

## Appendix F – Road Safety Audit Designer’s Responses

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# Adastral Park, Ipswich : Eastern Priority Junction Access off Ipswich Road

## Technical Note : Designer's Response to Road Safety Audits at Stage 1

13<sup>th</sup> June 2017

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### 1 Introduction

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Brookbanks Consulting Limited (BCL) is commissioned by Commercial Estates Group (CEG) Ltd to provide technical advice on viability and delivery on a proposed mixed use development at Adastral Park, Martlesham Heath, Suffolk. A Transport Assessment has been produced that has assessed the potential implications. A range of highway interventions has been subsequently identified.

For the Outline Planning Application, the following access strategy was offered:

- Traffic Signals Access off the A12 Dual Carriageway;
- Two simple priority junction accesses off Ipswich Road;
- Simple priority junction access off Gloster Road through the North-west Quadrant.

The Transport Assessment also identified that off-site highway mitigation measures were necessary at the following locations:

- A14 / A12 / A1156 Interchange;
- A12 / Newbourne Rd / Foxhall Road Roundabout;
- A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction;
- A12 / Anson Road / Eagle Way Roundabout;
- A12 / A1214 Roundabout;
- A1189 Heath Road / Foxhall Road Roundabout;
- A1189 Bixley Road / A1156 Felixstowe Road Bixley Roundabout;
- A1214 / A1189 Gyratory Junction.

All design options, at the request of Suffolk County Council, have been subject to a Stage 1 Road Safety Audit. This note sets out the findings of the audits for the Eastern Priority Junction Access off Ipswich Road together with a designers response.

### 2 Designer's Response

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The Designers Response should be read in conjunction with the Road Safety Audit (ref SESL1715) as attached in Appendix A.

#### Problem 1

**Location:** Ipswich Road / eastern access

**Summary:** Junction form may not be adequate. Traffic flows were not available for this junction. As this access serves a significant size site it may require a ghost island.

**Recommendation:** Assess the projected flows and provide a ghost island if the numbers merit it.

**BCL Response:** *It has been demonstrated through Paramics modelling that the proposed junction will work adequately with respect to traffic flows, as there is minimal queuing from Ipswich Road to the east wishing to turn into the site. This is attributable to the road being lightly trafficked and not serving a substantial area.*

### 3 Limitations

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Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

The benefits of this report are provided to Carlyle Land Ltd and Commercial Estates Group for the proposed development on Land at Adastral Park.

Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

# **Safety Engineering Services Ltd**

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Land South and East of Adastral Park, Ipswich  
**Proposed Priority Junction  
Eastern Access off Ipswich Road**

**Stage 1 Road Safety Audit**



# Stage 1 Road Safety Audit

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Report Number	Client Reference	Report Status
SESL1715	10391	FINAL

## 1 INTRODUCTION

This report presents the findings of a Road Safety Audit carried out on off-site highway mitigation works proposed to enable site access to land to the south and east of Adastral Park, Ipswich, at the request of Brookbanks Consulting Ltd. The development will consist of up to 2000 dwellings, local centres, with facilities to serve recreation and education.

The audit was carried out by the following:

S Hancock	Road Safety Audit Team Leader Safety Engineering Services Ltd
D Ramsden Certificate of Competency gained in June 2015	Road Safety Audit Team Member Safety Engineering Services Ltd

The audit took place on Saturday 27 May 2017 and comprised a desktop study of the plans provided and a drive and walk through of the site by both team members. During the site visit, the weather was sunny and fine and the road surfaces were dry. Traffic at the time of the audit was very light.

A list of drawings and documents provided for the purpose of audit is in Appendix A. The locations of any problems have been identified on an annotated drawing in Appendix B.

The main terms of reference of the audit are as described in HD19/15. The team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

There are eleven junctions in total requiring offsite highway mitigation works associated with this development. This Road Safety Audit focuses on the proposed priority junction of Adastral Park Road with Ipswich Road.

## **2 ROAD SAFETY AUDIT FINDINGS**

### **2.1 PROBLEM**

Location: Ipswich Road / eastern access

Summary: Junction form may not be adequate.

Traffic flows were not available for this junction. As this access serves a significant size site it may require a ghost island.

### **RECOMMENDATION**

Assess the projected flows and provide a ghost island if the numbers merit it.

### 3 AUDIT STATEMENT

We certify that this audit has been carried out in accordance with HD 19/15.

Signed:



S Hancock  
Audit Team Leader  
Safety Engineering Services Ltd

Date 28 May 2017

Signed:



D Ramsden  
Audit Team Member  
Safety Engineering Services Ltd

Date: 30 May 2017

**DRAWINGS AND DOCUMENTS PROVIDED FOR AUDIT**

10391-H-04 Rev C	Proposed Priority Junction - Eastern Access off Ipswich Road
10391TA01Rv2	Land South and East of Adastral Park - Transport Assessment



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# Adastral Park, Ipswich : Western Priority Junction Access off Ipswich Road

## Technical Note : Designer's Response to Road Safety Audits at Stage 1

13<sup>th</sup> June 2017

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### 1 Introduction

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Brookbanks Consulting Limited (BCL) is commissioned by Commercial Estates Group (CEG) Ltd to provide technical advice on viability and delivery on a proposed mixed use development at Adastral Park, Martlesham Heath, Suffolk. A Transport Assessment has been produced that has assessed the potential implications. A range of highway interventions has been subsequently identified.

For the Outline Planning Application, the following access strategy was offered:

- Traffic Signals Access off the A12 Dual Carriageway;
- Two simple priority junction accesses off Ipswich Road;
- Simple priority junction access off Gloster Road through the North-west Quadrant.

The Transport Assessment also identified that off-site highway mitigation measures were necessary at the following locations:

- A14 / A12 / A1156 Interchange;
- A12 / Newbourne Rd / Foxhall Road Roundabout;
- A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction;
- A12 / Anson Road / Eagle Way Roundabout;
- A12 / A1214 Roundabout;
- A1189 Heath Road / Foxhall Road Roundabout;
- A1189 Bixley Road / A1156 Felixstowe Road Bixley Roundabout;
- A1214 / A1189 Gyratory Junction.

All design options, at the request of Suffolk County Council, have been subject to a Stage 1 Road Safety Audit. This note sets out the findings of the audits for the Western Priority Junction Access off Ipswich Road together with a designers response.

### 2 Designer's Response

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The Designers Response should be read in conjunction with the Road Safety Audit (ref SESL1716) as attached in Appendix A.

#### Problem 1

**Location:** Ipswich Road / proposed western access

**Summary:** Visibility is obstructed. There are a large number of significant sized trees in the vicinity of this junction which may obstruct visibility.

**Recommendation:** Measure the visibility at a setback of 2.4 metres and specify the removal of any trees which fall within this.

**BCL Response:** *The vegetation clearance including trees has been specified for this site through an arboricultural survey. This has resolved that any trees blocking the visibility splay are not protected and therefore can be removed.*

#### Problem 2

**Location:** Ipswich Road / western access

**Summary:** Junction form may not be adequate. Traffic flows were not available for this junction. As this access serves a significant size site it may require a ghost island.

**Recommendation:** Assess the projected flows and provide a ghost island if the numbers merit it.

**BCL Response:** *It has been demonstrated through Paramics modelling that the proposed junction will work adequately with respect to traffic flows, as there is minimal queuing from Ipswich Road to the east wishing to turn into the site. This is attributable to the road being lightly trafficked and not serving a substantial area.*

### 3 Limitations

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Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

The benefits of this report are provided to Carlyle Land Ltd and Commercial Estates Group for the proposed development on Land at Adastral Park.

Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.



# **Safety Engineering Services Ltd**

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Land South and East of Adastral Park, Ipswich  
**Proposed Priority Junction**  
**Western Access**

**Stage 1 Road Safety Audit**

# Stage 1 Road Safety Audit

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Report Number	Client Reference	Report Status
SESL1716	10391	FINAL

## 1 INTRODUCTION

This report presents the findings of a Road Safety Audit carried out on off-site highway mitigation works proposed to enable site access to land to the south and east of Adastral Park, Ipswich, at the request of Brookbanks Consulting Ltd. The development will consist of up to 2000 dwellings, local centres, with facilities to serve recreation and education.

The audit was carried out by the following:

S Hancock	Road Safety Audit Team Leader Safety Engineering Services Ltd
D Ramsden Certificate of Competency gained in June 2015	Road Safety Audit Team Member Safety Engineering Services Ltd

The audit took place on Saturday 27 May 2017 and comprised a desktop study of the plans provided and a drive and walk through of the site by both team members. During the site visit, the weather was fine and sunny and the road surfaces were dry. Traffic at the time of the audit was very light.

A list of drawings and documents provided for the purpose of audit is in Appendix A. The locations of any problems have been identified on an annotated drawing in Appendix B.

The main terms of reference of the audit are as described in HD19/15. The team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

There are eleven junctions in total requiring offsite highway mitigation works associated with this development. This Road Safety Audit focuses on the proposed westernmost simple priority junction.

## **2 ROAD SAFETY AUDIT FINDINGS**

### **2.1 PROBLEM**

Location: Ipswich Road / proposed western access

Summary: Visibility is obstructed

There are a large number of significant sized trees in the vicinity of this junction which may obstruct visibility.

#### RECOMMENDATION

Measure the visibility at a setback of 2.4 metres and specify the removal of any trees which fall within this.

### **2.2 PROBLEM**

Location: Ipswich Road / eastern access

Summary: Junction form may not be adequate.

Traffic flows were not available for this junction. As this access serves a significant size site it may require a ghost island.

#### RECOMMENDATION

Assess the projected flows and provide a ghost island if the numbers merit it.

**3 AUDIT STATEMENT**

We certify that this audit has been carried out in accordance with HD 19/15.


Signed:



S Hancock  
Audit Team Leader  
Safety Engineering Services Ltd

Date 28 May 2017

Signed:



D Ramsden  
Audit Team Member  
Safety Engineering Services Ltd

Date: 30 May 2017

**DRAWINGS AND DOCUMENTS PROVIDED FOR AUDIT**

10391-H-05 Rev C	Proposed Priority Junction - Western Access
10391TA01Rv2	Land South and East of Adastral Park - Transport Assessment



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# Adastral Park, Ipswich : North-west Quadrant Access off Gloster Road

## Technical Note : Designer's Response to Road Safety Audits at Stage 1

13<sup>th</sup> June 2017

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### 1 Introduction

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Brookbanks Consulting Limited (BCL) is commissioned by Commercial Estates Group (CEG) Ltd to provide technical advice on viability and delivery on a proposed mixed use development at Adastral Park, Martlesham Heath, Suffolk. A Transport Assessment has been produced that has assessed the potential implications. A range of highway interventions has been subsequently identified.

For the Outline Planning Application, the following access strategy was offered:

- Traffic Signals Access off the A12 Dual Carriageway;
- Two simple priority junction accesses off Ipswich Road;
- Simple priority junction access off Gloster Road through the North-west Quadrant.

The Transport Assessment also identified that off-site highway mitigation measures were necessary at the following locations:

- A14 / A12 / A1156 Interchange;
- A12 / Newbourne Rd / Foxhall Road Roundabout;
- A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction;
- A12 / Anson Road / Eagle Way Roundabout;
- A12 / A1214 Roundabout;
- A1189 Heath Road / Foxhall Road Roundabout;
- A1189 Bixley Road / A1156 Felixstowe Road Bixley Roundabout;
- A1214 / A1189 Gyratory Junction.

All design options, at the request of Suffolk County Council, have been subject to a Stage 1 Road Safety Audit. This note sets out the findings of the audit for the North-west Quadrant Access together with a designers response.

### 2 Designer's Response

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The Designers Response should be read in conjunction with the Road Safety Audit (ref SESL1718) as attached in Appendix A.

#### Problem 1

**Location:** Quadrant Access Road/ Gloster Road

**Summary:** Risk of loss of control/sideswipes on the bends. The bends in the road are designed in accordance with the Manual for Streets, but the approaches are straight and will not encourage the requisite speeds to travel around them. This could lead to losses of control and/or poor lane discipline due to speed. It is recognised that the red line boundary is a constraint and it may not be possible to realign the road.

**Recommendation:** Provide traffic calming / speed management measures to reduce speeds on the straight sections.

**BCL Response:** *The potential provision of traffic calming measures will be discussed at detailed design stage.*



### 3 Limitations

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Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

The benefits of this report are provided to Carlyle Land Ltd and Commercial Estates Group for the proposed development on Land at Adastral Park.

Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

# **Safety Engineering Services Ltd**

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Land South and East of Adastral Park, Ipswich  
**Proposed Priority Junction  
North-west Quadrant Access**

**Stage 1 Road Safety Audit**

# Stage 1 Road Safety Audit

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Report Number	Client Reference	Report Status
SESL1718	10391	FINAL

## 1 INTRODUCTION

This report presents the findings of a Road Safety Audit carried out on off-site highway mitigation works proposed to enable site access to land to the south and east of Adastral Park, Ipswich, at the request of Brookbanks Consulting Ltd. The development will consist of up to 2000 dwellings, local centres, with facilities to serve recreation and education.

The audit was carried out by the following:

S Hancock	Road Safety Audit Team Leader Safety Engineering Services Ltd
D Ramsden Certificate of Competency gained in June 2015	Road Safety Audit Team Member Safety Engineering Services Ltd

The audit took place on Saturday 27 May 2017 and comprised a desktop study of the plans provided and a drive and walk through of the site by both team members. During the site visit, the weather was sunny and fine and the road surfaces were dry. Traffic at the time of the audit was moderate.

A list of drawings and documents provided for the purpose of audit is in Appendix A. The locations of any problems have been identified on an annotated drawing in Appendix B.

The main terms of reference of the audit are as described in HD19/15. The team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

There are eleven junctions in total requiring offsite highway mitigation works associated with this development. This Road Safety Audit focuses on the proposed priority junction with Gloster Road and the access road.

## **2 ROAD SAFETY AUDIT FINDINGS**

### **2.1 PROBLEM**

Location: Quadrant Access Road/ Gloster Road

Summary: Risk of loss of control/sideswipes on the bends.

The bends in the road are designed in accordance with the Manual for Streets, but the approaches are straight and will not encourage the requisite speeds to travel around them. This could lead to losses of control and/or poor lane discipline due to speed. It is recognised that the red line boundary is a constraint and it may not be possible to realign the road.

### **RECOMMENDATION**

Provide traffic calming / speed management measures to reduce speeds on the straight sections.

**3 AUDIT STATEMENT**

We certify that this audit has been carried out in accordance with HD 19/15.


Signed:



S Hancock  
Audit Team Leader  
Safety Engineering Services Ltd

Date 28 May 2017

Signed:



D Ramsden  
Audit Team Member  
Safety Engineering Services Ltd

Date: 30 May 2017

**DRAWINGS AND DOCUMENTS PROVIDED FOR AUDIT**

10391-H-06	Proposed Priority Junction - North-west Quadrant Access
10391TA01Rv2	Land South and East of Adastral Park - Transport Assessment





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# Adastral Park, Ipswich : Off-site Highway Mitigation to A14/A1156 Felixtowe Road / A12 Ring Road / Bucklesham Lane Roundabout

## Technical Note : Designer's Response to Road Safety Audits at Stage 1

13<sup>th</sup> June 2017

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### 1 Introduction

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Brookbanks Consulting Limited (BCL) is commissioned by Commercial Estates Group (CEG) Ltd to provide technical advice on viability and delivery on a proposed mixed use development at Adastral Park, Martlesham Heath, Suffolk. A Transport Assessment has been produced that has assessed the potential implications. A range of highway interventions has been subsequently identified.

For the Outline Planning Application, the following access strategy was offered:

- Traffic Signals Access off the A12 Dual Carriageway;
- Two simple priority junction accesses off Ipswich Road;
- Simple priority junction access off Gloster Road through the North-west Quadrant.

The Transport Assessment also identified that off-site highway mitigation measures were necessary at the following locations:

- A14 / A12 / A1156 Interchange;
- A12 / Newbourne Rd / Foxhall Road Roundabout;
- A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction;
- A12 / Anson Road / Eagle Way Roundabout;
- A12 / A1214 Roundabout;
- A1189 Heath Road / Foxhall Road Roundabout;
- A1189 Bixley Road / A1156 Felixstowe Road Bixley Roundabout;
- A1214 / A1189 Gyratory Junction.

All design options, at the request of Suffolk County Council, have been subject to a Stage 1 Road Safety Audit. This note sets out the findings of the audit for the A14 / A12 / A1156 Interchange together with a designers response.

### 2 Designer's Response

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The Designers Response should be read in conjunction with the Road Safety Audit (ref SESL1718) as attached in Appendix A and revised Drawing No: 10391-HL-11C as attached in Appendix B.

#### Problem 1

**Location:** Circulatory carriageway / A14 westbound exit slip

**Summary:** Likelihood of shunt accidents or failure to comply with signals. The visibility of the offside signals for drivers in the offside lane by the bridge parapet and as there is a significant risk of the nearside signal being obstructed by high sided vehicles, drivers in the offside may not appreciate the presence of the signals in time.

**Recommendation:** Provide a signal layout which ensures that drivers in the offside lane will have a view of at least one signal head at the requisite distance. One solution would be the provision of a mast arm.

**BCL Response:** *High-mast traffic signals have now been provided on the A14 Westbound Off-slip approach as advised.*

## Problem 2

**Location:** All approaches to signals.

**Summary:** Mature trees (and other vegetation) obstruct visibility. There are a significant number of large trees (and other vegetation) which obstruct the various visibility splays required. These splays need to be cleared and kept clear for the life of the signals.

**Recommendation:** Apply for the removal of the trees to ensure the requisite splays can be achieved for signalisation.

**BCL Response:** *All trees and other vegetation that hinder visibility to traffic signal heads are recommended to be cropped back and maintained on a regular basis.*

## Problem 3

**Location:** Dedicated left-turn lane, A14 to A1156

**Summary:** Risk of vehicles striking kerb or signal head. With kerbed dedicated lanes, vehicles are known to strike the kerb which can result in loss of control or overturning for high sided vehicles. This hatching means that vehicles approach in the straightest line possible and then drive directly adjacent to the kerb following the tightest radius around this bend. They are also running directly next to the nearside signal head, which is sited on this relatively narrow feature.

**Recommendation:** Swap the start of the nearside hatching to the offside of this lane which will also achieve better segregation between this and the adjacent signalised ahead lane. Continue the hatching around on the kerbed side, increasing the distance between the running area and the kerbs and signal head. The hatching should be then provided on both sides to create the largest radius path around this bend. At detailed design, reflective features should be provided along the length of the kerbed island to minimise the chance of it being struck by vehicles, both turning left and exiting the circulatory.

**BCL Response:** *In TD 51/17 for the design of Segregated Left turn Lanes and Subsidiary Deflection Islands at Roundabouts, hatching is advised to be on the nearside of the curve in Paragraph 2.5.10. In addition, placing the hatching on the off-side would reduce forward visibility for vehicles travelling along this lane outside of the hatched area. Reflective features will be discussed at detailed design stage.*

## Problem 4

**Location:** Circulatory carriageway / A12 ring road.

**Summary:** Risk of sideswipes and shunts (and non-compliance with stopline). The circulatory carriageway is reduced down to one lane on approach to the signals with the A12 entry. The hatching appears to create a pinch point for the two exit lanes to the A12 Ring Road which could lead to sideswipes. It also reduces stacking capacity at the signals which could result in queuing back into the offside exit lane, which if not anticipated could result in high speed shunts. (The layout also appears to show the stopline not extending from kerb to kerb, which means vehicles can legally cross the hatching against a red light).

**Recommendation:** Provide two lanes on this approach, removing the hatching.

**BCL Response:** *This has now been amended to reflect this observation.*

## 3 Limitations

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Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

The benefits of this report are provided to Carlyle Land Ltd and Commercial Estates Group for the proposed development on Land at Adastral Park.

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# **Safety Engineering Services Ltd**

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Land South and East of Adastral Park, Ipswich  
**A14 Roundabout Signalisation**

**Stage 1 Road Safety Audit**

# Stage 1 Road Safety Audit

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Report Number	Client Reference	Report Status
SESL1718	10391	FINAL

## 1 INTRODUCTION

This report presents the findings of a Road Safety Audit carried out on off-site highway mitigation works proposed to enable site access to land to the south and east of Adastral Park, Ipswich, at the request of Brookbanks Consulting Ltd. The development will consist of up to 2000 dwellings, local centres, with facilities to serve recreation and education.

The audit was carried out by the following:

S Hancock	Road Safety Audit Team Leader Safety Engineering Services Ltd
D Ramsden Certificate of Competency gained in June 2015	Road Safety Audit Team Member Safety Engineering Services Ltd

The audit took place on Saturday 27 May 2017 and comprised a desktop study of the plans provided and a drive and walk through of the site by both team members. During the site visit, the weather was sunny and fine and the road surfaces were dry. Traffic at the time of the audit was moderate.

A list of drawings and documents provided for the purpose of audit is in Appendix A. The locations of any problems have been identified on an annotated drawing in Appendix B.

The main terms of reference of the audit are as described in HD19/15. The team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

There are eleven junctions in total requiring offsite highway mitigation works associated with this development. This Road Safety Audit focuses on the proposals to signalise 3 of the 5 arms of the A14/A1156 Felixtowe Road/A12 Ring Road/Bucklesham Lane roundabout.

## **2 ROAD SAFETY AUDIT FINDINGS**

### **2.1 PROBLEM**

Location: Circulatory carriageway / A14 westbound exit slip

Summary: Likelihood of shunt accidents or failure to comply with signals.

The visibility of the offside signals for drivers in the offside lane by the bridge parapet and as there is a significant risk of the nearside signal being obstructed by high sided vehicles, drivers in the offside may not appreciate the presence of the signals in time.

#### RECOMMENDATION

Provide a signal layout which ensures that drivers in the offside lane will have a view of at least one signal head at the requisite distance. One solution would be the provision of a mast arm.

### **2.2 PROBLEM**

Location: All approaches to signals.

Summary: Mature trees (and other vegetation) obstruct visibility.

There are a significant number of large trees (and other vegetation) which obstruct the various visibility splays required. These splays need to be cleared and kept clear for the life of the signals.

#### RECOMMENDATION

Apply for the removal of the trees to ensure the requisite splays can be achieved for signalisation.

### **2.3 PROBLEM**

Location: Dedicated left-turn lane, A14 to A1156

Summary: Risk of vehicles striking kerb or signal head.

With kerbed dedicated lanes, vehicles are known to strike the kerb which can result in loss of control or overturning for high sided vehicles. This hatching means that vehicles approach in the straightest line possible and then drive directly adjacent to the kerb following the tightest radius around this bend. They are also running directly next to the nearside signal head, which is sited on this relatively narrow feature.

RECOMMENDATION

Swap the start of the nearside hatching to the offside of this lane which will also achieve better segregation between this and the adjacent signalised ahead lane. Continue the hatching around on the kerbed side, increasing the distance between the running area and the kerbs and signal head. The hatching should be then provided on both sides to create the largest radius path around this bend. At detailed design, reflective features should be provided along the length of the kerbed island to minimise the chance of it being struck by vehicles, both turning left and exiting the circulatory.

**2.4 PROBLEM**

Location: Circulatory carriageway / A12 ring road.

Summary: Risk of sideswipes and shunts (and non-compliance with stopline).

The circulatory carriageway is reduced down to one lane on approach to the signals with the A12 entry. The hatching appears to create a pinch point for the two exit lanes to the A12 Ring Road which could lead to sideswipes. It also reduces stacking capacity at the signals which could result in queuing back into the offside exit lane, which if not anticipated could result in high speed shunts. (The layout also appears to show the stopline not extending from kerb to kerb, which means vehicles can legally cross the hatching against a red light.)

RECOMMENDATION

Provide two lanes on this approach, removing the hatching.

**3 AUDIT STATEMENT**

We certify that this audit has been carried out in accordance with HD 19/15.


Signed:



S Hancock  
Audit Team Leader  
Safety Engineering Services Ltd

Date 28 May 2017

Signed:



D Ramsden  
Audit Team Member  
Safety Engineering Services Ltd

Date: 30 May 2017



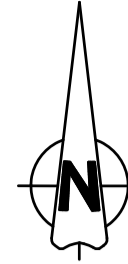
**DRAWINGS AND DOCUMENTS PROVIDED FOR AUDIT**

10391-H-11 Rev B	Offsite Highway Mitigation - A14 Roundabout Signalisation
10391TA01Rv2	Land South and East of Adastral Park - Transport Assessment

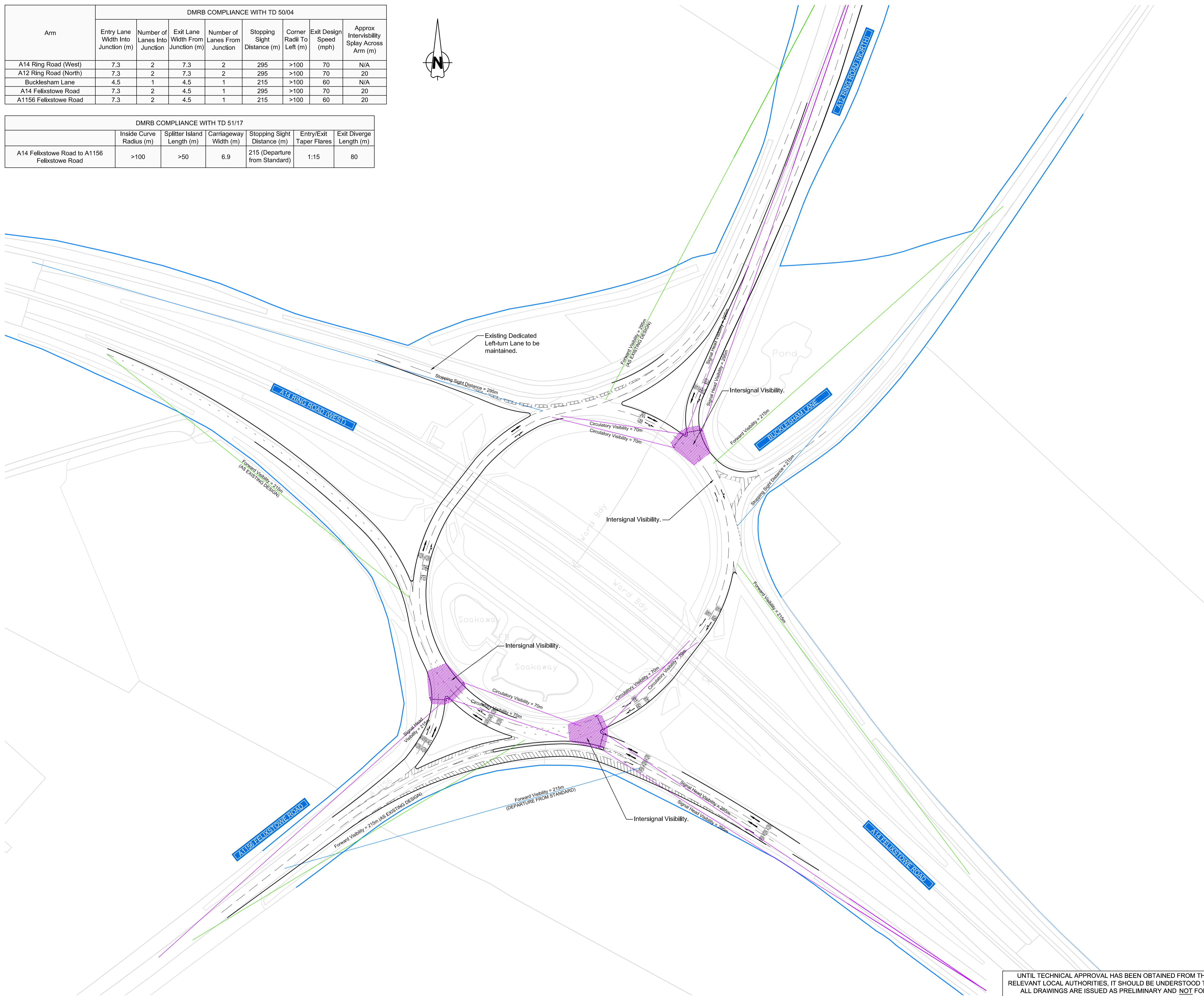




DMRB COMPLIANCE WITH TD 50/04								
Arm	Entry Lane Width Into Junction (m)	Number of Lanes Into Junction	Exit Lane Width From Junction (m)	Number of Lanes From Junction	Stopping Sight Distance (m)	Corner Radii To Left (m)	Exit Design Speed (mph)	Approx Intervisibility Splay Across Arm (m)
A14 Ring Road (West)	7.3	2	7.3	2	295	>100	70	N/A
A12 Ring Road (North)	7.3	2	7.3	2	295	>100	70	20
Bucklesham Lane	4.5	1	4.5	1	215	>100	60	N/A
A14 Felixstowe Road	7.3	2	4.5	1	295	>100	70	20
A1156 Felixstowe Road	7.3	2	4.5	1	215	>100	60	20



DMRB COMPLIANCE WITH TD 51/17						
	Inside Curve Radius (m)	Splitter Island Length (m)	Carriageway Width (m)	Stopping Sight Distance (m)	Entry/Exit Taper Flares	Exit Diverge Length (m)
A14 Felixstowe Road to A1156 Felixstowe Road	>100	>50	6.9	215 (Departure from Standard)	1:15	80



**Construction Design and Management (CDM)**  
**Key Residual Risks**  
 Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.

- 1) Overhead and underground services
- 2) Street Lighting Cables
- 3) Working adjacent to water courses and flood plain
- 4) Soft ground conditions
- 5) Working adjacent to live highways and railway line
- 6) Unchartered services
- 7) Existing buildings with potential asbestos hazards

**NOTES:**

1. Do not scale from this drawing
2. All dimensions are in metres unless otherwise stated.
3. Brookbanks Consulting Ltd has prepared this drawing for the sole use of the client. The drawing may not be relied upon by any other party without the express agreement of the client and Brookbanks Consulting Ltd. Where any data supplied by the client or from other sources has been used, it has been assumed that the information is correct. No responsibility can be accepted by Brookbanks Consulting Ltd for inaccuracies in the data supplied by any other party. The drawing has been produced based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.
4. No part of this drawing may be copied or duplicated without the express permission of Brookbanks Consulting.
5. The junctions, roundabouts and links have been designed in accordance with the following DMRB standards:
  - TA 23/81: Junctions and Accesses - Determination of Size of Roundabouts and Major-Minor Junctions
  - TA 90/05: The Geometric Design of Pedestrian, Cycle and Equestrian Routes;
  - TA 91/05: Provision for Non-Motorised Users;
  - TD 9/93: Highway Link Design;
  - TD 50/04: The Geometric Layout of Signal-controlled Junctions and Signalized Roundabouts;
  - Traffic Advisory Leaflet 3/03: Equestrian Crossings.

**KEY:**

- Assumed Highway Boundary
- Signal Head Visibility
- Traffic Signal Head
- High-mast Traffic Signal Head
- Intersignal Visibility
- Forward Visibility on Exit
- Forward Visibility on Entry

B Amendments as per Road Safety Audit. MDM LW PAB 12.06.17  
 B Amendments as per client's requests. MDM LW PAB 10.03.17  
 A Amendments as per client's requests. MDM LW PAB 19.10.16  
 - First Issue - - - 19.10.16

# Brookbanks

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 www.brookbanks.com

Carlyle Land Ltd and  
 Commercial Estates Group

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Land South and East of  
 Aداstral Park, Ipswich

Off-site Highway Mitigation:  
**A14 Roundabout Signalisation**

Status	Approval		Status Date	Oct 2016
Drawn	MDM	Checked	LW	Date
Scale	1:1000	Number	10391-HL-11	Rev
				C

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.



---

# Adastral Park, Ipswich : Traffic Signals Access off the A12 Dual Carriageway with a Dedicated Right-turn Lane

## Technical Note : Designer's Response to Road Safety Audits at Stage 1

7<sup>th</sup> September 2017

---

### 1 Introduction

---

Brookbanks Consulting Limited (BCL) is commissioned by Commercial Estates Group (CEG) Ltd to provide technical advice on viability and delivery on a proposed mixed use development at Adastral Park, Martlesham Heath, Suffolk. A Transport Assessment has been produced that has assessed the potential implications. A range of highway interventions has been subsequently identified.

For the Outline Planning Application, the following access strategy was offered:

- Traffic Signals Access off the A12 Dual Carriageway with a dedicated right-turn lane;
- Two simple priority junction accesses off Ipswich Road;
- Simple priority junction access off Gloster Road through the North-west Quadrant.

The Transport Assessment also identified that off-site highway mitigation measures were necessary at the following locations:

- A14 / A12 / A1156 Interchange;
- A12 / Newbourne Rd / Foxhall Road Roundabout;
- A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction;
- A12 / Anson Road / Eagle Way Roundabout;
- A12 / A1214 Roundabout;
- A1189 Heath Road / Foxhall Road Roundabout;
- A1189 Bixley Road / A1156 Felixstowe Road Bixley Roundabout;
- A1214 / A1189 Gyratory Junction.

All design options, at the request of Suffolk County Council, have been subject to a Stage 1 Road Safety Audit. This note sets out the findings of the audit for the traffic signals access off the A12 Dual Carriageway with a dedicated right-turn lane together with a designers response.

### 2 Designer's Response

---

The Designers Response should be read in conjunction with the Road Safety Audit (ref SESL1728) as attached in Appendix A and revised Drawing No: 10391-HL-07C as attached in Appendix B.

#### Problem 1

**Location:** A12 Ring Road

**Summary:** Likely excessive speed on approach to signals which can result in a number of accident types. The signalised junction is positioned on a national speed limit road, which encourages too higher speeds on approach to this type of junction.

**Recommendation:** To encourage reduced speed on the approach to the signal junction, a 50mph speed limit should be applied on the A12 between the Barrack Square roundabout to the north and Foxhall Road roundabout to the south.

**BCL Comment:** *The Stopping Sight Distance for the signalised crossing will achieve the required distances for the existing speed limit as specified in TD 9/93 Table 3. Advance warning sign provision to further enhance this will be discussed at detailed design stage.*

## Problem 2

**Location:** Aadastral Park Road

**Summary:** Risk of kerb strikes. The tie in at the exit from the signals is acute and could result in vehicles hitting the nearside kerb.

**Recommendation:** Provide a smoother transition.

**BCL Comment:** *The transition has now been amended to provide a smoother transition on exit from the junction.*

## Problem 3

**Location:** Aadastral Park Road

**Summary:** Risk of horses being spooked/injury to pedestrians. The current crossing point for horses looks unused, which is probably due to the very busy A12. However, the proposed formal crossing may encourage use of this route. However the route is very convoluted, involving stopping the horse several times in the face of traffic.

**Recommendation:** Provide a straight-across equestrian crossing point in the direct vicinity of the bridleway.

**BCL Response:** *This is no longer applicable as a Pegasus crossing is no longer being provided.*

## Problem 4

**Location:** Aadastral Park Road horse crossing

**Summary:** Horses may become spooked and pedestrians may not appreciate oncoming vehicles. The stagger for the crossing is the wrong way round which means that the horses and riders will be approaching the crossing with their back to traffic. This may frighten the horses if they are not expecting vehicles to pass them at speed from behind. It also means that pedestrians will not be observing traffic on approach to the crossing and make errors of judgement if crossing against the lights.

**Recommendation:** Amend the stagger on the crossing so that the riders and horses are facing oncoming traffic.

**BCL Response:** *This is no longer applicable as a Pegasus crossing is no longer being provided.*

## Problem 5

**Location:** A12 and Aadastral Park Road crossings

**Summary:** Insufficient space for horses which may result in the horses waiting too close to the traffic or unable to manoeuvre properly, both of which may spook them. The segregated area for horses in the central islands do not appear wide enough for a horse to turn, (particularly as the traffic signal pole will have to be in this area), or provide enough space for them to wait. There are also no holding areas for horses either side of the A12.

**Recommendation:** Provide a straight across Pegasus Crossing as recommended in Problem 2.3. If this is not done, extend the island to provide sufficient holding space and extend it to ensure that the signal equipment is outside of this area for horses, to reduce the chances of them being spooked. Provide holding areas in all places where the horses are expected to wait. Holding areas should be 10m x 5m.

**BCL Response:** *This is no longer applicable as a Pegasus crossing is no longer being provided.*

## Problem 7

**Location:** A12, Pegasus crossing

**Summary:** Horses may become spooked. The path to and from the crossing on the west side of the A12 is adjacent to the carriageway. As much segregation from the traffic as possible should be provided.

**Recommendation:** Provide a straight across crossing as recommended in Problem 2.3. If this is not done, realign the path so that it follows the back of highway.

**BCL Response:** *This is no longer applicable as a Pegasus crossing is no longer being provided.*

### 3 Limitations

---

Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

The benefits of this report are provided to Carlyle Land Ltd and Commercial Estates Group for the proposed development on Land at Adastral Park.

Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

# **Safety Engineering Services Ltd**

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Land South and East of Adastral Park, Ipswich  
**Proposed Western Signalised Access**  
**A12 Dual Carriageway**

**Stage 1 Road Safety Audit**

# Stage 1 Road Safety Audit

## CONTENTS

1 INTRODUCTION ..... 1

2 ROAD SAFETY AUDIT FINDINGS ..... 2

3 AUDIT STATEMENT ..... 3

APPENDIX A ..... 6

APPENDIX B ..... 8

Report Number	Client Reference	Report Status
SESL1728	10391	FINAL



## 1 INTRODUCTION

This report presents the findings of a Road Safety Audit carried out on off-site highway mitigation works proposed to enable site access to land to the south and east of Adastral Park, Ipswich, at the request of Brookbanks Consulting Ltd. The development will consist of up to 2000 dwellings, local centres, with facilities to serve recreation and education.

The audit was carried out by the following:

S Hancock	Road Safety Audit Team Leader Safety Engineering Services Ltd
D Ramsden Certificate of Competency gained in June 2015	Road Safety Audit Team Member Safety Engineering Services Ltd

The audit took place on Tuesday 5 September 2017 and comprised a desktop study of the plans provided and a drive and walk through of the site by both team members. During the site visit, the weather was overcast and the road surfaces were dry. Traffic at the time of the audit was moderate.

The drawings and documents provided for the purpose of audit are listed in Appendix A. The locations of any problems have been identified on an annotated drawing in Appendix B.

The main terms of reference of the audit are as described in HD19/15. The team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

There are two junctions put forward for this audit with highway mitigation works for this development. This Road Safety Audit report focuses on the proposed signalised junction on the A12, which incorporates an equestrian crossing.

## **2 ROAD SAFETY AUDIT FINDINGS**

### **2.1 PROBLEM**

Location: A12 Ring Road

Summary: Likely excessive speed on approach to signals which can result in a number of accident types.

The signalised junction is positioned on a national speed limit road, which encourages too higher speeds on approach to this type of junction.

#### RECOMMENDATION

To encourage reduced speed on the approach to the signal junction, a 50mph speed limit should be applied on the A12 between the Barrack Square roundabout to the north and Foxhall Road roundabout to the south.

### **2.2 PROBLEM**

Location: Adastral Park Road

Summary: Risk of kerb strikes.

The tie in at the exit from the signals is acute and could result in vehicles hitting the nearside kerb.

#### RECOMMENDATION

Provide a smoother transition.

### **2.3 PROBLEM**

Location: Adastral Park Road

Summary: Risk of horses being spooked/injury to pedestrians

The current crossing point for horses looks unused, which is probably due to the very busy A12. However, the proposed formal crossing may encourage use of this route. However the route is very convoluted, involving stopping the horse several times in the face of traffic.

#### RECOMMENDATION

Provide a straight-across equestrian crossing point in the direct vicinity of the bridleway.

## 2.4 PROBLEM

Location: Adastral Park Road horse crossing

Summary: Horses may become spooked and pedestrians may not appreciate oncoming vehicles.

The stagger for the crossing is the wrong way round which means that the horses and riders will be approaching the crossing with their back to traffic. This may frighten the horses if they are not expecting vehicles to pass them at speed from behind. It also means that pedestrians will not be observing traffic on approach to the crossing and make errors of judgement if crossing against the lights.

### RECOMMENDATION

Amend the stagger on the crossing so that the riders and horses are facing oncoming traffic.

## 2.5 PROBLEM

Location: A12 and Adastral Park Road crossings

Summary: Insufficient space for horses which may result in the horses waiting too close to the traffic or unable to manoeuvre properly, both of which may spook them.

The segregated area for horses in the central islands do not appear wide enough for a horse to turn, (particularly as the traffic signal pole will have to be in this area), or provide enough space for them to wait. There are also no holding areas for horses either side of the A12.

### RECOMMENDATION

Provide a straight across Pegasus Crossing as recommended in Problem 2.3. If this is not done, extend the island to provide sufficient holding space and extend it to ensure that the signal equipment is outside of this area for horses, to reduce the chances of them being spooked. Provide holding areas in all places where the horses are expected to wait. Holding areas should be 10m x 5m.

## 2.6 PROBLEM

Location: A12, Pegasus crossing

Summary: Horses may become spooked.

The path to and from the crossing on the west side of the A12 is adjacent to the carriageway. As much segregation from the traffic as possible should be provided.

## RECOMMENDATION

Provide a straight across crossing as recommended in Problem 2.3. If this is not done, realign the path so that it follows the back of highway.

**3 AUDIT STATEMENT**

We certify that this audit has been carried out in accordance with HD 19/15.

Signed:



S Hancock  
Audit Team Leader  
Safety Engineering Services Ltd

Date 6 September 2017

Signed:

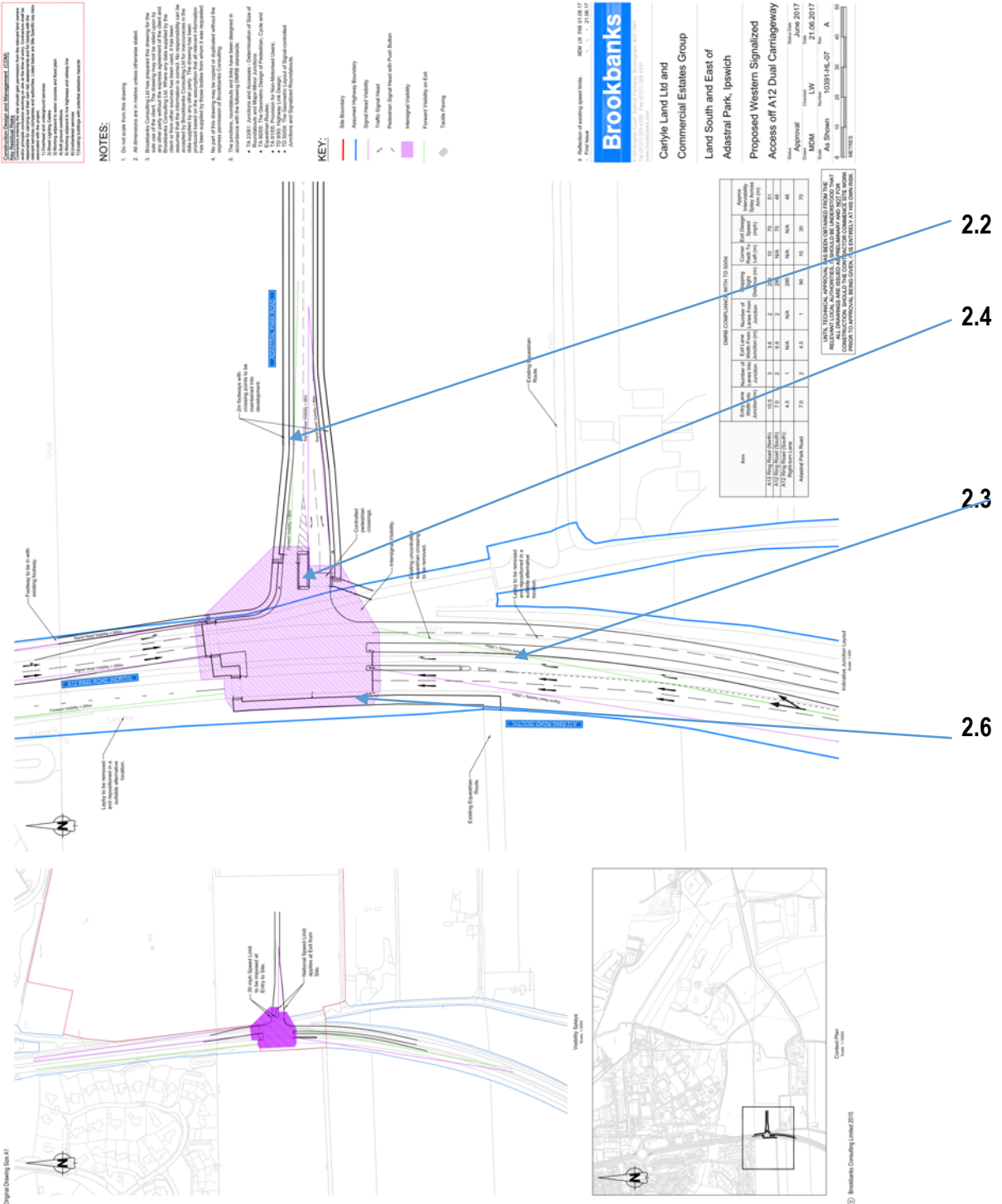


D Ramsden  
Audit Team Member  
Safety Engineering Services Ltd

Date: 6 September 2017

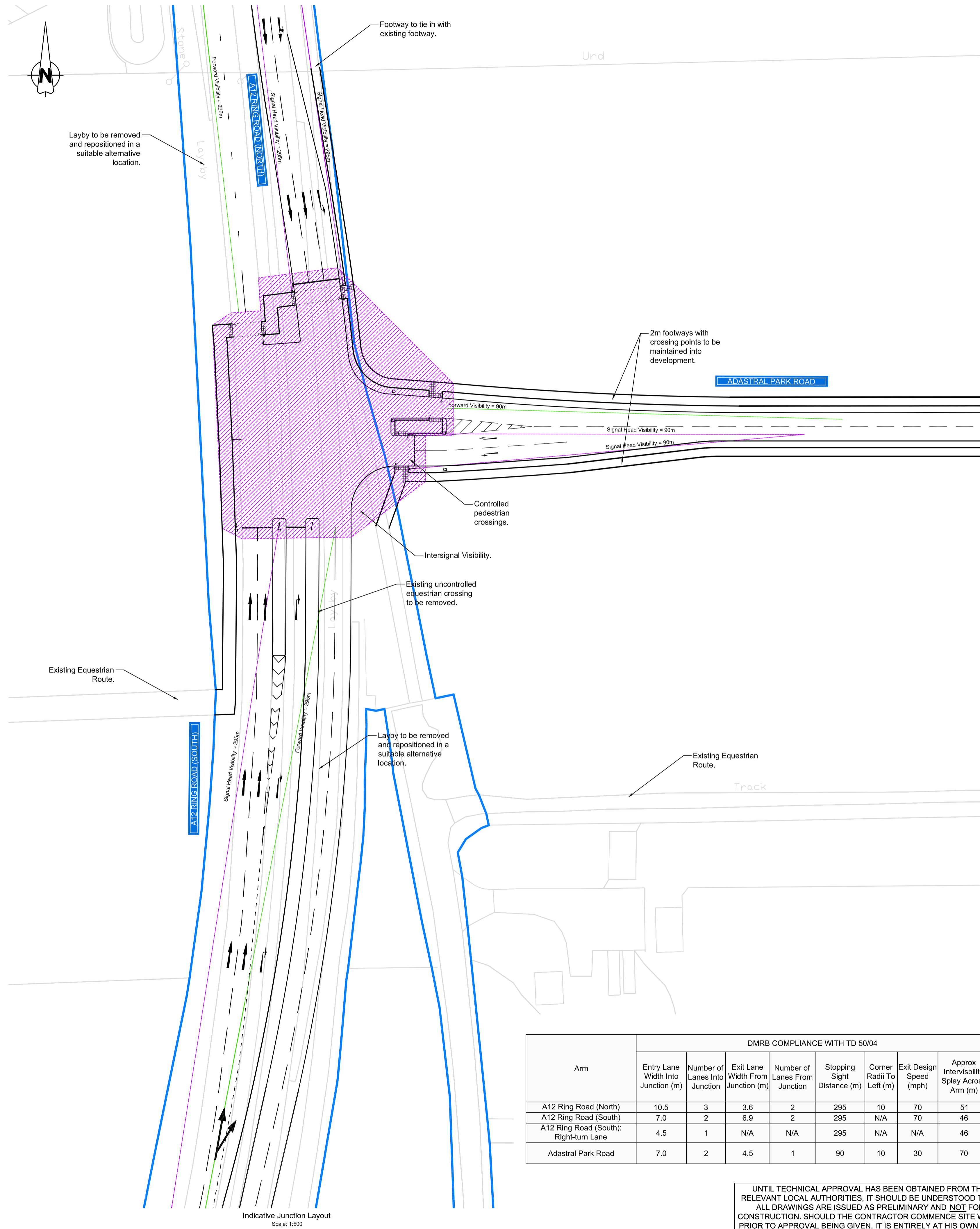
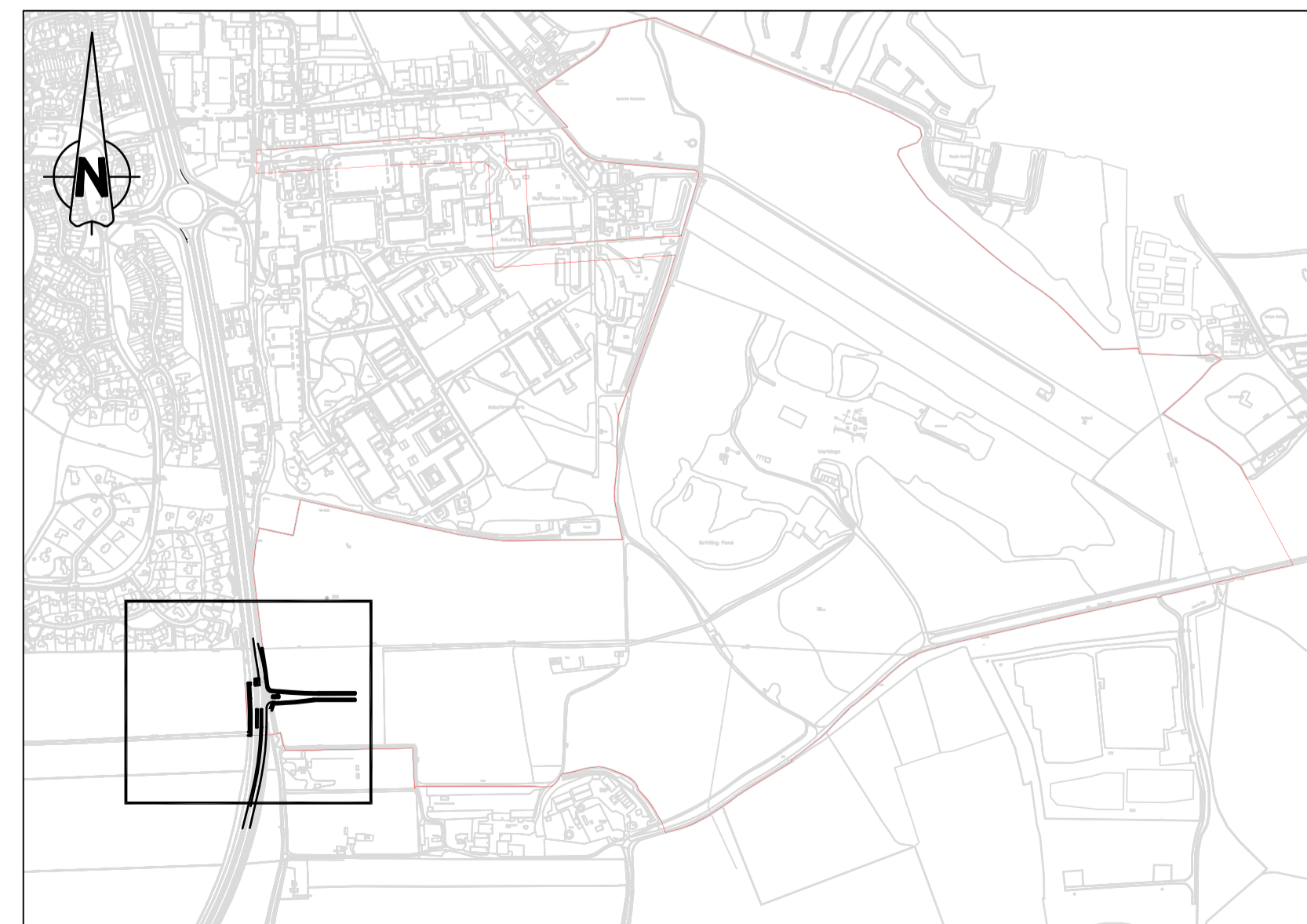
**DRAWINGS AND DOCUMENTS PROVIDED FOR AUDIT**

10391-H-0L-07 rev A	Proposed Western Signalised Access off A12 Dual Carriageway
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Problems 2.1 and 2.5 not identified on drawing.





Arm	DMRB COMPLIANCE WITH TD 50/04							
	Entry Lane Width Into Junction (m)	Number of Lanes Into Junction	Exit Lane Width From Junction (m)	Number of Lanes From Junction	Stopping Sight Distance (m)	Corner Radii To Left (m)	Exit Design Speed (mph)	Approx. Intervisibility Splay Across Arm (m)
A12 Ring Road (North)	10.5	3	3.6	2	295	10	70	51
A12 Ring Road (South)	7.0	2	6.9	2	295	N/A	70	46
A12 Ring Road (South): Right-Turn Lane	4.5	1	N/A	N/A	295	N/A	N/A	46
Adastral Park Road	7.0	2	4.5	1	90	10	30	70

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.

**Construction Design and Management (CDM) Key Residual Risks**  
 Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.

- 1) Overhead and underground services
- 2) Street Lighting Cables
- 3) Working adjacent to water courses and flood plain
- 4) Soft ground conditions
- 5) Working adjacent to live highways and railway line
- 6) Unchartered services
- 7) Existing buildings with potential asbestos hazards

- NOTES:**
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  4. No part of this drawing may be copied or duplicated without the express permission of Brookbanks Consulting.
  5. The junctions, roundabouts and links have been designed in accordance with the following DMRB standards:
    - TA 23/81: Junctions and Accesses - Determination of Size of Roundabouts and Major-Minor Junctions
    - TA 90/05: The Geometric Design of Pedestrian, Cycle and Equestrian Routes;
    - TA 91/05: Provision for Non-Motorised Users;
    - TD 9/93: Highway Link Design;
    - TD 50/04: The Geometric Layout of Signal-controlled Junctions and Signalized Roundabouts.

- KEY:**
- Site Boundary
  - Assumed Highway Boundary
  - Signal Head Visibility
  - Traffic Signal Head
  - Pedestrian Signal Head with Push Button
  - Intersignal Visibility
  - Forward Visibility on Exit
  - Tactile Paving

C Modifications as per RSA comments. MDM LW PAB 07.09.17  
 B Modifications as per SCC's comments. MDM LW PAB 01.09.17  
 A Reflection of existing speed limits. MDM LW PAB 01.08.17  
 - First Issue - - - 21.06.17

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 www.brookbanks.com

Carlyle Land Ltd and  
 Commercial Estates Group  
 Land South and East of  
 Adastral Park, Ipswich

Proposed Western Signalized  
 Access off A12 Dual Carriageway

Status	Approval	Checked	MDM	LW	Date	June 2017
Scale	As Shown	Number	10391-HL-07	Rev	C	21.06.2017

0 10 20 30 40 50  
 METRES



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# Adastral Park, Ipswich : Off-site Highway Mitigation to Foxhall Roundabout

## Technical Note : Designer's Response to Road Safety Audits at Stage 1

28<sup>th</sup> November 2017

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### 1 Introduction

---

Brookbanks Consulting Limited (BCL) is commissioned by Commercial Estates Group (CEG) Ltd to provide technical advice on viability and delivery on a proposed mixed use development at Adastral Park, Martlesham Heath, Suffolk. A Transport Assessment has been produced that has assessed the potential implications. A range of highway interventions has been subsequently identified.

For the Outline Planning Application, the following access strategy was offered:

- Traffic Signals Access off the A12 Dual Carriageway with a dedicated right-turn lane;
- Two simple priority junction accesses off Ipswich Road;
- Simple priority junction access off Gloster Road through the North-west Quadrant.

The Transport Assessment also identified that off-site highway mitigation measures were necessary at the following locations:

- A14 / A12 / A1156 Interchange;
- A12 / Newbourne Rd / Foxhall Road Roundabout;
- A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction;
- A12 / Anson Road / Eagle Way Roundabout;
- A12 / A1214 Roundabout;
- A1189 Heath Road / Foxhall Road Roundabout;
- A1189 Bixley Road / A1156 Felixstowe Road Bixley Roundabout;
- A1214 / A1189 Gyratory Junction.

All design options, at the request of Suffolk County Council, have been subject to a Stage 1 Road Safety Audit. This note sets out the findings of the audit for the A12 / Newbourne Rd / Foxhall Road Roundabout together with a designers response.

### 2 Designer's Response

---

The Designers Response should be read in conjunction with the Road Safety Audit (ref SESL1729) as attached in the Appendix and revised Drawing No: 10391-HL-40A.

#### Problem 1

**Location:** A12 north and southbound approach.

**Summary:** Confusing lane markings could result in lane change accidents. All 3 lanes are marked as ahead lanes. However, the offside ahead lane leads into a right turn only lane and as the default offside lane from the south and possibly also from the north (the tie-in is beyond the drawing extents) this is likely to result in lane changes on approach and also possibly last-minute on the circulatory carriageway itself when drivers are suddenly presented with a right turn arrow. In addition, this lane then becomes right turn only, effectively making it a U-turn lane which is likely to lead to sideswipe/lane change accidents at the Foxhall Road exit. See also Problem 2.2.

**Recommendation:** Amend the approach lane lining so that the offside lanes allow ahead movements, with right turn lanes developing from these. If this is not done, significant suitable advance signing advising drivers of the lane destinations must be provided at detailed design.

**BCL response:** *The TSM Chapter 5 Para. 8.31 Recommends avoiding right turn arrows on the approach to the roundabout. The lining and directions can be amended during the detailed design of the junction in consultation with the Highway Authority with the appropriate advanced signing.*

## **Problem 2**

**Location:** A12 northbound entry

**Summary:** Risk of lane change accidents and/or sideswipes. There are 3 ahead lanes proposed for northbound vehicles, but these lead into two lanes on the circulatory carriageway.

**Recommendation:** Ensure that the lane markings are consistent with subsequent lane numbers.

**BCL Response:** *Agreed. The left hand lane should be shown as a left turn approach only (this has been done).*

## **3 Limitations**

---

Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

The benefits of this report are provided to Carlyle Land Ltd and Commercial Estates Group for the proposed development on Land at Adastral Park.

Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

## Appendix A: Road Safety Auditor's Report

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## Appendix B: Updated Design Drawing

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# **Safety Engineering Services Ltd**

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Land South and East of Adastral Park, Ipswich  
**Foxhall Roundabout Mitigation**

**Stage 1 Road Safety Audit**

# Stage 1 Road Safety Audit

## CONTENTS

1 INTRODUCTION ..... 1

2 ROAD SAFETY AUDIT FINDINGS ..... 2

3 AUDIT STATEMENT.....3

APPENDIX A.....4

APPENDIX B.....6

Report Number	Client Reference	Report Status
SESL1729	10391	FINAL

## 1 INTRODUCTION

This report presents the findings of a Road Safety Audit carried out on off-site highway mitigation works proposed to enable site access to land to the south and east of Adastral Park, Ipswich, at the request of Brookbanks Consulting Ltd. The development will consist of up to 2000 dwellings, local centres, with facilities to serve recreation and education.

The audit was carried out by the following:

S Hancock	Road Safety Audit Team Leader Safety Engineering Services Ltd
C Berry CertComp	Road Safety Audit Team Member Safety Engineering Services Ltd

The audit took place on Friday 17th November and comprised a desktop study of the plans provided and a drive and walk through of the site by both team members. During the site visit, the weather was fine and the road surfaces were dry. Traffic at the time of the audit was moderate to heavy.

A list of drawings and documents provided for the purpose of audit is in Appendix A. The locations of any problems have been identified on an annotated drawing in Appendix B.

The main terms of reference of the audit are as described in HD19/15. The team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

This audit assesses the proposed measures at the A12/Foxhall Road Roundabout to increase capacity, including signalisation of the A12 north and southbound arms.

## **2 ROAD SAFETY AUDIT FINDINGS**

### **2.1 PROBLEM**

Location: A12 southbound approach.

Summary: Confusing lane markings could result in lane change accidents.

All 3 lanes are marked as ahead lanes. However, the offside ahead lane leads into a right turn only lane and as the default offside lane from the south and possibly also from the north (the tie-in is beyond the drawing extents) this is likely to result in lane changes on approach and also possibly last-minute on the circulatory carriageway itself when drivers are suddenly presented with a right turn arrow. In addition, this lane then becomes right turn only, effectively making it a U-turn lane which is likely to lead to sideswipe/lane change accidents at the Foxhall Road exit. See also Problem 2.2.

#### **RECOMMENDATION**

Amend the approach lane lining so that the offside lanes allow ahead movements, with right turn lanes developing from these. If this is not done, significant suitable advance signing advising drivers of the lane destinations must be provided at detailed design.

### **2.2 PROBLEM**

Location: A12 Northbound entry

Summary: Risk of lane change accidents and/or sideswipes

There are 3 ahead lanes proposed for northbound vehicles, but these lead into two lanes on the circulatory carriageway.

#### **RECOMMENDATION**

Ensure that the lane markings are consistent with subsequent lane numbers.



**3 AUDIT STATEMENT**

We certify that this audit has been carried out in accordance with HD 19/15.

Signed:



S Hancock  
Audit Team Leader  
Safety Engineering Services Ltd

Date 22 November 2017

Signed:



C Berry  
Audit Team Member  
Safety Engineering Services Ltd

Date: 22 November 2017

**APPENDIX A**

**DRAWINGS AND DOCUMENTS PROVIDED FOR AUDIT**

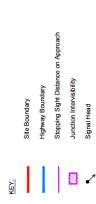
10391-HL-40 DRAFT rev A	Offsite Highway Mitigation - Foxhall Roundabout Mitigation
-------------------------	--

**APPENDIX B**

**CONTRACT INFORMATION AND MANAGEMENT LOG**

Contract Name: Foxhall Roundabout  
 Client: Brookbanks  
 Project Manager: [Name]  
 Date: 11/11/2017

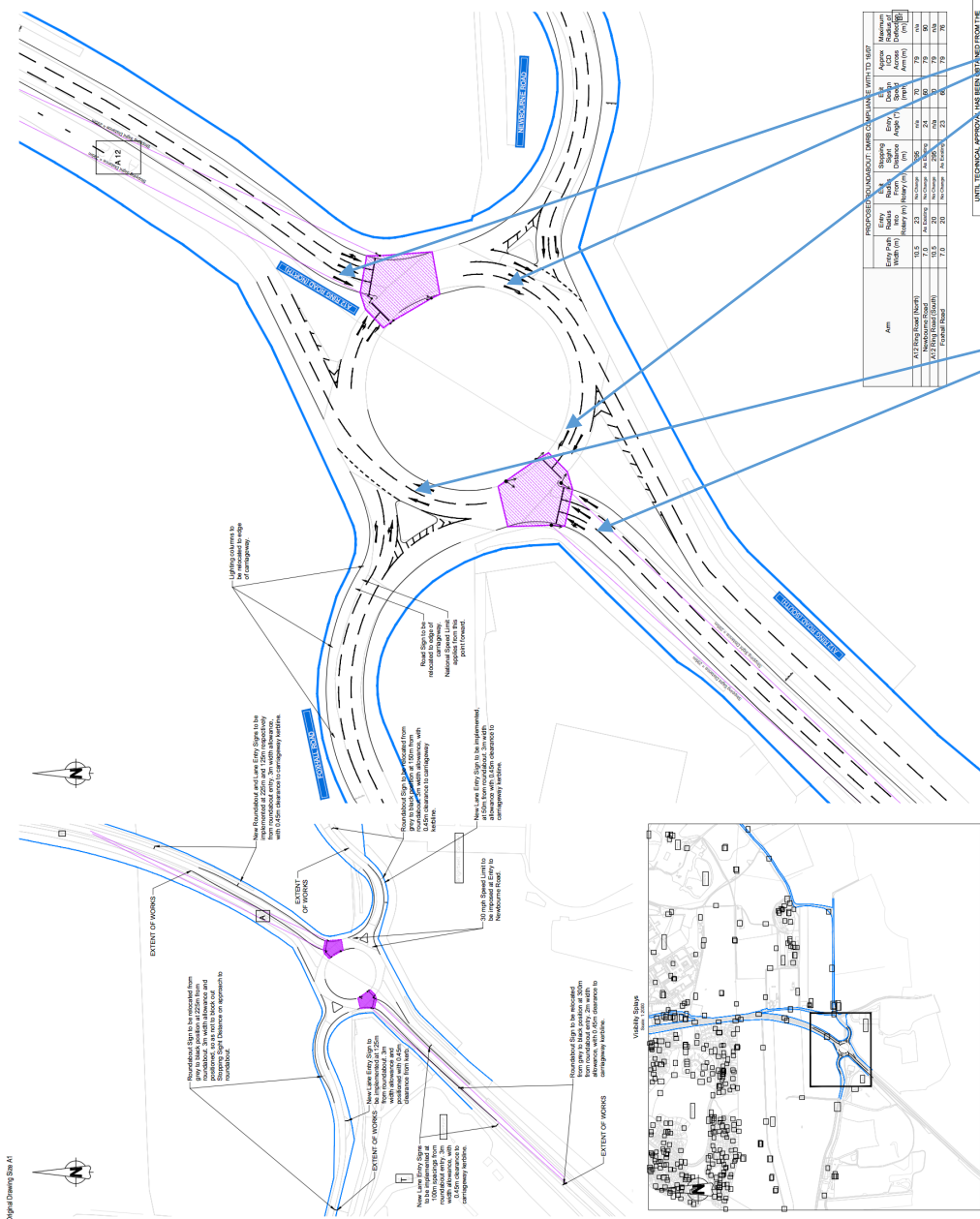
- NOTES:**
- Do not scale from this drawing.
  - All dimensions are in metres unless otherwise stated.
  - Brookbanks Consulting Ltd has prepared this drawing for the client and is not responsible for any errors or omissions on the part of any other party, without the express agreement of this client and without the client's written consent. This drawing is the property of Brookbanks Consulting Ltd and shall remain the property of Brookbanks Consulting Ltd for the purposes of the contract. Brookbanks Consulting Ltd shall not be held responsible for any errors or omissions on the part of any other party, without the express agreement of this client and without the client's written consent.
  - No part of this drawing may be copied or duplicated without the written consent of Brookbanks Consulting Ltd.
  - The junction, roadworks and lines have been designed in accordance with the following DMRB standards:
    - DMRB 1089 - Junctions with Roundabouts
    - DMRB 1091 - Junctions with Roundabouts
    - DMRB 1092 - Junctions with Roundabouts
    - DMRB 1093 - Junctions with Roundabouts
    - DMRB 1094 - Junctions with Roundabouts
    - DMRB 1095 - Junctions with Roundabouts
    - DMRB 1096 - Junctions with Roundabouts
    - DMRB 1097 - Junctions with Roundabouts
    - DMRB 1098 - Junctions with Roundabouts
    - DMRB 1099 - Junctions with Roundabouts
    - DMRB 1100 - Junctions with Roundabouts



GL: DN: 211117  
 11/11/2017  
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 Fax: 01473 222222  
 Email: info@brookbanks.co.uk  
 Website: www.brookbanks.co.uk

**Canyle Land Ltd and Commercial Estates Group**  
**Land South and East of Adastral Park, Ipswich**  
**Office Location: Foxhall Roundabout**  
**SCC Always Proposal**

Project Name: Foxhall Roundabout  
 Date: 11/11/2017  
 Scale: 1:1000  
 Drawing No: 10391-HL-40  
 Revision: A  
 Status: As Shown  
 Author: [Name]  
 Checker: [Name]  
 Approver: [Name]  
 Date: 11/11/2017



Arm	INDICATED ROUNDABOUT DIMENSIONS WITH TO STOP				Maximum	
	Entry Path Radius (m)	Radius (m)	Entry Sight Triangle (m)	Exit Sight Triangle (m)	Radius (m)	Radius (m)
A12 (Inner Lane)	10.0	25.0	10.0	10.0	7.5	10.0
A12 (Outer Lane)	10.0	25.0	10.0	10.0	7.5	10.0
A12 (Inner Lane)	10.0	25.0	10.0	10.0	7.5	10.0
A12 (Outer Lane)	10.0	25.0	10.0	10.0	7.5	10.0
Roundabout	10.0	25.0	10.0	10.0	7.5	10.0

2.1

2.2

Original Drawing: Site A1

---

# Adastral Park, Ipswich : Offsite Highway Mitigation to A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction

## Technical Note : Designer's Response to Road Safety Audits at Stage 1

28<sup>th</sup> November 2017

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### 1 Introduction

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Brookbanks Consulting Limited (BCL) is commissioned by Commercial Estates Group (CEG) Ltd to provide technical advice on viability and delivery on a proposed mixed use development at Adastral Park, Martlesham Heath, Suffolk. A Transport Assessment has been produced that has assessed the potential implications. A range of highway interventions has been subsequently identified.

For the Outline Planning Application, the following access strategy was offered:

- Traffic Signals Access off the A12 Dual Carriageway;
- Two simple priority junction accesses off Ipswich Road;
- Simple priority junction access off Gloster Road through the North-west Quadrant.

The Transport Assessment also identified that off-site highway mitigation measures were necessary at the following locations:

- A14 / A12 / A1156 Interchange;
- A12 / Newbourne Rd / Foxhall Road Roundabout;
- A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction;
- A12 / Anson Road / Eagle Way Roundabout;
- A12 / A1214 Roundabout;
- A1189 Heath Road / Foxhall Road Roundabout;
- A1189 Bixley Road / A1156 Felixstowe Road Bixley Roundabout;
- A1214 / A1189 Gyratory Junction.

All design options, at the request of Suffolk County Council, have been subject to a Stage 1 Road Safety Audit. This note sets out the findings of the audit for the A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction together with a designers response.

### 2 Designer's Response

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The Designers Response should be read in conjunction with the Road Safety Audit (ref SESL1731) as attached in the Appendix and revised Drawing No: 10391-HL-23F.

#### Problem 1

**Problem:** Location: A12 northbound and southbound approach and westbound exit.

**Summary:** Confusing lane markings could result in lane change accidents. All 3 lanes are marked as ahead lanes. However, the offside lane is actually a right turn only lane, and as the possible default offside lane (the tie-in is beyond the drawing extents) this is likely to result in lane changes on approach and also possibly last-minute on the circulatory carriageway itself when drivers are suddenly presented with a right turn arrow. In addition, the right turn lane from the north leads into a right turn lane which could lead to sideswipe/lane change accidents at the Foxhall Road exit.

**Recommendation:** Amend the approach lane lining so that the offside lane allows ahead movements, with right turn lanes

developing from these. If this is not done, provide significant suitable advance signing advising drivers of the lane destinations at detailed design. Amend the lining on the circulatory carriageway westbound.

*BCL Response: The TSM Chapter 5 Para. 8.31 Recommends avoiding right turn arrows on the approach to the roundabout. The lining and directions can be amended during the detailed design of the junction in consultation with the Highway Authority.*

#### **Problem 2**

**Location:** Barrack Square exit arm

**Summary:** Risk of lane change accidents There are two lanes on this exit, with a very short length for unfamiliar drivers to ascertain the correct lane to be in. This can lead to conflicts if drivers need to change lanes with a very short length to do so.

**Recommendation:** Provide a single lane on exit, developing the left turn lane immediately afterwards.

*BCL Response: This is the proposal BCL had initially designed. The modelling requires a two lane exit, which we have provided. There is space to allow vehicles to change lanes. This can be revised during the detailed design stage in conjunction with the Highway Authority with the appropriate advanced signing.*

#### **Problem 3**

**Location:** circulatory carriageway.

**Summary:** Risk of sideswipe accidents. The layout indicates some narrow lanes throughout which can result in conflict.

**Recommendation:** Carry out swept path analysis to ensure that all vehicles can travel within the intended lanes and make adjustments as required.

*BCL Response: The lanes are 3.5m wide currently with design. Swept path design and alterations, if necessary, can be carried out during the detailed design stage with minor alterations to the central island.*

## **3 Limitations**

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Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

The benefits of this report are provided to Carlyle Land Ltd and Commercial Estates Group for the proposed development on Land at Adastral Park.

Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

## Appendix A: Road Safety Auditor's Report

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# **Safety Engineering Services Ltd**

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Land South and East of Adastral Park, Ipswich  
**Adastral Park Roundabout  
and Gloster Road Mitigation**

**Stage 1 Road Safety Audit**

# Stage 1 Road Safety Audit

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Report Number	Client Reference	Report Status
SESL1731	10391	FINAL

## 1 INTRODUCTION

This report presents the findings of a Road Safety Audit carried out on the A12 / Gloster Road Roundabout off-site highway mitigation works, proposed as part of a suite of works to enable site access to land to the south and east of Adastral Park, Ipswich, at the request of Brookbanks Consulting Ltd. The development will consist of up to 2000 dwellings, local centres, with facilities to serve recreation and education.

The audit was carried out by the following:

S Hancock	Road Safety Audit Team Leader Safety Engineering Services Ltd
C Berry CertComp	Road Safety Audit Team Member Safety Engineering Services Ltd

The audit took place on Friday 17th November and comprised a desktop study of the plans provided, and a drive and walk through of the site by both team members. During the site visit, the weather was fine and the road surfaces were dry. Traffic at the time of the audit was moderate to heavy.

A list of drawings and documents provided for the purpose of audit is in Appendix A. The locations of any problems have been identified on an annotated drawing in Appendix B.

The main terms of reference of the audit are as described in HD19/15. The team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

This audit assesses the proposed measures at the Adastral Park Roundabout to increase capacity, including signalisation of the A12 southbound arm and amendments to the adjacent priority junction with Gloster Road.

## **2 ROAD SAFETY AUDIT FINDINGS**

### **2.1 PROBLEM**

Location: A12 northbound and southbound approach and westbound exit.

Summary: Confusing lane markings could result in lane change accidents.

All 3 lanes are marked as ahead lanes. However, the offside lane is actually a right turn only lane, and as the possible default offside lane (the tie-in is beyond the drawing extents) this is likely to result in lane changes on approach and also possibly last-minute on the circulatory carriageway itself when drivers are suddenly presented with a right turn arrow. In addition, the right turn lane from the north leads into a right turn lane which could lead to sideswipe/lane change accidents at the Foxhall Road exit.

#### **RECOMMENDATION**

Amend the approach lane lining so that the offside lane allows ahead movements, with right turn lanes developing from these. If this is not done, provide significant suitable advance signing advising drivers of the lane destinations at detailed design. Amend the lining on the circulatory carriageway westbound.

### **2.2 PROBLEM**

Location: Barrack Square exit arm

Summary: Risk of lane change accidents

There are two lanes on this exit, with a very short length for unfamiliar drivers to ascertain the correct lane to be in. This can lead to conflicts if drivers need to change lanes with a very short length to do so.

#### **RECOMMENDATION**

Provide a single lane on exit, developing the left turn lane immediately afterwards.

### **2.3 PROBLEM**

Location: Circulatory carriageway.

Summary: Risk of sideswipe accidents.

The layout indicates some narrow lanes throughout which can result in conflict.

#### **RECOMMENDATION**

Carry out swept path analysis to ensure that all vehicles can travel within the intended lanes and make adjustments as required.

**3 AUDIT STATEMENT**

We certify that this audit has been carried out in accordance with HD 19/15.

Signed:



S Hancock  
Audit Team Leader  
Safety Engineering Services Ltd

Date 22 November 2017

Signed:



C Berry  
Audit Team Member  
Safety Engineering Services Ltd

Date: 22 November 2017

**APPENDIX A**

**DRAWINGS AND DOCUMENTS PROVIDED FOR AUDIT**

10391-H-23 Rev F DRAFT	Offsite Highway Mitigation - Adastral Park Roundabout and Gloster Road Mitigation
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**APPENDIX B**





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# Adastral Park, Ipswich : Offsite Highway Mitigation to A12 / Anson Road / Eagle Way Roundabout

## Technical Note : Designer's Response to Road Safety Audits at Stage 1

28<sup>th</sup> November 2017

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### 1 Introduction

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Brookbanks Consulting Limited (BCL) is commissioned by Commercial Estates Group (CEG) Ltd to provide technical advice on viability and delivery on a proposed mixed use development at Adastral Park, Martlesham Heath, Suffolk. A Transport Assessment has been produced that has assessed the potential implications. A range of highway interventions has been subsequently identified.

For the Outline Planning Application, the following access strategy was offered:

- Traffic Signals Access off the A12 Dual Carriageway;
- Two simple priority junction accesses off Ipswich Road;
- Simple priority junction access off Gloster Road through the North-west Quadrant.

The Transport Assessment also identified that off-site highway mitigation measures were necessary at the following locations:

- A14 / A12 / A1156 Interchange;
- A12 / Newbourne Rd / Foxhall Road Roundabout;
- A12 / Barrack Square / Eagle Way Roundabout and Gloster Road / Barrack Square Priority Junction;
- A12 / Anson Road / Eagle Way Roundabout;
- A12 / A1214 Roundabout (Signal Timing Modification only);
- A1189 Heath Road / Foxhall Road Roundabout;
- A1189 Bixley Road / A1156 Felixstowe Road Bixley Roundabout;
- A1214 / A1189 Gyratory Junction.

All design options, at the request of Suffolk County Council, have been subject to a Stage 1 Road Safety Audit. This note sets out the findings of the audit for the A12 / Anson Road / Eagle Way Roundabout together with a designers response.

### 2 Designer's Response

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The Designers Response should be read in conjunction with the Road Safety Audit (ref SESL1721) as attached in the Appendix and revised Drawing No: 10391-HL-24E.

#### Problem 1

**Location:** A12 southbound approach.

**Summary:** Risk of sideswipes/collision with central island. The drawing indicates narrow lanes on approach which could result in sideswipes. There also appears to be insufficient width on the northeast quadrant of the circulatory carriageway to accommodate vehicles in three lanes. It is likely that vehicles in the left turn lane will encroach into nearside ahead lane on the circulatory carriageway, which could force them into the offside ahead lane, in conflict with vehicles there.

**Recommendation:** Carry out swept path analysis on this approach/path and ensure that the geometry can accommodate all manoeuvres.

*BCL Response: The lanes are 3.5m wide currently within the design. Swept path design and alterations if necessary can be carried out during the detailed design stage.*

## **Problem 2**

**Location:** Anson Road approach.

**Summary:** Risk of sideswipes/collision with central island. The drawing indicates there may be insufficient width on the southeast quadrant of the circulatory carriageway to accommodate 3 lanes and it is likely that vehicles in the left turn lane will encroach into ahead lane, which could force them into the offside ahead lane, in conflict with vehicles there.

**Recommendation:** Carry out swept path analysis and ensure that the geometry can accommodate all manoeuvres.

*BCL Response: The lanes are 3.5m wide currently within the design. Swept path design and alterations if necessary can be carried out during the detailed design stage.*

## **Problem 3**

**Location:** A12 northbound approach.

**Summary:** Confusing lane markings could result in lane change accidents. All 3 lanes are marked as ahead lanes. However, the offside lane is actually a right turn only lane, and as the possible default offside lane (the tie-in is beyond the drawing extents) this is likely to result in lane changes on approach and also possibly last-minute on the circulatory carriageway itself when drivers are suddenly presented with a right turn arrow.

**Recommendation:** Amend the approach lane lining so that the offside lane allows ahead movements, with right turn lanes developing from these. If this is not done, provide significant suitable advance signing advising drivers of the lane destinations at detailed design.

*BCL Response: The TSM Chapter 5 Para. 8.31 Recommends avoiding right turn arrows on the approach to the roundabout. The lining and directions can be amended during the detailed design of the junction in consultation with the Highway Authority with the appropriate advanced signing.*

## **3 Limitations**

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Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

The benefits of this report are provided to Carlyle Land Ltd and Commercial Estates Group for the proposed development on Land at Adastral Park.

Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

## Appendix A: Road Safety Auditor's Report

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# **Safety Engineering Services Ltd**

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Land South and East of Adastral Park, Ipswich  
**Martlesham Roundabout**

**Stage 1 Road Safety Audit**

# Stage 1 Road Safety Audit

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Report Number	Client Reference	Report Status
SESL1721	10391	FINAL

## 1 INTRODUCTION

This report presents the findings of a Road Safety Audit carried out on off-site highway mitigation works proposed to enable site access to land to the south and east of Adastral Park, Ipswich, at the request of Brookbanks Consulting Ltd. The development will consist of up to 2000 dwellings, local centres, with facilities to serve recreation and education.

The audit was carried out by the following:

S Hancock	Road Safety Audit Team Leader Safety Engineering Services Ltd
C Berry CertComp	Road Safety Audit Team Member Safety Engineering Services Ltd

The audit took place on Friday 17th November and comprised a desktop study of the plans provided and a drive and walk through of the site by both team members. During the site visit, the weather was fine and the road surfaces were dry. Traffic at the time of the audit was moderate to heavy.

A list of drawings and documents provided for the purpose of audit is in Appendix A. The locations of any problems have been identified on an annotated drawing in Appendix B.

The main terms of reference of the audit are as described in HD19/15. The team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria.

This Road Safety Audit focuses on the proposed amendments to the A12 Ring Road/Eagle Way/Anson Road roundabout, comprising signalisation of the north and southbound entry arms and an additional approach lane on Anson Road.

## **2 ROAD SAFETY AUDIT FINDINGS**

### **2.1 PROBLEM**

Location: A12 southbound approach.

Summary: Risk of sideswipes/collision with central island.

The drawing indicates narrow lanes on approach which could result in sideswipes. There also appears to be insufficient width on the northeast quadrant of the circulatory carriageway to accommodate vehicles in three lanes. It is likely that vehicles in the left turn lane will encroach into nearside ahead lane on the circulatory carriageway, which could force them into the offside ahead lane, in conflict with vehicles there.

#### RECOMMENDATION

Carry out swept path analysis on this approach/path and ensure that the geometry can accommodate all manoeuvres.

### **2.2 PROBLEM**

Location: Anson Road Approach.

Summary: Risk of sideswipes/collision with central island.

The drawing indicates there may be insufficient width on the southeast quadrant of the circulatory carriageway to accommodate 3 lanes and it is likely that vehicles in the left turn lane will encroach into ahead lane, which could force them into the offside ahead lane, in conflict with vehicles there.

#### RECOMMENDATION

Carry out swept path analysis and ensure that the geometry can accommodate all manoeuvres.

### **2.3 PROBLEM**

Location: A12 northbound approach.

Summary: Confusing lane markings could result in lane change accidents.

All 3 lanes are marked as ahead lanes. However, the offside lane is actually a right turn only lane, and as the possible default offside lane (the tie-in is beyond the drawing extents) this is likely to result in lane changes on approach and also possibly last-minute on the circulatory carriageway itself when drivers are suddenly presented with a right turn arrow.

#### RECOMMENDATION

Amend the approach lane lining so that the offside lane allows ahead movements, with right turn lanes developing from these. If this is not done, provide significant suitable advance signing advising drivers of the lane destinations at detailed design.



**3 AUDIT STATEMENT**

We certify that this audit has been carried out in accordance with HD 19/15.

Signed:



S Hancock  
Audit Team Leader  
Safety Engineering Services Ltd

Date 22 November 2017

Signed:



C Berry  
Audit Team Member  
Safety Engineering Services Ltd

Date: 22 November 2017

**APPENDIX A**

**DRAWINGS AND DOCUMENTS PROVIDED FOR AUDIT**

10391-H-24 Rev E DRAFT	Offsite Highway Mitigation - Martlesham Road Roundabout Mitigation
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**APPENDIX B**

**CONTRACT MANAGEMENT (CMA)**  
 The Client is responsible for the management of the contract. The Client is responsible for the management of the contract. The Client is responsible for the management of the contract.

Arm	Entry Path Width (m)	Entry Path Length (m)	Exit Path Width (m)	Exit Path Length (m)	Queue Length (m)	Queue Capacity (Veh)	Queue Delay (s)	Queue Delay (h)
A12 (Left Hand Drive)	10.5	20	10.5	20	25	30	33	0.0001
A12 (Right Hand Drive)	10.5	20	10.5	20	25	30	33	0.0001
A12 (Left Hand Drive)	10.5	20	10.5	20	25	30	33	0.0001
A12 (Right Hand Drive)	10.5	20	10.5	20	25	30	33	0.0001

- NOTES:**
- All road works from this drawing.
  - All dimensions are in metres unless otherwise stated.
  - Brookbanks Consulting Ltd has prepared this drawing for the client. The client is responsible for the management of the contract. The client is responsible for the management of the contract.
  - No part of this drawing may be copied or duplicated without the express permission of Brookbanks Consulting.

- KEY:**
- Site Boundary
  - Highway Boundary
  - Stopping Sight Distance on Approach
  - Junction Intensity
  - Signal Head

**Brookbanks**  
 1011-1013, 1015, 1017, 1019, 1021, 1023, 1025, 1027, 1029, 1031, 1033, 1035, 1037, 1039, 1041, 1043, 1045, 1047, 1049, 1051, 1053, 1055, 1057, 1059, 1061, 1063, 1065, 1067, 1069, 1071, 1073, 1075, 1077, 1079, 1081, 1083, 1085, 1087, 1089, 1091, 1093, 1095, 1097, 1099, 1101, 1103, 1105, 1107, 1109, 1111, 1113, 1115, 1117, 1119, 1121, 1123, 1125, 1127, 1129, 1131, 1133, 1135, 1137, 1139, 1141, 1143, 1145, 1147, 1149, 1151, 1153, 1155, 1157, 1159, 1161, 1163, 1165, 1167, 1169, 1171, 1173, 1175, 1177, 1179, 1181, 1183, 1185, 1187, 1189, 1191, 1193, 1195, 1197, 1199, 1201, 1203, 1205, 1207, 1209, 1211, 1213, 1215, 1217, 1219, 1221, 1223, 1225, 1227, 1229, 1231, 1233, 1235, 1237, 1239, 1241, 1243, 1245, 1247, 1249, 1251, 1253, 1255, 1257, 1259, 1261, 1263, 1265, 1267, 1269, 1271, 1273, 1275, 1277, 1279, 1281, 1283, 1285, 1287, 1289, 1291, 1293, 1295, 1297, 1299, 1301, 1303, 1305, 1307, 1309, 1311, 1313, 1315, 1317, 1319, 1321, 1323, 1325, 1327, 1329, 1331, 1333, 1335, 1337, 1339, 1341, 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2007, 2009, 2011, 2013, 2015, 2017, 2019, 2021, 2023, 2025, 2027, 2029, 2031, 2033, 2035, 2037, 2039, 2041, 2043, 2045, 2047, 2049, 2051, 2053, 2055, 2057, 2059, 2061, 2063, 2065, 2067, 2069, 2071, 2073, 2075, 2077, 2079, 2081, 2083, 2085, 2087, 2089, 2091, 2093, 2095, 2097, 2099, 2101, 2103, 2105, 2107, 2109, 2111, 2113, 2115, 2117, 2119, 2121, 2123, 2125, 2127, 2129, 2131, 2133, 2135, 2137, 2139, 2141, 2143, 2145, 2147, 2149, 2151, 2153, 2155, 2157, 2159, 2161, 2163, 2165, 2167, 2169, 2171, 2173, 2175, 2177, 2179, 2181, 2183, 2185, 2187, 2189, 2191, 2193, 2195, 2197, 2199, 2201, 2203, 2205, 2207, 2209, 2211, 2213, 2215, 2217, 2219, 2221, 2223, 2225, 2227, 2229, 2231, 2233, 2235, 2237, 2239, 2241, 2243, 2245, 2247, 2249, 2251, 2253, 2255, 2257, 2259, 2261, 2263, 2265, 2267, 2269, 2271, 2273, 2275, 2277, 2279, 2281, 2283, 2285, 2287, 2289, 2291, 2293, 2295, 2297, 2299, 2301, 2303, 2305, 2307, 2309, 2311, 2313, 2315, 2317, 2319, 2321, 2323, 2325, 2327, 2329, 2331, 2333, 2335, 2337, 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