. 7. **Agreement to be made with Norfolk County Council and the Police for the implementation of a local 40mph speed limit would negate most of the relaxations and departures.** 8. This option will introduce a **1.5km diversion** for residents along Cantley Lane South. 9. **Generates less excavated materials** and reduces the schemes surplus of excavated material. 10. Requires **existing Cantley Stream and access**	6	1. **Design in accordance with Manual for Streets design requirements and not DMRB standards; would require agreement from Local Authority. Design does not comply with DMRB.** 2. The proposed section of road requires several geometric relaxations which are compounded and combined. There are **7 Departure from Standards and 3 Relaxations** which form part of combination departures. 3. **All the departures are a combination of departures and relaxations in horizontal curvature (1 step below), vertical curvature (1 step below) and visibilities on the approach to junctions (1 step below).** 4. **A key departure occur as a result of the relaxations at the low radii bends** where the layout has been designed to DMRB connector road standards however the layout exhibits long straight sections of carriageway which negates the use of this type of layout. **5. Two key departures are relaxations in "v" distance (visibility to the left and right)** at the Station Road (South) junction. This departure is unlikely to be acceptable to operational safety although A11 diverge traffic speed should be low as traffic exits the A11. Visibility envelope is affect by the existing railway bridge crest to the north and by verge constraints to the south. 6. This option will introduce a **5.6km diversion** for residents along Cantley Lane South. 7. **This option generates less excavated materials and can reduce the schemes surplus of excavated material** if site won material is suitable for reuse in the embankment. 8. Depending on the quality of site won material	3	1. Roundabout design **not fully in accordance with DMRB.** 2. This option requires **2 Departure from Standards**. 3. **One key Departure from Standard is the Roundabout proximity to Station Lane Junction (99m provided - less than the 1km required) with reduced stopping sight distance and weaving length.** 4. **The siting of a normal roundabout on a high category dual carriageway is not recommended in the DMRB.** 5. The roundabout introduces a junction along the mainline which **will impede A11 mainline through traffic.** 6. Existing A11 mainline will introduce **high speeds approaching roundabout**. 7. This option will introduce a **4.9km diversion** for residents along Cantley Lane South. 8. **Additional drainage facilities in terms of attenuation storage and pollution control will be required** for the roundabout. 9. **Additional drainage survey will be required** outside of the current Red Line Boundary.	4	1. Layout design **not fully in accordance with DMRB.** 2. This option requires several geometric relaxations which are compounded and combined. There are **10 Departure from Standards and 4 Relaxations** which form part of combination departures. 3. **A key departure is substandard weaving length (146m provided - less than the 1km required) between proposed A11 Eastbound taper merge and Station Lane (North) diverge.** This is a **dangerous layout** as there will be merging traffic accelerating and diverging traffic slowing significantly. This is likely to cause confusion and side swipe and shunt type accidents. 4. **A key departure is substandard Stopping Sight Distance (3 steps below)** approaching the merge. 5. **A key departure is the substandard merge type layout** onto the A11 Eastbound. **6. A key departure is the Station Lane (South) junction proximity to the A11 diverge.** Traffic leaving the A11 D2AP will be in conflict with traffic waiting to turn right and traffic leaving the A11 will not expect traffic to be stationary. High likelihood of collisions. 7. This option will introduce a **6.3km diversion** for residents along Cantley Lane South. 8. **Deep cutting required in a tight corridor between the A11 carriageway and the existing railway line.** 9. **Underpass required below the live A11** carriageway required in a tight corridor between the A11 carriageway and the existing railway line.	2

DESIGN	[illegible] to the existing Cantley Stream. 10. **Additional drainage facilities in terms of attenuation storage and pollution control will be required** prior to discharge.		**[illegible] track to the south west of the alignment to be realigned / diverted.** 11. This proposed link connects two derestricted rural roads with national speed limits. The design speed and departures have been assessed to DMRB. Road cross-sections have not been assessed. **12. Drainage of this option will discharge to the pond already required for the main link roads to the scheme.** **13. Overland flow of surface water drainage to be intercepted at the toe of earthworks.**		[illegible] imported fill may be required. 9. **Additional drainage facilities in terms of attenuation storage and pollution control will be required** for the overbridge and link roads. 10. **Additional drainage survey will be required** outside of the current Red Line Boundary.				10. Construction within tight corridor between the A11 carriageway and the existing live railway line. 11. **Additional drainage facilities in terms of a pumping station, attenuation storage and pollution control will be required** for the roundabout, associated slip roads and underpass. 12. **Additional drainage survey will be required** outside of the current Red Line Boundary.	
PROPOSED CONSTRUCTION METHODOLOGY	1. **Traffic Management required to create contraflows to enable the structure to be constructed in two halves.** 2. **Working under and adjacent to high voltage overhead electricity line** (400kV and 132kV). 3. Working over low pressure gas pipes, BT cables, water pipes and other statutory infrastructure at Cantley Lane South tie in to the west of the link. 4. **Existing gravel pit land may require ground stabilisation.**	**3**	1. Traffic Management required to segregate abutment/pier construction from the live carriageway. 2. Likley that **temporary road closures will be rquired on the A11** for beam lifts although anticipated this will be during off peak periods. 3. **Existing contaminated land may require ground stabilisation.**	**5**	1. **Extensive Traffic Management required** to segregate abutment/pier construction from the live carriageway. Likley that **temporary road closures** will be required on the A11 for beam lifts although anticipated this will be during off peak periods. 2. **Working over and adjacent to live railway line.** 3. **Temporary rail closures** will be required for beam lifts. 4. **Additional Ground Investigation required.**	**4**	1. **Extensive Traffic Management** required to segregate roundabout construction from the live carriageway. Likley that **temporary road closures** will be required on the A11 for tie in works. 2. **Additional Ground Investigation required.** 3. **No structures required** for this option.	**6**	1. **Extensive Traffic Management required.** Likley that **temporary road closures** will be required on the A11 for the underpass although anticipated this will be during off peak periods. 2. **Working adjacent to live railway line.** 3. **Additional Ground Investigation required.** 4. **Earthwork cutting slope may require stabilisation** so as not to adversely impact the railway/earthworks. 5. **Groundwater issues** due to depth of cutting and underpass.	**3**

OPERATIONAL SAFETY	1. The proposed link road for vehicles travelling between Cantley Lane South and Round House Roundabout provides an attractive opportunity to access the wider highway network. 2. The provision of an additional arm on the Roundhouse Way roundabout will lead to more weaving and crossing movements and thereby increase the risk of injury collisions including side-swipes and re-starts. 3. The increased traffic as a result of item (1), above, will impact on future residents of the proposed Cringleford Residential Extension Development, in particular leading to possible conflicts between pedestrians and cyclists and motor vehicles. 4. The alignment of the link is influenced by Manual for Streets (MfS) rather than the Design Manual for Roads and Bridges (DMRB), resulting in significantly tighter geometry, including low radii bends on a road subject to the national speed limit (NSL). This will increase the risk of vehicles leaving the carriageway. 5. The vertical alignment on the East side of the existing A47 requires a steep gradient of 8% to tie in outside of the Cringleford Development. This could lead to single-vehicle loss of control crashes by vehicles travelling towards Cantley Lane South. 6. Similarly the 8% gradient will affect winter maintenance operations and vehicles heading both eastbound and westbound will be at risk of single-vehicle loss of control collisions in icy conditions. 7. The underpass beneath the existing A47 was not favoured by the local residents during consultation due to personal safety concerns. 8. Norfolk Fire Service indicated their preference towards this option, as it provided 2-way access to / from Cantley Lane South, which would reduce response times. However it also required emergency vehicles to be routed through a proposed housing development.	3	1. The design introduces a new link between the B1172 and Cantley Lane South. The addition of 2 new junctions where none currently exist will create the risk of injury collisions such as re-starts and overshoots. Crashes on the link may be mitigated by giving it the character of a rural lane in keeping with the existing Cantley Lane South. 2. Overbridges will be required to carry the new link over the A11. This will increase the maintenance burden and thereby the risk to maintenance personnel being struck by passing vehicles or falls from height. 3. Norfolk Fire Service indicated their preference towards this option, as it provided 2-way access to / from Cantley Lane South, which would reduce response times.	5	1. The detour to the main group of properties on Cantley Lane South (approx 5.6km), which includes rural two-way single lane carriageway roads with limited passing places, would adversely affect emergency services response times. It could also lead to head-on collisions during emergencies. 2. The alignment of the link is influenced by Manual for Streets (MfS) rather than the Design Manual for Roads and Bridges (DMRB), resulting in significantly tighter geometry, including low radii bends on a road subject to the national speed limit (NSL). This will increase the risk of vehicles leaving the carriageway. 3. The addition of two new junctions where none currently exist will introduce the risk of injury collisions such as re-starts and overshoots. 4. The proposed route alignment is subject to a Height (13'/4m) & Weight (7.5T) restriction at the existing railway bridge. During consultation with Norfolk Fire Service, they highlighted that while a 4m clearance was acceptable, it was on the limit of acceptability. There is a risk of vehicles colliding with the infrastructure. 5. Norfolk Fire service raised concerns that this route was single access, would result in increased response times, and presented logistical issues if a multi vehicle response was required. 6. To overcome the height restriction at the railway bridge, potential mitigation could be to raise the existing structure or lower the existing highway although this would be at significant cost. 7. This option would have to retain the existing uncontrolled pedestrian crossing east of Station Lane which across the mainline A11 since using the underpass would introduce a 0.6km diversion including two overbridges to cross the railway line and A11. There is a high personal injury collision risk to pedestrians, cyclists and horse riders due to the high speeds of vehicles using the A11.	2	1. The detour to the main group of properties on Cantley Lane South (approx 4.9km), which includes rural 2-way single lane carriageway roads with limited passing places, would adversely affect emergency services response times. It could also lead to head-on collisions during emergencies. 2. The roundabout's proximity to the Station Lane junction is sub-standard, reducing both the Sight Stopping Distance (SSD) and weaving length and increasing the probability of side-swipe collisions due to late lane changing. 3. The siting of a normal roundabout on a high category dual carriageway is not recommended in the DMRB. The roundabout introduces a junction along the mainline which will impede high-speed A11 mainline through traffic and introduce more conflicts. There is the potential to introduce shunt, re-start and side-swipe injury collisions due to the roundabout. 4. The proposed route alignment is subject to a Height (13'/4m) & Weight (7.5T) restriction at the existing railway bridge. During consultation with Norfolk Fire Service, they highlighted that while a 4m clearance was acceptable, it was on the limit of acceptability. There is a risk of vehicles colliding with the infrastructure. 5. Norfolk Fire service raised concerns that this route was single access, would result in increased response times, and presented logistical issues if a multi vehicle response was required. 6. To overcome the height restriction at the railway bridge, potential mitigation could be to raise the existing structure or lower the existing highway although this would be at significant cost. 7. This option would replace the existing uncontrolled pedestrian crossing east of Station Lane which crosses the mainline A11, due to the provision of the roundabout which would be no longer than the existing. However, the roundabout crossing would likely require traffic signal control to ensure safe crossing across a high speed, high traffic flow carriageway. There is a high personal injury collision risk to pedestrians, cyclists and horse riders due to the high speeds of vehicles using the A11.	2	1. This option contains a proposed departure for weaving length that is below the recommended length of 1km within the DMRB. This would result in a higher risk of injury accidents on the A11 Dual Carriageway, particularly side-swipes. 2. The detour to the main group of properties on Cantley Lane South (approx 6.3km), which includes rural 2-way single lane carriageway roads with limited passing places, would adversely affect emergency services response times. It could also lead to head-on collisions during emergencies. 3. The proposed route alignment is subject to a Height (13'/4m) & Weight (7.5T) restriction at the existing railway bridge. During consultation with Norfolk Fire Service, they highlighted that while a 4m clearance was acceptable, it was on the limit of acceptability. There is a risk of vehicles colliding with the infrastructure. 4. Norfolk Fire service raised concerns that this route was single access, would result in increased response times, and presented logistical issues if a multi vehicle response was required. 5. To overcome the height restriction at the railway bridge, potential mitigation could be to raise the existing structure or lower the existing highway although this would be at significant cost. 6. This option would have to retain the existing uncontrolled pedestrian crossing east of Station Lane which crosses the mainline A11, since using the underpass would introduce a 1.6km diversion and would require an offline route from the roundabout to Station Lane. There is a high personal injury collision risk to pedestrians, cyclists and horse riders due to the high speeds of vehicles using the A11.	2

OPERATIONAL TRAFFIC	1. Although this option does provide an alternative through route to the Thickthorn junction, the transport model predicts that it is unlikely to attract any additional rerouted traffic from a wider area. The reason for this could be that the Reconnection Link Road, Cantley Lane South and Station Lane form a relative longer route for Westbound traffic to access A11 as compared to the Thickthorn route and the Thickthorn scheme also reduces the delay at the interchange. **However, in the event of an incident on the A11 / A47, there could be a significant increase of traffic utilising this parallel route.** 2. **This option could also see a small rise in traffic from a wider area utilising Cantley Lane South to travel to / from Ketteringham Recycling Centre. Although this is not captured in the transport model, our professional judgement on this increase would be around 100 AADT based on actual count data for the recycling centre.** 3. **Under this option, there would be a slightly increase on average journey time for residents on Cantley Lane South to access Thickthorn Junction from approximately 1 minute (A47 Westbound off slip road approach) in the base to 3 minutes (A11 Newmarket road approach) in 2037.**	5	1. **The option provides benefits to the properties along the eastern section of Cantley Lane South as there will no longer be any through traffic passing the properties.** 2. **Under this option, there would be a slightly increase on average journey time for residents on Cantley Lane South to access Thickthorn Junction from approximately 1 minute (A47 Westbound off slip road approach) in the base to 2 minutes (B1172 approach) in 2037.**	5	1. **This option prevents any through traffic on Cantley Lane South due to existing access on A11 / A47 to be closed. Therefore, the predicted traffic on Cantley Lane South is zero except for local traffic associated with residents on Cantley Lane South, which is not captured in the strategic transport model.** 2. **This scheme does not form a through route between Hethersett and Ketteringham recycling centre via Station Lane North because the northern part of Station Lane North is closed to traffic as per the base year. In addition, traffic on Station Lane North has to give way to A11 mainline traffic, which deters rerouted traffic from Ketteringham. A merge option was considered for the A11 Eastbound Traffic, which would attract more vehicles to use this link; however the sub-standard weaving length to the proposed A11 Eastbound diverge ruled this out on safety grounds.** 3. **Under this option, there would be a significant increase on average journey time for residents on Cantley Lane South to access Thickthorn Junction from approximately 1 minute (A47 Westbound off slip road approach) in the base to 7 minutes (A11 Eastbound off slip road approach) in 2037.**	3	1. **This option prevents any through traffic on Cantley Lane South due to existing access on A11 / A47 to be closed. Therefore, the predicted traffic on Cantley Lane South is zero except for local traffic associated with residents on Cantley Lane South, which is not captured in the strategic transport model.** 2. **This option does not meet one of Highways England key goals of providing a free flowing network; The provision of an "at-grade" roundabout on the busy A11 would lead to an increase in journey times and congestion.** 3. **According to the transport model, this option is estimated to cause 177 seconds delay per vehicle on A11 Eastbound traffic and 117 seconds delay per vehicle for the opposite direction in 2037 AM Peak. In addition, the appearance of agricultural vehicles would adversely effect the performance of the roundabout.** 4. **Under this option, there would be a significant increase in delay and average journey time for residents on Cantley Lane South to access Thickthorn Junction from approximately 1 minute (A47 Westbound off slip road approach) in the base to 6 minutes (A11 Eastbound off slip road approach) in 2037.**	0	1. **This option prevents any through traffic on Cantley Lane South due to existing access on A11/A47 to be closed. Therefore, the predicted traffic on Cantley Lane South is zero except for local traffic associated with residents on Cantley Lane South, which is not captured in the strategic transport model.** 2. This scheme does not form a through route between Hethersett and Ketteringham recycling centre via Station Lane North because the northern part of Station Lane North is closed to traffic as per the base year. In addition, the design of single lane merge reduces the difficulty for Eastbound traffic to access A11 as compared to Option 6 and therefore attracted more rerouted traffic from Ketteringham. 3. **Under this option, there would be a significant increase on average journey time for residents on Cantley Lane South to access Thickthorn Junction from approximately 1 minute (A47 Westbound off slip road approach) in the base to 6 minutes (A11 Eeastbound off slip road approach) in 2037.**	4

OPERATIONAL WCHR (Walking Cycling Horse Riding)	1. NMU Count data: during school term time an average of 12 pedestrians and 27 cyclists used the existing bridge on a weekday and 13 pedestrians and 36 cyclists used it on a weekend. 2. **The alignment introduces an 8% gradient leading to Cantley Lane (North of A47) which is above the DMRB 5% maximum gradient for non-motorised users, particularly elderly, disabled and walkers.** 3. An offline non-motorised user route will be required to avoid the 8% gradient which will require additional land and potentially, additional structures. 4. **The footbridge will not be replaced with an new footbridge since a non-motorised user route will be provided as part of the underpass option.** 5. **Removal or non-replacement of the footbridge would contravene Highways England's policy as stated in 'Cycling Strategy - Our approach' and meets Highway England goal of modernising the network to Improve facilities for cyclists, pedestrians and other road users.** 6. **This option would retain the existing at-grade pedestrian crossing east of Station Lane which crosses the mainline A11. Therefore the existing risk of crossing the A11 at-grade would remain.**	**3**	1. NMU Count data: during school term time an average of 12 pedestrians and 27 cyclists used the existing bridge on a weekday and 13 pedestrians and 36 cyclists used it on a weekend. 2. **The footbridge will be replaced as part of the scheme as this is a desired route for access to local amenities such as the Doctors surgery and shops in Cringleford.** 3. **The proposed non motorised user route alongside the carriageway will link Cantley Lane South to the East-West cycle route along B1172 Norwich Road that is well used by commuters.** 4. **Removal or non-replacement of the footbridge would contravene Highways England's policy as stated in 'Cycling Strategy - Our approach' and meets Highway England goal of modernising the network to Improve facilities for cyclists, pedestrians and other road users.** 5. **This option would retain the existing at-grade pedestrian crossing east of Station Lane which crosses the mainline A11. Therefore the existing risk of crossing the A11 at-grade would remain.**	**5**	1. NMU Count data: during school term time an average of 12 pedestrians and 27 cyclists used the existing bridge on a weekday and 13 pedestrians and 36 cyclists used it on a weekend. 2. **The footbridge will be replaced as part of the scheme as this is a desired route for access to local amenities such as the Doctors surgery and shops in Cringleford.** 3. **This option would close the existing at-grade pedestrian crossing east of Station Lane which crosses the mainline A11 due to the provision of the overbridge. However, since using this would require a 600m diversion this alternative is unlikely to be used by some pedestrians and cyclists. Therefore some risk of crossing the A11 at-grade would remain, albeit reduced from the current level.** 4. **Removal or non-replacement of the footbridge would contravene Highways England's policy as stated in 'Cycling Strategy - Our approach' and meets Highway England goal of modernising the network to Improve facilities for cyclists, pedestrians and other road users.**	**5**	1. NMU Count data: during school term time an average of 12 pedestrians and 27 cyclists used the existing bridge on a weekday and 13 pedestrians and 36 cyclists used it on a weekend. 2. **The footbridge will be replaced as part of the scheme as this is a desired route for access to local amenities such as the Doctors surgery and shops in Cringleford.** 3. **This option would replace the existing at-grade pedestrian crossing east of Station Lane which crosses the mainline A11, due to the provision of the roundabout incorporating a crossing which would be no longer than the existing. However, the roundabout crossing would likely require traffic signal control to ensure safe crossing across a high trafficked highway.** 4. **Removal or non-replacement of the footbridge would contravene Highways England's policy as stated in 'Cycling Strategy - Our approach' and meets Highway England goal of modernising the network to Improve facilities for cyclists, pedestrians and other road users.**	**5**	1. NMU Count data: during school term time an average of 12 pedestrians and 27 cyclists used the existing bridge on a weekday and 13 pedestrians and 36 cyclists used it on a weekend. 2. **The footbridge will be replaced as part of the scheme as this is a desired route for access to local amenities such as the Doctors surgery and shops in Cringleford.** 3. **This option would close the existing at-grade pedestrian crossing east of Station Lane which crosses the mainline A11. However, since using the underpass would introduce a 1.6km diversion and would require an offline route from the roundabout to Station Lane this alternative is unlikely to be used by some pedestrians and cyclists. Therefore some risk of crossing the A11 at-grade would remain, albeit reduced from the current level.** 4. **Removal or non-replacement of the footbridge would contravene Highways England's policy as stated in 'Cycling Strategy - Our approach' and meets Highway England goal of modernising the network to Improve facilities for cyclists, pedestrians and other road users.**	**5**
MAINTENANCE	1. Moderate additional maintenance requirements due to underpass beneath the A47 and link / slip roads. 2. **Additional periodic maintenace required within drainage to prevent the proposed underpass becoming unpassable during extreme storm events.** 3. **Frequent maintenance during periods of adverse cold weather to ensure route remains open due to 8% Gradient.**	**5**	1. Moderate additional maintenance due to the number of structures required to cross the existing A11 and link roads.	**6**	1. **Significant additional maintenance due to additional multiple structures required to cross** the existing A11 and existing railway line and the additional junctions. 2. **Option may require access to live railway lines** for structures assessment / maintenance.	**3**	1. This option requires the **least additional maintenance** of all options. 2. Additional maintenance effects due to additional pavements although no structures.	**8**	1. **Significant additional maintenance due to the additional pumping station, underpass, retaining wall adjacent to railway and link roads** beneath the A47 and the associated slip roads. 2. **Additional periodic maintenace required within drainage to prevent the proposed underpass becoming unpassable during extreme storm events.**	**2**

ENVIRONMENTAL (Detail on Environmental Summary Table)	**Summary** Based on a qualitative assessment only. Potential for direct and indirect impacts on noise, greenhouse gases, historic environment, biodiversity (NERC Act habitats) and water environment. **Noise** - This option will see increased traffic flow down Cantley Lane and Cantley Lane South and introduce new source of noise. **Air Quality** - Negative impact expected on air quality due to increase in traffic however increase not expected to be significant. **Greenhouse gases** -Negative impact on regional greenhouse anticipated however impact not expected to be significant. Full assessment not undertaken. **Landscape** - Affects woodland area to south of the underpass, west of the A47. Alignment causes very limited field severance to south of A47. - Alignment through new urban development rather than through open countryside. - Visual effects on Cantley Lane South properties however can be mitigated.	3	**Summary** Based on a qualitative assessment only. Potential for significant adverse impacts on historic environment, biodiversity (NERC Act habitats) and water environment. **Noise** - New access road linking Cantley Lane to D1172 introduces new source of noise but is not close to residential receptors. Noise from A47 & A11 already dominates in this area. **Air Quality** - The design is not expected to increase traffic flows along Cantley Lane South where there are sensitive receptors. **Greenhouse gases** -No increase in regional greenhouse gases anticipated as no expected increase in traffic on Cantley Lane south. Full assessment not yet undertaken. **Landscape** - Loss of significant parts of Cantley Wood, fragmentation of existing field pattern. Limited view from PRoW. - Visual effect on property where Cantley Lane South meets new extension.	2	**Summary** Based on a qualitative assessment only. Area impacted by side road option has not been subject of baseline surveys and therefore is a desk-based assessment only. Potential for direct and indirect impacts on greenhouse gases, landscape, historic environment. biodiversity and water environment. **Noise** - Noise from Cantley Lane South would reduce as no through traffic but new A47 slip roads would offset this. New A11 access unlikely to effect existing non-residential receptors due to proximity of high noise A11. **Air Quality** - 5.6km detour from Cantley Lane South via Station Lane would increase regional emissions but increases would not be significant. **Greenhouse gases** -Negative impact on regional greenhouse anticipated however impact not expected to be significant. Full assessment not undertaken. **Landscape** - Loss of localised areas of mature hedgerow, mature trees , scrubby vegetation, small trees and loss and severance of arable farm land around A11 highway boundary and Station Lane (either side of A11). - Visual impacts on horizon around existing largely flat landscape. Scheme visible from local PRoW, A11 Highway and Breckland Railway west of Station Lane, partially visible from residential properties on High Street, winter views from northern extent of Station Lane.	3	**Summary** Based on a qualitative assessment only. Area impacted by side road option has not been subject of baseline surveys and therefore is a desk-based assessment only. Potential for direct and indirect impacts on greenhouse gases, biodiversity and water environment. **Noise** - Noise from Cantley Lane South would reduce as no through traffic but new A47 slip roads would offset this. New A11 access unlikely to effect existing non-residential receptors due to proximity of high noise A11. **Air Quality** - 4.9km detour from Cantley Lane South via Station Lane would increase regional emissions but increases would not be significant. **Greenhouse gases** -Negative impact on regional greenhouse anticipated however impact not expected to be significant. Full assessment not undertaken. **Landscape** - Loss of localised areas of hedgerows and semi mature trees north of existing A11. - Visual impacts on horizon around existing largely flat landscape. Scheme visible from Station Court and A11 highway, partial views from local PRoW.	4	**Summary** Based on a qualitative assessment only. Area impacted by side road option has not been subject of baseline surveys and therefore is a desk-based assessment only. Potential for direct and indirect impacts on greenhouse gases, landscape, historic environment. biodiversity and water environment. **Noise** - Noise from Cantley Lane South would reduce as no through traffic but new A47 slip roads would offset this. New A11 access unlikely to effect existing non-residential receptors due to proximity of high noise A11. **Air Quality** - 6.3km detour from Cantley Lane South via Station Lane would increase regional emissions but increases would not be significant. **Greenhouse gases** -Negative impact on regional greenhouse anticipated however impact not expected to be significant. Full assessment not undertaken. **Landscape** - Loss of localised areas of woodland, shrubs, scrubby vegetation, rough grassland and loss and severance of arable farm land around A11 highway boundary / Breckland railway. - Visual impacts on horizon around existing largely flat landscape. Scheme visible from local PRoW, parts of Breckland Railway west of Station Lane.	3

ENVIRONMENTAL (Detail on Environmental Summary Table)	**Historic Environment** - Reduction in the total area of surviving historic landscape of The Round House (Grade II) would affect the legibility within its original context -Increased noise would adversely effect the setting of The Round House (Grade II) during operation.		**Historic Environment** - Scheduled Monument (2 No. Tumuli) approx. 20m from toe of proposed embankment - increased noise impacts on setting during construction and operation. - Area between embankment and Tumuli previously mined for gravel/sand. Subsequently used for landfill - reduced likelihood of buried archaeology in this area. - North of the A11, proposed road runs through grounds of Thickthorn Park (non-designated, early C19th landscape park). Setting of the historic park altered by construction and operation of a new road through grounds.		**Historic Environment** - Area not subject to archaeological surveys. - Isolated instances of finds in area of scheme on Norfolk Explorer Heritage Database - Potential for moderate adverse effect on buried archaeological remains impacted by construction - option would introduce new cuttings on land not currently built on.		**Historic Environment** - Area not subject to archaeological surveys. - Isolated instances of finds in area of scheme on Norfolk Explorer Heritage Database - Low adverse effect on buried archaeological remains potentially impacted by construction - option constructed on existing A11 mainline.		**Historic Environment** - Area not subject to archaeological surveys. - Isolated instances of finds in area of scheme on Norfolk Explorer Heritage Database - Potential moderate adverse effect on buried archaeological remains impacted by construction - option would introduce new cuttings on land not currently built on.	
	Biodiversity - Potential direct and indirect impact upon Natural Environment and Rural Communities (NERC) habitats and other habitats of high biodiversity value (Route Hub Option 9). -Additional mitigation measures to avoid, reduce, mitigate or comoensate are needed in order to manage potential ecological effects.		**Biodiversity** - Potential direct and indirect impact upon Natural Environment and Rural Communities (NERC) habitats and high number of habitats of high biodiversity value. - 1 No. veteran trees would be lost as a result of this option. - Mitigation measures not possible for loss of mature trees. -Additional mitigation measures to avoid, reduce, mitigate or compensate are needed in order to manage potential ecological effects. - Loss of Bat roost requires licence.		**Biodiversity** - Area not previously subject to baseline ecological surveys - Potential direct and indirect impacts upon Natural Environment and Rural Communities (NERC) habitats and other habitats of high biodiversity value. - Mitigation measures not possible for loss of mature trees. -Additional mitigation measures to avoid, reduce, mitigate or compensate are needed in order to manage potential ecological effects. - Loss of Bat roost requires licence.		**Biodiversity** - Area not previously subject to baseline ecological surveys - Potential direct and indirect impacts upon NERC Act habitats and other habitats of high biodiversity value. - Mitigation measures not possible for loss of mature trees. -Additional mitigation measures to avoid, reduce, mitigate or compensate are needed in order to manage potential ecological effects. - Loss of Bat roost requires licence.		**Biodiversity** - Area not previously subject to baseline ecological surveys. - Potential direct and indirect impacts upon Natural Environment and Rural Communities (NERC) habitats and other habitats of high biodiversity value. - Mitigation measures not possible for loss of mature trees. -Additional mitigation measures to avoid, reduce, mitigate or compensate are needed in order to manage potential ecological effects.	
	Water Environment Does not intersect any source protection zone. - Proposed underpass may intercept groundwater flow if it extends below water table.		**Water Environment** - Stream Diversion of approx. 600m required with associated ecological (water vole, otter) and surface water impacts (flood plain). - Historic landfill physically impacted upon, potential for groundwater pollution. - Crosses a source protection zone 2.		**Water Environment** - Crosses source protection zone 2. - Cantley Lane via Station Lane diversion located in Flood Zone 1 for fluvial flooding. A11 / railway overbridge at low risk of deep surface water flooding. - Bedrock beneath scheme is drinking water protected aquifer.		**Water Environment** - Crosses source protection zone 2. - Cantley Lane via Station Lane diversion located in Flood Zone 1 for fluvial flooding - Bedrock beneath scheme is drinking water protected aquifer		**Water Environment** - Crosses source protection zone 2. - Cantley Lane via Station Road diversion located in Flood Zone 1 for fluvial flooding - Bedrock beneath scheme is drinking water protected aquifer.	

CUSTOMER	1. This link would provide the opportunity of an alternative route for vehicles travelling between Cantley Lane South and Round House Roundabout, particularly if incidents occur on the mainline A11 or A47 and Thickthorn Interchange. 2. The detour to the main group of properties on Cantley Lane South (approx 1.2km) avoids the restricted height / width along Cantley Lane which is rural 2-way single lane carriageway road with limited passing places and would minimise emergency services response times. 3. Underpass beneath the existing A47 was not favoured by the local residents during consultation due to personal safety concerns 4. The 8% gradient is difficult to negotiate by non-motorised users, particularly for wheelchair / pushchair users, the elderly and disabled. Mitigation could be provided by re-aligning the footway away from the highway which would be within the extent of greenspace allocated to the Cringleford Residential Extension. 5. Increased traffic will impact on Future Residents of the proposed Cringleford Residential Extension Development. 6. This option minimises disruption to road users as the majority of this option is offline which reduces the traffic management required to existing highways.	3	1. This option would remove the opportunity of 'rat running' along Cantley Lane between Station Lane and Roundhouse Roundabout / Thickthorn Interchange. 2. The detour to the main group of properties on Cantley Lane South (approx 1.5km) avoids the restricted height / width along Cantley Lane which is rural 2-way single lane carriageway road with limited passing places and would minimise emergency services response times. 3. This option includes provision of a non-motorised user bridge over the existing A47 - preferred option from consultation with local residents and Local Authority and provides a safer route across the A47. 4. This option minimises disruption to road users as the majority of this option is offline which reduces the traffic management required to existing highways.	6	1. This option would avoid the risk of 'rat running' along Cantley Lane between Station Lane and Roundhouse Roundabout / Thickthorn Interchange. 2. The detour to the main group of properties on Cantley Lane South (approx 5.6km), which includes rural 2-way single lane carriageway roads with limited passing places. would adversely affect emergency services response times. 3. This option includes provision of a non-motorised user bridge over the existing A47 - preferred option from consultation with local residentsand Local Authority and provides a safer route across the A47. 4. The proposed route alignment is subject to a Height (13" / 4m) & Weight (7.5T) restriction at the existing railway bridge. During consultation with Norfolk Fire Service, they highlighted that while a 4m clearance was acceptable, it was on the limit of acceptability. There is a risk of vehicles colliding with the infrastructure. 5. Norfolk Fire service raised concerns that this route was single access, would result in increased response times, and presented logistical issues if a multi vehicle response was required. 6. This option has significant impacts on A11 road users and the railway due to disruption during construction of the bridges across the A11 and railway.	2	1. This option would avoid the risk of 'rat running' along Cantley Lane between Station Lane and Roundhouse Roundabout / Thickthorn Interchange. 2. The detour to the main group of properties on Cantley Lane South (approx 4.9km), which includes rural 2-way single lane carriageway roads with limited passing places. would adversely affect emergency services response times. 3. The roundabout introduces a junction along the mainline which will impede A11 mainline through traffic. 4. Delays during peak periods will occur as a result of the roundabout impeding free-flowing traffic. 5. This option includes provision of a non-motorised user bridge over the existing A47 - preferred option from consultation with local residentsand Local Authority and provides a safer route across the A47. 6. The proposed route alignment is subject to a Height (13" / 4m) & Weight (7.5T) restriction at the existing railway bridge. During consultation with Norfolk Fire Service, they highlighted that while a 4m clearance was acceptable, it was on the limit of acceptability. There is a risk of vehicles colliding with the infrastructure. 7. Norfolk Fire service raised concerns that this route was single access, would result in increased response times, and presented logistical issues if a multi vehicle response was required. 8. This option has significant impacts on A11 road users due to disruption during construction of the roundabout and complex traffic management phasing that is required.	2	1. This option would avoid the risk of 'rat running' along Cantley Lane between Station Lane and Roundhouse Roundabout / Thickthorn Interchange. 2. The detour to the main group of properties on Cantley Lane South (approx 6.1km), which includes rural 2-way single lane carriageway roads with limited passing places. would adversely affect emergency services response times. 3. This option includes provision of a non-motorised user bridge over the existing A47 - preferred option from consultation with local residents and Local Authority and provides a safer route across the A47. 4. The proposed route alignment is subject to a Height (13" / 4m) & Weight (7.5T) restriction at the existing railway bridge. During consultation with Norfolk Fire Service, they highlighted that while a 4m clearance was acceptable, it was on the limit of acceptability. There is a risk of vehicles colliding with the infrastructure. 5. Norfolk Fire service raised concerns that this route was single access, would result in increased response times, and presented logistical issues if a multi vehicle response was required. 6. This option has significant impacts on A11 road users due to the disruption to road users during construction of the underpass and slip roads.	2

COST	1. This option fits within current HE scheme budget estimate. 2. Approx quantities for this option: Land = 60,000m2 Site Clearance = 60,000m2 Fencing = 1200m Road Restraint = 150m Drainage pipes = 1100m Drainage manholes = 17 No. Drainage Gullies = 27 No. Earthworks Cut = 45,000m3 Pavements = 5,500m2 Kerbing = 2,200m Structures = 1 underpass 3. Approximate cost of this Option is approximately £5.0M.	5	1. This option fits within current HE scheme budget estimate. 2. Structural design & construction works more complex and extensive than Option 3. Scheduled Monuments – geophysical survey required to confirm extents and whether the proposed link road adversely impacts upon buried archaeology. 4. Realignment of Cantley stream, associated culverts and access track. 5. Approx quantities for this option: Land = 130,000m2 Site Clearance = 130,000m2 Fencing = 1600m Road Restraint = 400m Drainage pipes = 1300m Drainage manholes = 20 No. Drainage Gullies = 27 No. Earthworks Fill = 66,000m3 Pavements = 5,500m2 Kerbing = 2,600m Structures = 2 overbridges 6. Approximate cost of this Option is approximately £4.6M.	5	1. Option is outwith current HE Scheme Budget. 2. This option requires two additional structures to cross the existing A11 and railway as well as new highway / junctions. 3. Increased scope resulting in increased design programme duration. 4. Increased construction Duration. 5. Interface with Network Rail and potential night working under track possession. 6. Approx additional quantities for this option: Land = 70,000m2 Site Clearance = 70,000m2 Fencing = 1800m Road Restraint = 1600m Drainage pipes = 1000m Drainage manholes = 10 No. Drainage Gullies = 33 No. Earthworks Fill = 180,000m3 Pavements fill = 6600m2 Kerbing = 900m Structures = 1 road overbridge and 1 railway overbridge 3. Approximate cost of this Option is approximately £6.3M.	2	1. This option requires additional pavement but no additional structures as well as new highway / junctions. 2. Option fits within current HE scheme budget estimate. 3. Approx additional quantities for this option: Land = 10,000m2 Site Clearance = 10,000m2 Fencing = 400m Road Restraint = 200m Drainage pipes = 600m Drainage manholes = 7 No. Drainage Gullies = 20 No. Earthworks Cut = 4,000m3 Pavements = 4,000m2 Kerbing = 600m Structures = No additional structures 4. Approximate cost of this Option is approximately £0.5M. .	7	1. This option requires additional structure beneath the existing A11 and significant slip road construction. 2. Approx additional quantities for this option: Land = 95,000m2 Site Clearance = 95,000m2 Fencing = 1200m Road Restraint = 600m Drainage pipes = 2200m Drainage manholes = 25 No. Drainage Gullies = 73 No. Earthworks Cut = 130,000m3 Pavements = 14,000m2 Kerbing = 600m Structures = 1 Underpass and 1 retaining wall 3. Approximate cost of this Option is approximately £10.0M.	1
RISK	1. The developer could object to the layout if further traffic is routed through the development which could affect the sale or value of properties in the area. 2. The developer could further object if the footprint of the alignment significantly effects the developable area. 3. Construction of underpass beneath the existing A47 will require more complex TM arrangements which may result in additional risk to programme and cost. 4. The provision of an 8% gradient along the route may not be accepted by Norfolk County Council due to the additional maintenance requirements and potential severance to emergency vehicles in winter conditions.	3	1. Alignment close to the schedule Monument may be rejected. 2. Proposed diversion of Cantley Stream may receive objections from Environment Agency. 3. Early engagement with EA over Cantley Stream diversion has been instigated to mitigate risk.	5	1. Alignment could be rejected on overall project impact, e.g. cost, programme, footprint, works being outside the originally proposed Red Line Boundary. 2. Construction of structure across existing railway line will require railway possession; interface with Network Rail may result in significant risk to programme. 3. Network Rail approvals for the structure crossing the railway, may result in additional programme risks.	3	1. Alignment could be rejected on overall project impact, e.g. cost, programme, footprint, works being outside the originally proposed Red Line Boundary. 2. Extensive traffic management arrangements will be required for this option which may result in significant delays on the network during construction - reputational risk to be managed. 3. This option does not deliver on the scheme objectives and results in additional delay to journey time. This may result in the scheme performance not being value for money and result in objections.	3	1. Alignment could be rejected on overall project impact, e.g. cost, programme, footprint, works being outside the originally proposed Red Line Boundary. 2. Construction of underpass beneath the existing A11 will require more complex TM arrangements which may result in additional risk to programme and cost. 3. Temporary works will be required directly adjacent to the railway during the excavation of the underpass, would result in delays during construction to obtain approvals from Network Rail.	3
TOTAL SCORES		38		50		30		41		27

Appendix F Side Road Strategy Options Designers Risk Assessment

SIDEROAD STRATEGY OPTIONS APPRAISAL - DESIGN RISK ASSESSMENT					Mott MacDonald Sweco
PROJECT	A47/A11 THICKTHORN JUNCTION IMPROVEMENT - PCF STAGE 3				
PROJECT No.	119556	Ref.	HE551492-MMSIV-GEN-000-SH-CX-00011		
SUBJECT	A47/A11 THICKTHORN CANTLEY LANE SIDEROAD STRATEGY OPTIONS APPRAISAL	APPROVAL DATE REQUIRED			
MAIN DESIGN TEAM	HIGHWAYS	SUPPORT TEAM 1	ENVIRONMENT	SUPPORT TEAM 1	STRUCTURES
LOCATION	A47/A11 Thickthorn Interchange, Norwich, Norfolk			MAIN DISCIPLINE	
				Route Alignment and Junctions	
DESIGNERS RISK ASSESSMENT			OPTION	Option 3	

HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Non-compliant with DMRB - Multiple Departures Required.	Single vehicle loss of control collisions at low radius bends as a result of inappropriately high speeds.	1. Alignment design in accordance with Manual for Streets which is applicable to urban environment 20/30mph speed limits. Requires Local Authority approval for change of speed limit and design standard. 2. Provide clear and concise road markings	HIGH
	Drivers use local roads to access wider highway network.	Motor vehicle collision with pedestrians, cyclists.	1. Option provides an opportunity for traffic from a wider area to avoid the Thickthorn Interchange and travel to / from the Station Road / A11 Junction via Cantley Lane. 2. Option is not an attrractive route due to the 13'6"/4.1m height & 5m width restriction at Cantley Lane South railway bridge and the 7.5t weight restriction at Cantley Lane South/Station Lane junction. 3. Consider street lighting on approach to junctions.	HIGH
	Drivers use local roads to access wider highway network.	Driver overshoots stop/give way markings at junctions.	1. Provide clear and concise road markings and signs. 2. Consider street lighting on approach to junctions.	Medium
	Construction of underpass beneath existing A47 Dual Carriageway.	Disruption to A47 during construction.	1. Extensive traffic management required during construction. 2. Anticipated top-down construction which will require numerous traffic management phasings during construction to install the structure.	HIGH

GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Flexibility of Design Layout	Change to design layout.	1. Ties into the current road layout proposed by the cringleford development contractor. 2. May introduce additional traffic that requires enhanced road geometry and road pavement. 3. Impacts and severes the developments open space identified between the existing A47 and Cringleford.	HIGH
	The provision of an additional arm on the Roundhouse Way roundabout will lead to more weaving and crossing movements and thereby increase the risk of injury collisions.	Side-swipe and re-start collisions.	1. Provide clear and concise road markings/spiralization to increase lane discipline.	HIGH
	The vertical alignment on the east side of the existing A47 requires a gradient of 8% to tie in outside of the Cringleford Development.	Single vehicle loss of control collisions as a result of steep gradient, particularly in wintry conditions.		HIGH
	Personal safety of walkers, cyclists and horse riders using the underpass beneath existing A47 Dual Carriageway.	Personal safety.	1. Street lighting and CCTV may be required within the underpass to provide an element of security for walkers, cyclists and horse riders.	HIGH
UTILITIES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Buried utilities	Injury, Burns, damage to apparatus, electrocution, explosion etc	1. Option will require additional length of utility diversions already considered under the scheme. 2. Overhead power cables directly adjacent to Option.	Medium
	High Voltage Overhead power lines (132kv and 400kv)	Injury, Burns	1. Option requires construction work directly adjacent and below the overhead power cables. However, works are required directly adjacent and below in any case although Option reduces the amount of works in close proximity.	HIGH
WORKING AT HEIGHT OR ON SLOPES (INCLUDED GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling from height	Personal exposure, long term injury, paralysis and fracture	1. Option will require works at height during construction of underpass structure and cutting earthworks. 2. If working at height cannot be avoided, suitable fall prevention systems/guard-rails are to be employed.	Low

EXCAVATIONS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling into earthworks, trenches, chambers, ducts.	Injury, whole body injury, paralysis and fracture	1. Option will require deep excavations within cutting slopes, trenches, chambers, ducting and the like. 2. Any earthworks, open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
	Unstable ground due to poor ground conditions / high groundwater table.	Injury	1. Option will require deep excavations within cutting slopes. 2. Ground investigation to be carried out. 3. GI report and drawings to be provided.	Medium
	Historical Gravel Pit south of A47 Footbridge and east of Cantley Lane South.	Unstable ground, poor ground conditions and possible contaminated ground.	1. Option cut coincides with area identified as historical gravel pit. Properties of gravel pit backfill material requires investigation. 2. Ground investigation to be carried out. 3. GI report and drawings to be provided.	High
	Deep cutting to accommodate the underpass (1:3 side slopes up to 11m in height).	Surplus excavated material	1. Option generates significant additional excavated material which adds to the surplus of excavated material already generated by the scheme.	HIGH
OCCUPATIONAL HEALTH (INCLUDE HEMP WHERE REQUIRED)	Noise	Effect on hearing	1. Option is within a cutting slope albeit closer to a number of residential properties within Cringleford. It is anticipated that traffic noise will increase as a result of highway traffic. 2. Noise Fences are likely required to screen noise impacts near properties although the precise extents are to be confirmed.	Medium
	Vibration	Effect on local features/property	1. Option is within cutting slope albeit closer to a number of residential properties within Cringleford. It is anticipated that vibration will increase as a result of highway traffic.	Medium
	Visual	Risk of objection by local residents and requirement of Planning.	1. Option is within cutting slope which provides an element of visual screening from the surroundings. 2. Underpass lighting is likely to be required for personal safety although the precise lighting/extents are to be confirmed.	Low

	Works at height	Injury	1. Option will require works on structures, deep excavations within cutting slopes, trenches, chambers, ducting and the like. 2. Any earthworks, open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
TEMPORARY WORKS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Historical Gravel Pit south of A47 Footbridge and east of Cantley Lane South.	Unstable ground, poor ground conditions and injury	1. Option cut coincides with area identified as historical gravel pit. Properties of gravel pit backfill material requires investigation. 2. Ground investigation to be carried out. 3. GI report and drawings to be provided.	Medium
	High Voltage Overhead power lines (132kv and 400kv)	Injury, Burns	1. Option requires additional construction work directly adjacent and below the overhead power cables. However, main scheme works are required directly adjacent and below in any case.	High
CONFINED SPACES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	N/A	N/A	N/A	
WATER (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling in stream, water, pool or pond	Injury, drowning	1. Option avoids works directly adjacent and within the Cantley Stream watercourse. 2. Operatives visiting water pools, balancing tanks, sewege works, canals and rivers should only do so with the permission of the landowner or responsible person in control of the land	Low
	Contracting Weil's or Lyme Disease	Injury, Infection	1. Operatives should wear gloves and foot / leg protection where contact with stagnant water such as from sewege works, road side drainage rivers, canals and drainage trenches.	Medium

MATERIALS (INCLUDE GD04 RISK ASSESSMENT WHERE PREPARED)	Contaminated land possible within historical landfill	Infection	1. Option avoids works directly adjacent and within the area of landfill that may contain contaminated land. 2. Ground investigation required to confirm extent of cantaminated land. 3. GI report and drawings, to be provided.	Low
	Historical Gravel Pit south of A47 Footbridge and east of Cantley Lane South.	Injury	1. Option cut coincides with area identified as historical gravel pit. Properties of gravel pit backfill material requires investigation. 2. Ground investigation to confirm presence of and extent of contaminated land. 3. GI report and drawings to be provided.	Medium
	Asbestos	Personal exposure, long term injury,abestos related diseases	1. Option avoids works directly adjacent and within the area of landfill that may contain contaminated land. 2. Geophys required to confirm extent of cantaminated land. 3. GI report and drawings, to be provided. 4. No demolition/dismantling of any structure/furniture unless it has been positively identified by a competent person not to contain asbestos.	Low
	Removal of tar bound pavement	Personal exposure, long term injury	1. Option may require works within existing pavement that may contain tar. 2. Operatives should not work on an existing pavement unless it has been positively identified as not containing tar materials.	Medium
			OVERALL RATING	High

SIDEROAD STRATEGY OPTIONS APPRAISAL - DESIGN RISK ASSESSMENT					Mott MacDonald Sweco
PROJECT	A47/A11 THICKTHORN JUNCTION IMPROVEMENT - PCF STAGE 3				
PROJECT No.	119556	Ref.	HE551492-MMSJV-GEN-000-SH-CX-00011		
SUBJECT	A47/A11 THICKTHORN CANTLEY LANE SIDEROAD STRATEGY OPTIONS APPRAISAL	APPROVAL DATE REQUIRED			
MAIN DESIGN TEAM	HIGHWAYS	SUPPORT TEAM 1	ENVIRONMENT	SUPPORT TEAM 1	STRUCTURES
LOCATION	A47/A11 Thickthorn Interchange, Norwich, Norfolk			MAIN DISCIPLINE	Route Alignment and Junctions
DESIGNERS RISK ASSESSMENT			OPTION	Option 4	

HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Drivers use local roads to access wider highway network.	Driver overshoots stop/give way markings at junctions.	1. Provide clear and concise road markings and signs. 2. Consider street lighting on approach to junctions.	Medium
	Turning movements at B1172 Norwich Road	Driver fails to appreciate the path or speed of an approaching vehicle, resulting in a side-on	1. Provide clear and concise road markings and warning signs. 2. Consider street lighting on approach to junctions.	Medium
	Construction of structure over existing A11 Dual Carriageway.	Disruption to A11 Journey Times during construction works.	1. Extensive traffic management required during construction. 2. Anticipated bottom-up construction which will require several traffic management phasings during construction of the structure. 3. Advanced mitigation works to forewarn road users of planned activities, use of mobile VMS during construction.	HIGH
	Cantley Stream	Works adjacent or within watercourse.	1. Option will require works within and directly adjacent to the existing Cantley Stream. 2. Operatives visiting water pools, balancing tanks. sewege works. canals and rivers should only do so with the permission of the landowner or responsible person in control of the land.	HIGH

GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Thickthorn Park & Ride Extension development.	Risk of objection by local Developer of Thickthorn Park & Ride Extension development.	1. Option is outwith the area identified for the future Thickthorn Park & Ride Extension development.	Low
	Contaminated land. Possible Contamination resulting from historical landfil	Poor ground conditions, infection and disturbance.	1. Option will require works directly adjacent and possibly within the area of landfill that may contain contaminated land. 2. Ground investigation required to confirm extent of cantaminated land. 3. GI report and drawings, to be provided. 4. No demolition/dismantling of any structure/furniture unless it has been positively identified by a competent person not to contain asbestos.	HIGH
	Archealogical remains: Ancient Scheduled Monuments	Impact on Ancient Scheduled Monuments	1. Option will require works directly adjacent to the Ancient Scheduled Monuments. 2. Geophys required to confirm extent of ancient scheduled monument.	Medium
UTILITIES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Buried utilities	Injury, Burns, damage to apparatus, electrocution, explosion etc	1. Option minimises impacts on utilities. 2. No overhead power cables in the vicinity of Option.	Low

WORKING AT HEIGHT OR ON SLOPES (INCLUDED GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling from height	Personal exposure, long term injury, paralysis and fracture	1. Option will require works at height during construction of structure and embankment earthworks. 2. If working at height cannot be avoided, suitable fall prevention systems/guard-rails are to be employed.	Low
EXCAVATIONS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling into earthworks, trenches, chambers, ducts.	Injury	1. Option will require deep excavations within trenches, chambers, ducting and the like. 2. Any earthworks, open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
	Historical Gravel Pit south of A47 Footbridge and east of Cantley Lane South.	Unstable ground, poor ground conditions and possible contaminated ground.	1. Option avoids area identified as historical gravel pit. 2. Ground investigation to be carried out. 3. GI report and drawings to be provided.	Low
	Unstable ground due to poor ground conditions / high groundwater table.	Injury	1. Ground investigation to be carried out. 2. GI report and drawings to be provided.	Low
OCCUPATIONAL HEALTH (INCLUDE HEMP WHERE REQUIRED)	Noise	Effect on hearing	1. Option is on embankment slope albeit further away from the residential properties within Cringleford. It is anticipated that noise will increase as a result but affect far fewer properties.	Low
	Vibration	Effect on local features/property	1. Option is on embankment slope albeit further away from the residential properties within Cringleford. It is anticipated that vibration will increase as a result of highway traffic but affect far fewer properties.	Low
	Visual	Risk of objection by local residents and requirement of Planning.	1. Option is on embankment slope albeit further away from the residential properties within Cringleford which will be more prominent in its surroundings.	Medium

TEMPORARY WORKS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Works at height	Injury	1. Option is on embankment and will require deep excavations within trenches, chambers, ducting and the like. 2. Any earthworks, open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
	Contaminated land. Possible Contamination resulting from historical landfil	Poor ground conditions, infection and disturbance.	1. Option will require works directly adjacent and possibly within the area of landfill that may contain contaminated land. 2. Ground investigation required to confirm extent of cantaminated land. 3. GI report and drawings, to be provided. 4. No demolition/dismantling of any structure/furniture unless it has been positively identified by a competent person not to contain asbestos.	HIGH
	Archealogical remains: Ancient Scheduled Monuments	Impact on Ancient Scheduled Monuments	1. Option will require works directly adjacent to the Ancient Scheduled Monuments. 2. Geophys required to confirm extent of ancient scheduled monument.	Medium
CONFINED SPACES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	N/A	N/A	N/A	
WATER (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling in stream, water, pool or pond	Injury, drowning	1. Option will require works within and directly adjacent to the existing Cantley Stream. 2. Operatives visiting water pools, balancing tanks, sewege works, canals and rivers should only do so with the permission of the landowner or responsible person in control of the land	HIGH
	Contracting Weil's or Lyme Disease	Injury, Infection	1. Operatives should wear gloves and foot / leg protection where contact with stagnant water such as from sewege works, road side drainage rivers, canals and drainage trenches.	Medium

	Contaminated land. Possible Contamination resulting from historical landfill	Infection	1. Option requires works directly adjacent and potentially within the area of contaminated land. 2. Geophys required to confirm extent of cantaminated land. 3. GI report and drawings, to be provided.	Medium
	Historical Gravel Pit south of A47 Footbridge and east of Cantley Lane South.	Injury, infection	1. Option avoids area identified as historical gravel pit. 2. Ground investigation to be carried out. 3. GI report and drawings to be provided.	Low
MATERIALS (INCLUDE GD04 RISK ASSESSMENT WHERE PREPARED)	Asbestos	Personal exposure, long term injury,abestos related diseases and programme/ construction delay	1. Option works are in close proximity to a disused landfill site where contaminated land could be present. 2. Ground investigation required to confirm extent of cantaminated land. 3. GI report and drawings, to be provided. 4. No demolition/dismantling of any structure/furniture unless it has been positively identified by a competent person not to contain asbestos.	Medium
	Removal of tar bound pavement	Personal exposure, long term injury	1. Option may require works within existing pavement that may contain tar. 2. Pavement survey to be undertaken. 3. Operatives should not work on an existing pavement unless it has been positively identified as not containing tar materials.	Medium
			OVERALL RATING	Medium

SIDEROAD STRATEGY OPTIONS APPRAISAL - DESIGN RISK ASSESSMENT					Mott MacDonald Sweco
PROJECT	A47/A11 THICKTHORN JUNCTION IMPROVEMENT - PCF STAGE 3				
PROJECT No.	119556	Ref.	HE551492-MMSJV-GEN-000-SH-CX-00011		
SUBJECT	A47/A11 THICKTHORN CANTLEY LANE SIDEROAD STRATEGY OPTIONS APPRAISAL	APPROVAL DATE REQUIRED			
MAIN DESIGN TEAM	HIGHWAYS	SUPPORT TEAM 1	ENVIRONMENT	SUPPORT TEAM 1	STRUCTURES
LOCATION	A47/A11 Thickthorn Interchange, Norwich, Norfolk			MAIN DISCIPLINE	
				Route Alignment and Junctions	
DESIGNERS RISK ASSESSMENT			OPTION	Option 5	

HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Non-compliant with DMRB - Multiple Departures Required.	Single vehicle loss of control collisions at low radius bends as a result of inappropriately high speeds.	1. Alignment design in accordance with Manual for Streets which is applicable to urban environment 20/30mph speed limits. Requires Local Authority approval for change of speed limit and design standard. 2. Provide clear and concise road markings and signs. 3. Consider street lighting on approach to junctions.	HIGH
	Construction of additional structures over existing A11 Dual Carriageway and existing railway.	Disruption to A11 and railway during construction.	1. Extensive traffic managemnet required during construction. 2. Railway possessions required to construct structures. 3. Anticipated bottom-up construction which will require numerous traffic management phasings during construction to install the structure. 4. Consider street lighting on approach to junctions.	HIGH
	Drivers use local roads to access wider highway network.	Inadequate width/height of existing highway network	1. Option is not an attractive route due to the 13'6"/4.1m height & 5m width restriction at Cantley Lane South railway bridge and the 7.5t weight restriction at Cantley Lane South/Station Lane junction. 2. Access to/from Cantley Lane South from Thickthorn Interchange will be removed as part of the scheme. 3. Provide additional road warning signs.	HIGH

GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Emergency services response times delayed/response prevented.	Inadequate width/height of existing highway network	1. Option may prevent access to the properties east of the railway bridge due to the 13'6"/4.1m height & 5m width restriction at the bridge and the 7.5t weight restriction at Cantley Lane South/Station Lane junction. 2. Lower the carriageway beneath the bridge or raise the bridge structure. 3. Provide additional road warning signs.	HIGH
	Despite the new infrastructure crossing the A11, the existing uncontrolled at-grade pedestrian crossing will likely need to be retained due to its convenience.	Motor vehicle collision with pedestrians, cyclists.	1. Provide grade separated crossing of A11 on Station Lane south/Station Lane north desire line.	HIGH
	Drivers use local roads to access wider highway network.	Driver overshoots stop/give way markings at junctions.	1. Provide clear and concise road markings and signs and consider gantry signage. 2. Consider street lighting on approach to junctions.	Medium
UTILITIES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Buried utilities	Injury. Burns. damage to apparatus, electrocution, explosion, etc.	1. Option will require additional utility diversions over and above those already considered as part of the scheme.	HIGH
WORKING AT HEIGHT OR ON SLOPES (INCLUDED GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling from height	Personal exposure, long term injury, paralysis and fracture	1. Option will require works at height during construction of structures and cutting earthworks. 2. If working at height cannot be avoided, suitable fall prevention systems/guard-rails are to be employed.	Low

EXCAVATIONS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling into earthworks, trenches, chambers, ducts.	Injury	1. Option will require works at height during construction of structure, deep excavations within trenches, chambers, ducting and the like. 2. Any open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
	Unstable ground due to poor ground conditions / high groundwater table.	Injury	1. Ground investigation to be carried out. 2. GI report and drawings to be provided.	Medium
OCCUPATIONAL HEALTH (INCLUDE HEMP WHERE REQUIRED)	Noise	Effect on hearing	1. Option is on embankment slope albeit further away from the residential properties within Cringleford. It is anticipated that noise will increase as a result but affect far fewer properties.	Low
	Vibration	Effect on local features/property	1. Option is on embankment slope albeit further away from the residential properties within Cringleford. It is anticipated that vibration will increase as a result but affect far fewer properties.	Low
	Visual	Risk of objection by local residents and requirement of Planning.	1. Option is on embankment slope albeit further away from the residential properties within Cringleford which will be more prominent in its surroundings.	Medium
TEMPORARY WORKS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Works at height	Injury	1. Option will require works at height during construction of structure, deep excavations within trenches, chambers, ducting and the like. 2. Any earthworks, open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
CONFINED SPACES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	N/A	N/A	N/A	
WATER (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	N/A	N/A	N/A	

MATERIALS (INCLUDE GD04 RISK ASSESSMENT WHERE PREPARED)	Contaminated land. Possible Contamination resulting from historical landfill	Infection	1. Ground Investigation required to confirm. 2. GI report and drawings, to be provided.	Low
	Asbestos	Personal exposure. long term injury,abestos related diseases	1. Ground Investigation required to confirm. 2. GI report and drawings, to be provided. 3. No demolition/dismantling of any structure/furniture unless it has been positively identified by a competent person not to contain asbestos.	Medium
	Removal of tar bound pavement	Personal exposure, long term injury	1. Option may require works within existing pavement that may contain tar. 2. Operatives should not work on an existing pavement unless it has been positively identified as not containing tar materials.	Medium
			OVERALL RATING	HIGH

SIDEROAD STRATEGY OPTIONS APPRAISAL - DESIGN RISK ASSESSMENT					Mott MacDonald Sweco
PROJECT	A47/A11 THICKTHORN JUNCTION IMPROVEMENT - PCF STAGE 3				
PROJECT No.	119556	Ref.	HE551492-MMSJV-GEN-000-SH-CX-00011		
SUBJECT	A47/A11 THICKTHORN CANTLEY LANE SIDEROAD STRATEGY OPTIONS APPRAISAL	APPROVAL DATE REQUIRED			
MAIN DESIGN TEAM	HIGHWAYS	SUPPORT TEAM 1	ENVIRONMENT	SUPPORT TEAM 1	STRUCTURES
LOCATION	A47/A11 Thickthorn Interchange, Norwich, Norfolk			MAIN DISCIPLINE	
				Route Alignment and Junctions	
DESIGNERS RISK ASSESSMENT			OPTION	Option 6	

HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Inadequate weaving length between proposed roundabout and existing A11/Station Lane diverge junctions.	Side swipe collisions	1. Option has sub-standard design which requires a departure from standard. 2. Provide clear and concise road markings and signs and consider gantry signage. 3. Consider street lighting.	HIGH
	A11 mainline traffic impeded by the roundabout.	Stop-start traffic during peak times increases risk of shunt collisions	1. Option roundabout provision along the mainline is over provision and requires a departure from standard. 2. Significant risk of accidents as a result of stop-start traffic. 3. Provide clear and concise road markings and signs. 4. Consider street lighting.	HIGH
	High speeds on the A11 approach to the roundabout.	Driver overshoots stop/give way markings at junctions.	1. Option roundabout provision along the mainline is over provision and requires a departure from standard. 2. Provide clear and concise road markings and signs. 3. Consider street lighting.	HIGH

GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Drivers use local roads to access wider highway network.	Inadequate width/height of existing highway network	1. Option is not an attractive route due to the 13'6"/4.1m height & 5m width restriction at Cantley Lane South railway bridge and the 7.5t weight restriction at Cantley Lane South/Station Lane junction. 2. Access to/from Cantley Lane South from Thickthorn Interchange will be removed as part of the scheme. 3. Provide additional road warning signs.	HIGH
	Emergency services response times delayed/response prevented.	Inadequate width/height of existing highway network	1. Option may prevent access to the properties east of the railway bridge due to the 13'6"/4.1m height & 5m width restriction at the bridge and the 7.5t weight restriction at Cantley Lane South/Station Lane junction. 2. Lower the carriageway beneath the bridge or raise the bridge structure. 3. Provide additional road warning signs.	HIGH
	New crossing at roundabout replaces existing uncontrolled at-grade pedestrian crossing.	Motor vehicle collision with pedestrians, cyclists.	1. Provide traffic signalised crossing of A11.	HIGH
	Drivers use local roads to access wider highway network.	Driver overshoots stop/give way markings at junctions.	1. Provide clear and concise road markings and signs and consider gantry signage. 2. Consider street lighting.	Medium
UTILITIES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Buried utilities	Injury, Burns, damage to apparatus, electrocution, explosion etc	1. Option will require additional utility diversions over and above those already considered as part of the scheme.	HIGH

WORKING AT HEIGHT OR ON SLOPES (INCLUDED GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	N/A	N/A	N/A	
EXCAVATIONS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling into earthworks, trenches, chambers, ducts.	Injury	1. Option will require works at height during construction of structure, deep excavations within trenches, chambers, ducting and the like. 2. Any open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
OCCUPATIONAL HEALTH (INCLUDE HEMP WHERE REQUIRED)	Noise	Effect on hearing	1. Option is at grade and further from a number of residential properties within Cringleford. It is anticipated that traffic noise would decrease as a result.	Low
	Vibration	Effect on local features/property	1. Option is at grade and further from a number of residential properties within Cringleford. It is anticipated that vibration would decrease as a result.	Low
	Visual	Risk of objection by local residents and requirement of Planning.	1 Option is at grade and would require additional screening proposals from the surroundings.	HIGH
TEMPORARY WORKS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	N/A	N/A	N/A	
CONFINED SPACES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	N/A	N/A	N/A	

WATER (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	N/A	N/A	N/A	
MATERIALS (INCLUDE GD04 RISK ASSESSMENT WHERE PREPARED)	Contaminated land. Possible Contamination resulting from historical landfill	Infection	1. Ground Investigation required to confirm. 2. GI report and drawings, to be provided.	Low
	Asbestos	Personal exposure, long term injury,abestos related diseases	1. Ground Investigation required to confirm. 2. GI report and drawings, to be provided. 3. No demolition/dismantling of any structure/furniture unless it has been positively identified by a competent person not to contain asbestos.	Medium
	Removal of tar bound pavement	Personal exposure, long term injury	1. Option may require works within existing pavement that may contain tar. 2. Operatives should not work on an existing pavement unless it has been positively identified as not containing tar materials.	Medium
			OVERALL RATING	HIGH

SIDEROAD STRATEGY OPTIONS APPRAISAL - DESIGN RISK ASSESSMENT					Mott MacDonald Sweco
PROJECT	A47/A11 THICKTHORN JUNCTION IMPROVEMENT - PCF STAGE 3				
PROJECT No.	119556	Ref.	HE551492-MMSJV-GEN-000-SH-CX-00011		
SUBJECT	A47/A11 THICKTHORN CANTLEY LANE SIDEROAD STRATEGY OPTIONS APPRAISAL	APPROVAL DATE REQUIRED			
MAIN DESIGN TEAM	HIGHWAYS	SUPPORT TEAM 1	ENVIRONMENT	SUPPORT TEAM 1	STRUCTURES
LOCATION	A47/A11 Thickthorn Interchange, Norwich, Norfolk			MAIN DISCIPLINE	
				Route Alignment and Junctions	
DESIGNERS RISK ASSESSMENT			OPTION	Option 7	

HAZARD GROUP	HAZARD	RISK	ELIMINATE, REDUCE, ISOLATE, CONTROL MITIGATIONS	POST-MITIGATION RISK RATING
GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Construction of additional structure beneath existing A11 Dual Carriageway.	Disruption to A11 during construction.	1. Extensive traffic management required during construction. 2. Anticipated top-down construction which will require numerous traffic management phasings during construction to install the structure.	HIGH
	Inadequate weaving length between proposed merge and existing A11/Station Lane diverge junctions.	Side-swipe collisions.	1. Option has sub-standard design which requires a departure from standard. 2. Provide clear and concise road markings and signs and consider gantry signage. 3. Consider street lighting.	HIGH
	Drivers make last minute lane change decisions along the A11 due to its complexity and proximity to existing A11/Station Lane junction.	Side-swipe collisions.	1. Option has sub-standard design that excacerbates this risk. 2. Provide clear and concise road markings and signs. 3. Consider street lighting.	HIGH
	Low traffic usage potentially results in high speeds on the A11 diverge approach to the roundabout.	Driver overshoots stop/give way markings at junctions.	1. Provide clear and concise road markings and signs and consider gantry signage. 2. Consider street lighting.	Medium

	Drivers use local roads to access wider highway network.	Inadequate width/height of existing highway network	1. Option is not an attractive route due to the 13'6"/4.1m height & 5m width restriction at Cantley Lane South railway bridge and the 7.5t weight restriction at Cantley Lane South/Station Lane junction. 2. Access to/from Cantley Lane South from Thickthorn Interchange will be removed as part of the scheme. 3. Provide additional road warning signs.	HIGH
GENERAL (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Drivers use local roads to access wider highway network.	Driver overshoots stop/give way markings at junctions.	1. Provide clear and concise road markings and signs and consider gantry signage. 2. Consider street lighting.	Medium
	Emergency services response times delayed/response prevented.	Inadequate width/height of existing highway network	1. Option may prevent access to the properties east of the railway bridge due to the 13'6"/4.1m height & 5m width restriction at the bridge and the 7.5t weight restriction at Cantley Lane South/Station Lane junction. 2. Lower the carriageway beneath the bridge or raise the bridge structure. 3. Provide additional road warning signs.	HIGH
	Despite the new infrastructure crossing the A11, the existing uncontrolled at-grade pedestrian crossing will likely need to be retained due to its convenience.	Motor vehicle collision with pedestrians, cyclists.	1. Provide grade separated crossing of A11 on Station Lane south/Station Lane north desire line.	HIGH
	Personal safety of walkers, cyclists and horse riders using the underpass beneath existing A47 Dual Carriageway.	Personal safety.	1. Street lighting and CCTV may be required within the underpass to provide an element of security for walkers, cyclists and horse riders.	HIGH
UTILITIES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Buried utilities	Injury, burns, damage to apparatus, electrocution, explosion etc	1. Option will require additional utility diversions over and above those already considered as part of the scheme.	HIGH
WORKING AT HEIGHT OR ON SLOPES (INCLUDED GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Falling from height	Personal exposure, long term injury, paralysis and fracture	1. Option will require works at height during construction of underpass structure and cutting earthworks. 2. If working at height cannot be avoided, suitable fall prevention systems/guard-rails are to be employed.	Low

	Falling into earthworks, trenches, chambers, ducts.	Injury	1. Option will require deep excavations within cutting slopes, trenches, chambers, ducting and the like. 2. Any earthworks, open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
EXCAVATIONS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Unstable ground due to poor ground conditions / high groundwater table.	Injury	1. Option will require deep excavations within cutting slopes. 2. Ground investigation to be carried out. 3. GI report and drawings to be provided.	HIGH
	Deep cutting to accommodate the underpass (1:3 side slopes up to 11m in height).	Injury	1. Option generates significant additional excavated material which adds to the surplus of excavated material already generated by the scheme.	HIGH
	Crest of proposed cutting directly adjacent to Network Rail assets and railway.	Side slope stability	1. Option may require steeper cutting side slope or side slope strengthening/stabilisation or retaining wall may be required to ensure the structural integrity of the side slope adjacent to the railway is acceptable.	Medium
OCCUPATIONAL HEALTH (INCLUDE HEMP WHERE REQUIRED)	Noise	Effect on hearing	1. Option is within cutting slope and further from a number of residential properties within Cringleford. It is anticipated that traffic noise would decrease as a result.	Low
	Vibration	Effect on local features/property	1. Option is within cutting slope and further from a number of residential properties within Cringleford. It is anticipated that vibration would decrease as a result.	Low
	Visual	Risk of objection by local residents and requirement of Planning.	1. Option is within cutting slope which provides an element of visual screening from the surroundings.	Low

TEMPORARY WORKS (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)	Works at height	Injury	1. Option will require deep excavations within cutting slopes, trenches, chambers, ducting and the like. > Any earthworks, open trenches, chambers or ducts to be suitably fenced off by the contractor to minimise the probability of occurence.	Low
CONFINED SPACES (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)				
WATER (INCLUDE GD04 RISK ASSESSMENT RESULTS WHERE PREPARED)				
MATERIALS (INCLUDE GD04 RISK ASSESSMENT WHERE PREPARED)	Contaminated land. Possible Contamination resulting from historical landfil	Infection	1. Ground Investigation required to confirm.	Low
	Asbestos	Personal exposure, long term injury,abestos related diseases	1. Ground Investigation required to confirm. 2. GI report and drawings, to be provided. 3. No demolition/dismantling of any structure/furniture unless it has been positively identified by a competent person not to contain asbestos.	Medium
	Removal of tar bound pavement	Personal exposure, long term injury	1. Option may require works within existing pavement that may contain tar. 2. Operatives should not work on an existing pavement unless it has been positively identified as not containing tar materials.	Medium
			OVERALL RATING	HIGH