

# Appendix C – ChandlerKBS Option Assessment Cost Report (August 2019)



# CHANDLERKBS

Option Assessment

Armagh East Link

WSP / Department for Infrastructure

August 2019



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## Appendices

Appendix A – 2017-01-05 Information for Cost Estimates-Issued to  
ChandlerKBS

Appendix B – ChandlerKBS High Level Cost Summary

Version		Prepared by	Checked by	Issue date
V1	Draft for discussion.	K Michie	P O'Hagan	31/10/2016
V2	Revision following review of assumptions by Mouchel ( <b>now WSP</b> ).	P Kelly	K Michie	01/12/2016
V3	Revision following further review of assumptions by Mouchel ( <b>now WSP</b> ).	K Michie	P O'Hagan	07/12/2016
V4	Revision following further review of assumptions by Mouchel ( <b>now WSP</b> ) and inclusion of Alignment 50.	P Kelly	K Michie	13/01/2017
V5	Revision of cost estimate for SAR 2 to take account of inflationary increase and changes in rates since Q3 2016.	K Michie	P O'Hagan	12/08/2019

## 1. Introduction

ChandlerKBS has been requested by Mr Colin Bell of WSP to update cost estimates of route options for Armagh East Link that had been previously prepared, to take account of inflationary increases and rate changes since the previous base date of Q3 2016.

It is envisioned that each of the four proposed options that have been assessed will improve traffic movements in and around Armagh by connecting the A28 Markethill Road in the south to the A3 Portadown Road in the north. The Old Preferred Route, Alignment 12, Alignment 16 and Alignment 50 will be single carriageway with no climbing lanes.

The following report details the information used in the assessment of each proposed option, with any assumptions that have been made by ChandlerKBS and agreed with WSP. No further design information is available at this stage, therefore we have included considerable assumptions in terms of the scope of the work. It is important to note that these estimates do not incorporate any changes in design, scope, quantities or changes to the assumptions since in January 2017.

The rates, prices and costs in this report are exclusive of VAT,

The base date of this report is Q2 2019 and there is no allowance for future inflation.

## 2. Options to be Assessed

WSP previously provided ChandlerKBS with details of four high level route options for Armagh East Link. These are listed below and include the Preferred Option from 2007, which is now termed the Old Preferred Option:

1. Old Preferred Option
2. Alignment 12
3. Alignment 16
4. Alignment 50

ChandlerKBS had been supplied drawings by WSP showing the Old Preferred Route, Alignment 12 and Alignment 16.

In January 2017 WSP produced a revised matrix, 2017-01-05 Information for Cost Estimates-Issued to ChandlerKBS, which presented the revised assumptions and also re-introduced Alignment 50 for inclusion in our January 2017 cost estimates. This matrix is included in **Appendix A**.

### 3. Basis of Assessment

#### 3.1. Information Received

WSP provided the following information which has been used to assess the potential costs:

- Drawing 1064968-A-D-0836 Ver. 01 – Armagh East Link Option Overview.
- Drawing 1064968-A-S-003 Ver. B – Armagh East Link TNI Land Folio Assessment.
- Matrix 2017-01-05 Information for Cost Estimates-Issued to ChandlerKBS

Costs for the options are based on the overall areas of the carriageway and footway with costs per m<sup>2</sup> extracted from our internal cost database. Where information has been provided we have carried out a more detailed assessment of the particular element in lieu of database costs.

ChandlerKBS has used its internal cost database to estimate the cost of the construction elements, except where indicated below. This has been necessary due to the level of design information available.

#### 3.2. Route Length and Carriageway Width

The route length has been advised by WSP, along with the width of the carriageway, 3.65m in each direction. WSP had advised that none of the routes under consideration have climbing lanes.

#### 3.3. Footways and Cycleways

The width of the shared footways and cycleways, 3m in each direction, had been advised by WSP and included in the overall pavement area of each option.

#### 3.4. Junction Strategy

WSP previously confirmed that all four options under consideration will each include three at grade roundabouts. Due to the lack of design and detail made available ChandlerKBS has included a nominal allowance, based on historical cost data, for each roundabout. This allowance is consistent throughout each of the three options.

### 3.5. Preliminaries and Traffic Management

Preliminaries have been included according to cost data in ChandlerKBS' cost database with includes an element of traffic management. Additional traffic management has been included for the urban sections on a rate per kilometre, based on historic data. The additional traffic management costs have been applied to the Old Preferred Route and Alignment 16.

### 3.6. Earthworks

WSP had provided cut and fill quantities for each route which ChandlerKBS has developed into a high level bill of quantities. WSP had advised the percentage of material to be assumed acceptable for re-use is 25%. This assumption has been applied throughout the options. This has an impact on the volumes of the material that need to be imported and disposed of in each option.

The earthwork costs also include an allowance for rock, contaminated material and unforeseen ground conditions. This is prudent due to the lack of design information at this stage.

### 3.7. Street Lighting

WSP had advised that all of the options are to be lit at junctions only, with the exception of the Old Preferred Option which will be fully lit.

Due to the high level of design it is not possible to fully quantify the lighting requirements. We have reviewed historic data to obtain relevant costs per m<sup>2</sup> of pavement for schemes that are lit only at junctions or are fully lit.

As more design information becomes available this element can be reviewed and the cost assessed in greater detail.

### 3.8. Structures

WSP had specified that there will be one under bridge on Option 12, Option 16 and Option 50. Due to the lack of design and detail ChandlerKBS has costed these on a cost per m<sup>2</sup> basis. The plan area for under bridges is based on a nominal span and width. When more specific information is available the cost per type of structure or individual structures can be assessed in more detail.



WSP had specified that there will be a 500m long retaining wall on the Old Preferred Option. Due to the lack of design and detail ChandlerKBS has costed these on a cost per m<sup>2</sup> basis. WSP had advised that the retaining wall will be less than 1m high.

WSP had specified that there will be two precast box culverts (4.6m x 2.3m) on the Old Preferred Route and four precast box culverts (4.6m x 2.3m) on Alignment 12, Alignment 16 and Alignment 50. These have been included in the cost estimate.

### 3.9. Land Take and Land Costs

WSP had advised on the land take required for the four options and on whether the land required is urban, rural or a combination of the two. WSP had advised of the proportion of urban and rural land.

The following allowances and assumptions have been made in respect of the land take:

- Old Preferred Option
  - 6.17 ha required.
  - 100% residential / development.
- Alignment 12
  - 10.02 ha required.
  - 100% rural / agricultural.
- Alignment 16
  - 8.62 ha required.
  - 58% rural / agricultural and 42% residential / development.
- Alignment 50
  - 14.25 ha required.
  - 100% rural / agricultural.

WSP had advised the following percentage of land is already owned by the Department for Infrastructure:

- Old Preferred Option – 45%
- Alignment 12 – 7%
- Alignment 16 – 15% (7% of rural / agricultural and 8% of residential / development).
- Alignment 50 – 5%

This has been factored into ChandlerKBS' cost assessment.

In the absence of advice from WSP or the Department for Infrastructure, ChandlerKBS reviewed, in January 2017, the current market for land in and around Armagh. These costs per hectare have been used in the high level assessments, are consistent over all options and to be reviewed when more detailed information is available. The cost of agricultural land was revised to £86.45k per hectare, based on land on the market in the latter half of 2016. No further review of the land market has been carried out in relation to this update of the cost estimates.

### 3.10. Properties to be Purchased and Demolished (Compensation)

WSP had advised that none of the options under current consideration have properties that will have to be purchased and demolished by the Department for Infrastructure.

### 3.11. Realignment of Existing Local Roads

All of the proposed options involve the realignment of the existing local roads.

Based on the lengths and widths detailed by WSP, ChandlerKBS has provided costs for realigning the existing roads which include the new road construction, tying in to the existing road and planing of the existing redundant side road. The overall earthworks for each option is deemed to include for any stopping up or other associated earthworks.

### 3.12. Roads Already Constructed

WSP had advised that all four options include small sections of road already constructed, as detailed below:

- Old Preferred Route – 550m
- Alignment 12 – 480m
- Alignment 16 – 480m
- Alignment 50 – 480m

ChandlerKBS has removed the sections of road already constructed from the overall length of each option, however, costs have been included for planing off and re-surfacing the existing carriageway.

### 3.13. Preparation, Supervision and Design

Based on data in ChandlerKBS' database allowances of 9% for design/preparation and 5% for supervision have been applied to the total value of the construction works. These percentages are considered to be suitable for a scheme of this nature at an early stage of the cost planning process.

### 3.14. Optimism Bias and Risk

Construction risk / contingency is included at a rate per m<sup>2</sup> based on data obtained from ChandlerKBS' database of highway costs in Northern Ireland, the Republic of Ireland and the mainland UK.

Optimism bias (OB) is included at 44% of all costs (excluding land and compensation), which is the upper limit of the recommended range for standard civil engineering schemes, according to the Green Book guidance.

#### 4. Assessment of Proposed Options

The following table details the high level cost options assessed for the four options identified by WSP. Further details are included in **Appendix B**, ChandlerKBS High Level Cost Summary.

##### Old Preferred Route, Alignment 12, Alignment 16 and Alignment 50

	OPR	Alignment 12	Alignment 16	Alignment 50
Option Length	2.23km	2.95km	2.86km	3.39km
Route Constructed	0.55km	0.48km	0.48km	0.48km
Option Length (net)	1.68km	2.47km	2.38km	2.91km
Preliminaries / TM	£ 1,717,403	£ 1,792,917	£ 2,021,272	£ 2,108,888
Land / Compensation	£ 2,012,612	£ 818,963	£ 2,119,346	£ 1,170,202
Construction Costs	£ 7,454,430	£ 15,375,197	£ 12,697,614	£ 18,760,766
<b>Sub Total</b>	<b>£ 11,184,446</b>	<b>£ 17,987,077</b>	<b>£ 16,838,231</b>	<b>£ 22,039,855</b>
Preparation, Supervision and Design	£ 1,320,174	£ 2,421,402	£ 2,095,082	£ 2,936,163
Statutory Authorities	£ 125,618	£ 185,430	£ 178,084	£ 218,108
<b>Sub Total</b>	<b>£ 12,630,238</b>	<b>£ 20,593,909</b>	<b>£ 19,111,398</b>	<b>£ 25,194,127</b>
Risk and OB (OB at 44%)	£ 5,880,780	£ 10,485,658	£ 9,190,490	£ 12,669,729
<b>Total</b>	<b>£ 18,511,018</b>	<b>£ 31,079,567</b>	<b>£ 28,301,888</b>	<b>£ 37,863,855</b>

The options reviewed can be ranked as per the following table (1 = Lowest Cost and 4 = Highest Cost):

Option	Total Cost	Rank
Old Preferred Route	£ 18.51 million	1
Alignment 16	£ 28.30 million	2
Alignment 12	£ 31.08 million	3
Alignment 50	£ 37.86 million	4



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## Appendix A

### 2017-01-05 Information for Cost Estimates-Issued to ChandlerKBS

Pricing Area	OPR	Alignment 12	Alignment 16	Alignment 50
<b>Highways</b>				
Route Length	2226m	2954m	2856m	3390m
Carriageway Type	Single	Single	Single	Single
Carriageway Width (3.65m lane width each direction)	7.3m	7.3m	7.3m	7.3m
Additional climbing lanes	0m	0m	0m	0m
Shared/Adjacent Use Footway/Cycleway (each direction)	3m	3m	3m	3m
Hardshoulder / Hardstrip	0m	0m	0m	0m
Verge widths (each direction)	1m	1m	1m	1m
Total width	14.3m	14.3m	14.3m	14.3m
Side Roads Re-aligned	443m	1121m	323m	811m
Length of Route Constructed (if applicable)	550m planing and resurfacing included in estimate.	480m planing and resurfacing included in estimate.	480m planing and resurfacing included in estimate.	480m planing and resurfacing included in estimate.
Fully lit (F) or Junctions only (J)	F	J - NB first 500m already lit	Partial - NB first 500m already lit J at A28 already lit F CH1650-2850	J - NB first 500m already lit
Signalised Junctions	0	0	0	0
At Grade Roundabouts	3	3	3	3
<b>Lands</b>				
Location	Urban	Rural	Rural 58% / Urban 42% Rural CH0-1650 / Urban CH1650-2850	Rural
Area of land required	61729m2	101863m2	86278m2	142486m2
% of Land to be Purchased	55%	93%	85%	95%
% of Land owned by TNI	45%	7%	15%	5%
<b>Structures</b>				
Retaining Walls	500m (less than 1m height)	0m	0m	0m
Underbridges	0	1	1	1
Overbridges	0	0	0	0
Watercourse Culverts	2	4	4	4
<b>Earthworks</b>				
Earthworks - Cut	69281m3	167680m3	117039m3	264273m3
Earthworks - Fill	14965m3	116863m3	102454m3	184065m3
Excavation of topsoil (300mm)	10185m3	28420m3	22001m3	40609m3
Excavation (excluding topsoil)	59096m3	139260m3	95038m3	223664m3
Percentage of reusable material	25%	25%	25%	25%
Deposition of reusable material (volume)	17320m3	41920m3	29260m3	66068m3
Disposal of unacceptable Material	54316m3	125760m3	87779m3	198205m3
Imported Acceptable Material volume	0m3 (2355m3 surplus)	74943m3	73194m3	117997m3
% Allowance for rock, Contaminated Material etc	50%	50%	30%	30%



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## **Appendix B**

### **ChandlerKBS High Level Cost Summary**

August 2019

Project Title

Armagh East Link - High Level Cost Summary



Client

TransportNI / Department for Infrastructure

High Level Cost Summary

	Old Preferred Option	Alignment 12	Alignment 16	Alignment 50
Single / Dual Carriageway	Single	Single	Single	Single
Location	Northern Ireland	Northern Ireland	Northern Ireland	Northern Ireland
Rural / Urban	Urban	Rural	Rural / Urban	Rural / Urban
Length (m)	1676	2474	2376	2910
Carriageway width (m - each direction)	3.65	3.65	3.65	3.65
Climbing lane width (m - each direction)	0	0	0	0.00
Climbing lane percentage (% - each direction)	0%	0%	0%	0%
Cyclepath width (m - each direction)	3	3	3	3
Central reserve width (m)	0	0	0	0
Hard strip / shoulder width (m)	0.5	0.5	0.5	0.5
Total pavement width	14.30	14.30	14.30	14.30
Number of properties to be purchased / demolished	0	0	0	0
Length of local roads / side roads to be realigned (m)	443	1121	323	811
Estimate Base Date	Q2 2019	Q2 2019	Q2 2019	Q2 2019
Preliminaries / Traffic Management	£ 1,717,403	£ 1,792,917	£ 2,021,272	£ 2,108,888
Land Costs and Compensation	£ 2,012,612	£ 818,963	£ 2,119,346	£ 1,170,202
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<b>Total</b>	<b>£ 18,511,018</b>	<b>£ 31,079,567</b>	<b>£ 28,301,888</b>	<b>£ 37,863,855</b>
Cost per km (£m)	£ 11.04	£ 12.56	£ 11.91	£ 13.01
Cost per km (£m), excluding Risk, OB and Structures	£ 7.19	£ 8.09	£ 7.80	£ 8.46





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