

local transport projects 


traffic engineering and transport planning

North Lincolnshire Council

**Brigg Link Road
Highways Masterplan 2021**

September 2021

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Brigg Link Road Highways Masterplan 2021

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Client Commission

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As part of our commitment to quality the following team of transport professionals was assembled specifically for the delivery of this project. Relevant qualifications are shown and CVs are available upon request to demonstrate our experience and credentials.

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BRIGG LINK ROAD HIGHWAYS MASTERPLAN 2021

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I. INTRODUCTION

I.1 Document Status

- 1.1.1 In September 2016, Local Transport Projects (LTP) was commissioned by North Lincolnshire Council (NLC) to develop an evidence-based Highways Masterplan to identify a solution for the delivery of a proposed Link Road in the north of Brigg to both support the Housing and Employment Land Allocations Development Plan Document (DPD), that was adopted in March 2016, and facilitate the identified proposed housing development.
- 1.1.2 The resultant LTP document '*Brigg Link Road Highways Masterplan*' (LTP, 2016) provides the final report from the 2016 commission and since then LTP has also produced a number of additional reports including the '*Brigg Link Road Preliminary Design Report*' (LTP, 2017) and '*Mini-Roundabout and Link Road West Preliminary Design Report*' (LTP, 2018) that provide further detail on the proposed junctions with the link road at Wrawby Road and Grammar School Road, respectively.
- 1.1.3 This document provides a 2021 update to the 2016 report to reflect revised development timescales and additional assessment work that is described in the project scope below.

I.2 Project Scope

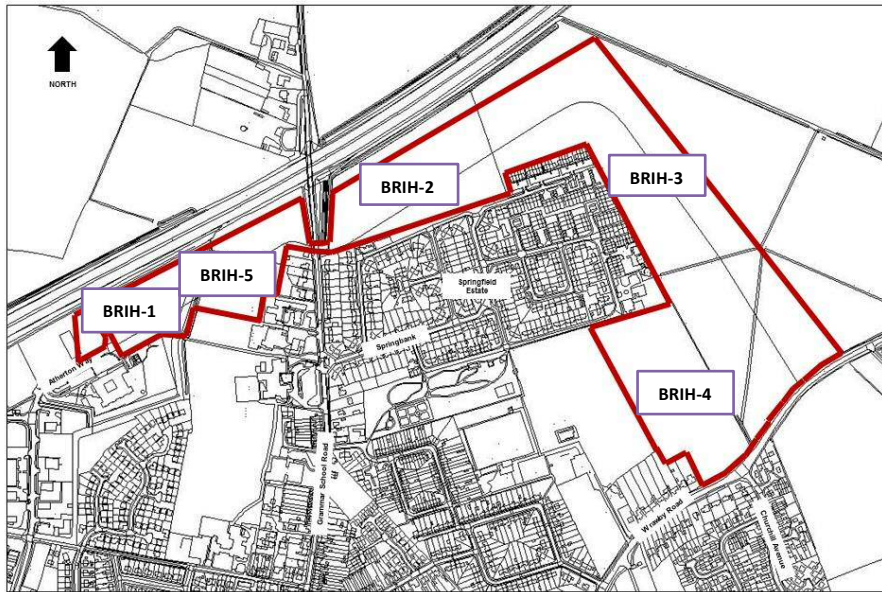
- 1.2.1 The 2016 study included assessment of the following:
- the location and number of vehicular accesses onto Wrawby Road and potential junction arrangements;
 - connections into the Springfield Estate for vehicles, pedestrians and cyclists;
 - interfaces between the Link Road and Grammar School Road to facilitate development on both sides either separately or concurrently, without prejudicing future development;
 - analysis of the potential traffic impact of residential development from Grammar School Road on Grammar School Road and the traffic signal junction at Barnard Avenue/Wesley Road;
 - the linkages between Grammar School Road and Atherton Way;
 - the impact of topography and vertical alignment on proposed junction arrangements;
 - preliminary costings for the Link Road including key junctions with the existing highway network;
 - potential risks in the development and delivery of the Link Road that would have an overall impact on the development with appropriate mitigation measures; and,
 - a phasing plan for the delivery of the link road, junction arrangements and housing.

- 1.2.2 The 2016 study was also informed through a meeting with representatives of a number of the land packages (BRIH-2, BRIH-3 and BRIH-4) that was facilitated by NLC at their offices on 16th September 2016. The purpose of the meeting was to obtain views on the proposed form and function of the Link Road together with additional information pertinent to the development of the Link Road proposals.
- 1.2.3 The 2021 study provides the following additional assessments and study updates:
- further review and assessment of using Grammar School Road as the primary access for housing development at the northern end of Grammar School Road (i.e. housing allocations BRIH-2 and BRIH-5);
 - feasibility design and assessment of potential priority junction arrangements to serve housing allocations BRIH-2 and BRIH-5;
 - feasibility design and assessment of a potential traffic signal-controlled crossroads junction at A18 Wrawby/Churchill Avenue to provide vehicular access to BRIH-4 from Wrawby Road;
 - assessment of junction performance of the proposed Wrawby Road access options over the timeframe of the Local Plan (i.e. to 2038) to take account of both forecast residential development traffic and likely redistribution of existing vehicle trips generated by other trip attractors that may be accessed from the completed Link Road, including the educational, retail and employment facilities on Atherton Way; and
 - an update of budget cost estimates and delivery timescales to reflect 2021 construction prices and the revised development timescales through to 2038.

1.3 Project Context

- 1.3.1 As part of the Local Development Framework (LDF), NLC produced a Housing and Employment Land Allocations Development Plan Document (DPD), which was adopted in March 2016. This includes five housing allocations in Brigg (824 dwellings) on the northern and eastern extents of the town as shown in Figure 1. A Link Road from Wrawby Road, across Grammar School Road to Atherton Way through the land allocations is considered an integral part of the development.

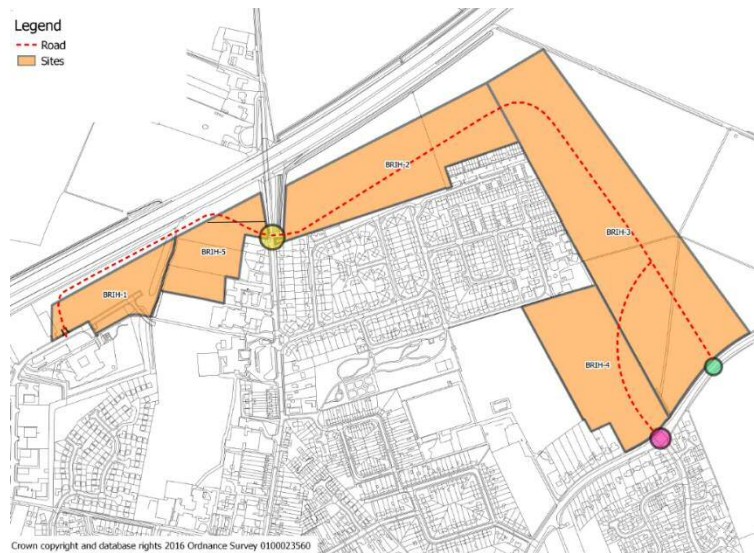
Figure 1: Brigg Housing Allocations



1.4 Link Road Function & Form

1.4.1 The function of the Link Road will be to provide, over time, a central “spine” route connecting all five land packages through a continuous highway incorporating high quality foot/cycleways and public transport access. Figure 2 provides an overview of the potential link road alignment between Wrawby Road and Atherton Way.

Figure 2: Potential Link Road Alignment



Source: NLC, 2016

1.4.2 It is important to state that the Link Road is not primarily intended to form a strategic highway link to provide relief or alternative routes from existing east-west routes, although there may be an element of traffic that chooses to utilise the Link Road to avoid travelling through Brigg town centre to access educational, retail and employment facilities on Atherton Way which is considered in Section 4 of this report.

- 1.4.3 The opportunity exists for the Link Road to form a route that wholly integrates with the development and surrounding area in term of quality of place. The form of the Link Road will be a matter for the developer’s design team, and it is envisaged the design will be pursuant to the good practice set out in Manual for Streets (MfS) and other relevant guidance.
- 1.4.4 It is envisaged that the detailed form of the Link Road will be defined within Transport Assessments and design proposals in support of future planning applications for the development sites.
- 1.4.5 For the purpose of this study, it has been assumed that the Link Road will be provided by the housing developers in order to accommodate their development proposals and align with the construction programme and timescales.

1.5 Housing Allocation Details

- 1.5.1 Table 1 provides details of the five housing allocations (BRIH-1 to BRIH-5) in terms of number of dwellings, proposed phasing, anticipated minimum/maximum build rates per annum and anticipated start years based on the updated timescales provided by NLC. All 5 No. housing allocations are expected to be complete by 2038.

Table 1: Housing Allocation Details

Housing allocation	Proposed dwellings	Proposed Timescale			Anticipated min/max build-rates (Dpa)	Anticipated construction from:	Proportion completed by 2038 (%)
		Phase 1 (2021-2026)	Phase 2 (2026-2031)	Phase 3 (2031-2038)			
BRIH-1	72				5/15	2026	100%
BRIH-2	186				6/30	2028	100%
BRIH-3	333				30/33	2028	100%
BRIH-4	152				30/32	2026	100%
BRIH-5	81				5/15	2026	100%

Source: Based on projections provided by NLC (January 2021)

- 1.5.2 Table 2 shows the required build rates to ensure completion of development in the 5 No. housing allocations by 2038 based on the assumed 2026 commencement year for sites BRIH-1, BRIH-4 and BRIH-5 and 2028 for the remaining sites (BRIH-2 and BRIH-3). These build rates have been used within the subsequent analysis and assessments within this study. It should be noted that build-rates will be ultimately determined from economic factors relating to the local housing market and the housing developer’s commercial strategy.

Table 2: Assumed Housing Allocation Build-Rates

Housing Allocation	Anticipated min/max build-rates (Dpa)	Assumed build rate (Dpa)
BRIH-1	5/15	12
BRIH-2	6/30	26.6
BRIH-3	30/33	30.3
BRIH-4	30/32	30.4
BRIH-5	5/15	13.5

Source: Based on projections provided by NLC (January 2021)

1.6 Proposed Link Road Objectives

- 1.6.1 At the project inception meeting on 24th August 2016, the proposed Link Road objectives as shown in Table 3 were discussed and agreed. The agreed objectives have been updated to reflect the amended development timescales up to 2038.

Table 3: Proposed Link Road Objectives

Proposed Link Road Objective	
1	Provides and/or supports transport connectivity across all modes between the 5 No. land packages (BRIH-1 to 5) in the Land Allocation Development Plan.
2	Maximises land available for development within the 5 No. land packages.
3	Supports a phased approach to the development of the 5 No. land packages within the refreshed local plan period (i.e. up to 2038).
4	Supports transport connectivity to wider area and facilities across all modes.
5	Aligns with the design principles of MfS with regards to layout and connectivity.
6	Minimises the traffic impacts (e.g. congestion, delay, road safety) on the adjacent highway network.
7	Minimises the environmental impacts (e.g. air quality, noise/vibration, surface water) on adjacent premises.
8	Provides a value for money solution in terms of both capital and operational costs.
9	Is deliverable, at reasonable cost, within the timescales required to meet the proposed development programme.

- 1.6.2 The objectives have been used throughout this project to support the assessment and appraisal of the various options for access location and junction type related to the proposed Link Road.

1.7 Structure of Report

- 1.7.1 Following this introduction, the report is divided into six further sections as follows:
- **Section 2** - an assessment of the various access options and the opportunities they provide to support the development of both the Link Road and 5 No. Land Packages;
 - **Section 3** - an assessment of the suitability of Grammar School Road to serve residential development;
 - **Section 4** - an assessment of the Wrawby Road access options based on the potential vehicle trip generation expected to utilise the proposed link road, including the residential allocations (BRIH-1 to BRIH-5) and the likely redistribution of vehicle trips to the Link Road;
 - **Section 5** - an assessment of the Grammar School Road/Link Road access options;
 - **Section 6** - a proposed implementation plan in terms of a phasing plan for the introduction of the Link Road, the estimated costs of the Link Road scheme and an assessment of the risks to delivery with potential mitigation measures; and
 - **Section 7** - the conclusions to the study.

2. ACCESS OPTIONS & OPPORTUNITIES

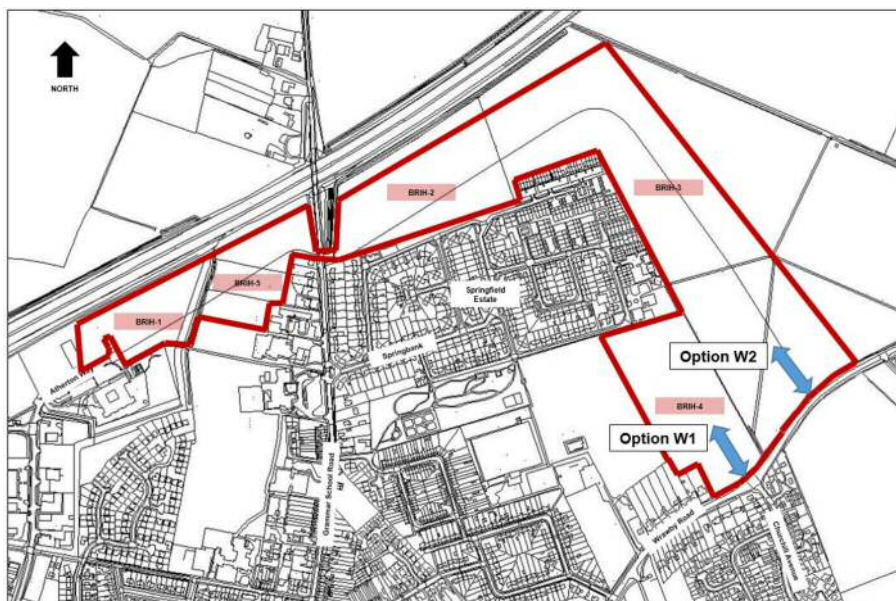
2.1 Introduction

2.1.1 This section of the report considers the site access options from Wrawby Road and Springfield Estate. A detailed appraisal associated with the potential for vehicular access via Grammar School Road has been undertaken separately in Section 3 of this report and has been considered against a range of factors, including available road widths, traffic flows, road safety, current guidance and junction capacity modelling.

2.2 Site Access Options from Wrawby Road

2.2.1 Figure 3 shows the proposed access options from Wrawby Road that would provide direct vehicular access to the BRIH-3 and BRIH-4 residential site allocations.

Figure 3: Site Access Options from Wrawby Road



- **Access Option W1** - access to the BRIH-4 site whilst incorporating the existing priority junction with Churchill Avenue;
- **Access Option W2** - access to the BRIH-3 site between Churchill Avenue and the eastern boundary of the site.

2.2.2 Table 4 identifies the key benefits and disbenefits of the access options from Wrawby Road and Table 5 provides an assessment of the options against the proposed Link Road objectives. It should be noted that the Wrawby Road access junction options have been formally assessed in Section 4 of this report.

Table 4: Wrawby Road Options - Benefits & Disbenefits

Option	Benefits	Disbenefits
W1 – opposite Churchill Avenue	<ul style="list-style-type: none"> • Low traffic speeds (existing 30mph speed restriction). • Reduced level difference between Wrawby Road and development land. • A roundabout option would provide an opportunity to create “gateway” feature on the A18 on the entry to Brigg. • Opportunity to improve existing cycle/pedestrian provision. • Proximity to town centre. • Direct cycle/pedestrian route to town centre. • Provides good access to developable area within both BRIH-3 & BRIH-4. 	<ul style="list-style-type: none"> • Proximity to existing properties during construction. • Potential increase in delays for traffic exiting Churchill Avenue and also on Wrawby Road. • Potential environmental impact to local residents.
W2 – between Churchill Avenue and eastern boundary of development site	<ul style="list-style-type: none"> • Provides good access to the developable area within BRIH-3. • Reduces potential traffic and environmental impacts at Churchill Avenue. 	<ul style="list-style-type: none"> • Large level difference (~2.0m) between Wrawby Road and development land. • Further from town centre than W1 (when considered as single point of access). • Less direct cycle/pedestrian route to town centre potentially requiring secondary cycle/pedestrian access (when considered as single point of access). • Would require long internal link/cul-de-sac to serve BRIH-4 (when considered as single point of access). • Higher traffic speeds (existing 40mph speed restriction).
W1 & W2	<p>In addition to the above:</p> <ul style="list-style-type: none"> • Supports development of BRIH-3 ahead of BRIH-4 whilst providing good access to BRIH-4 in the future. • Enhances block structure and internal connectivity within the site. 	<p>In addition to the above:</p> <ul style="list-style-type: none"> • Requires two junctions. • Introduces two new access points in close proximity on Wrawby Road. • Increases potential conflicts for main road traffic.

Table 5: Wrawby Road Options: Assessment against Link Road Objectives

Objective	Option W1	Option W2	Option W1 & W2
Provides and/or supports transport connectivity across all modes between the 5 No. land packages (BRIH-1 to 5) in the Land Allocation Development Plan.	<ul style="list-style-type: none"> • Link Road would connect all land packages and in particular provides good access to developable area within BRIH-4 without the need for long internal links/culs-de-sac. 	<ul style="list-style-type: none"> • Link Road would not directly access BRIH-4 requiring long internal links/culs-de-sac. 	<ul style="list-style-type: none"> • Link Road would connect all land packages and in particular provides good access to developable area within BRIH-4 without the need for long internal links/culs-de-sac.
Maximises land available for development within the 5 No. land packages.	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • Yes
Supports a phased approach to the development of 5 No. land packages within the refreshed local plan period (i.e. up to 2038).	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • Yes • Provides additional flexibility in allowing BRIH-3 to proceed without BRIH-4.
Supports transport connectivity to wider area and facilities across all modes.	<ul style="list-style-type: none"> • Closer proximity to town centre provides good connectivity to local destinations/facilities across all modes. 	<ul style="list-style-type: none"> • Less direct cycle/pedestrian route to town centre potentially requiring secondary cycle/pedestrian access. 	<ul style="list-style-type: none"> • Good connectivity to local destinations/facilities across all modes. • Opportunity to improve existing cycle/pedestrian provision at access junction.

Objective	Option W1	Option W2	Option W1 & W2
	<ul style="list-style-type: none"> Opportunity to improve existing cycle/pedestrian provision at access junction. 		
Minimises traffic impacts (e.g. congestion, delay, road safety) on the adjacent highway network.	Ghost island priority junction		
		<ul style="list-style-type: none"> No delay to Wrawby Road. Low/medium delay to development site. 	
	Roundabout		
	<ul style="list-style-type: none"> Low/medium delay on Wrawby Road. Low additional delay to Churchill Avenue. Low/medium delay to development site. Opportunity to improve existing cycle/pedestrian facilities. See Section 4 for results of the junction capacity assessments. 	<ul style="list-style-type: none"> Low/medium delay on Wrawby Road. Low/medium delay to development site. 	<ul style="list-style-type: none"> Low/medium delay on Wrawby Road. Low additional delay to Churchill Avenue. Low/medium delay to development site. Opportunity to improve existing cycle/pedestrian facilities. Increased traffic disruption during construction due to additional access.
	Signalised Junction		
<ul style="list-style-type: none"> Medium delay on Wrawby Road. Low additional delay to Churchill Avenue. Low/medium delay to development site. Potential to encourage traffic away from Grammar School Road on completion of the Link Road. Opportunity to improve existing cycle/pedestrian facilities. See Section 4 for results of the junction capacity assessments. 	<ul style="list-style-type: none"> Medium delay on Wrawby Road. Low/medium delay to development site. Potential to encourage traffic away from Grammar School Road on completion of the Link Road. Opportunity to improve existing cycle/pedestrian facilities. 	<ul style="list-style-type: none"> Medium delay on Wrawby Road. Low additional delay to Churchill Avenue. Low/medium delay to development site. Potential to encourage traffic away from Grammar School Road on completion of link. Opportunity to improve existing cycle/pedestrian facilities. Increased traffic disruption during construction due to additional access. Two closely spaced signalised junctions would need to be linked to ensure co-ordination. 	
Aligns with the design principles of Manual for Streets with regards to Layout and Connectivity:			
Provides connected/ permeable streets	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Link Road would not directly access BRIH-4 requiring long internal links/culs-de-sac. 	<ul style="list-style-type: none"> Yes – the opportunity to create a loop between W1 and W2 provides additional benefit in this respect.
Supports good external connectivity	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Less direct cycle/pedestrian route to town centre potentially requiring secondary cycle/pedestrian access. 	<ul style="list-style-type: none"> Yes
Provides a walkable neighbourhood	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Link Road would not directly access BRIH-4 requiring long internal links/culs-de-sac. 	<ul style="list-style-type: none"> Yes
Supports a block structure street pattern	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Yes – the opportunity to create a loop between W1 and W2 provides additional benefit in this respect.

Objective	Option W1	Option W2	Option W1 & W2
Reduces use of culs-de-sac	<ul style="list-style-type: none"> Yes 	<ul style="list-style-type: none"> Link Road would not directly access BRIH-4 requiring long internal links/culs-de-sac. 	<ul style="list-style-type: none"> Yes – the opportunity to create a loop between W1 and W2 provides additional benefit in this respect.
Minimises the environmental impacts (e.g. air quality, noise/vibration, surface water) on adjacent premises.	<ul style="list-style-type: none"> Potential low impact on adjacent premises with regards air quality and noise/vibration. 	<ul style="list-style-type: none"> Negligible. 	<ul style="list-style-type: none"> Potential low impact on adjacent premises with regards air quality and noise/vibration.
Provides a value for money solution in terms of both capital and operational costs.	<ul style="list-style-type: none"> Subject to further detailed assessments. 	<ul style="list-style-type: none"> Subject to further detailed assessments. 	<ul style="list-style-type: none"> Subject to further detailed assessments.
Is deliverable, at reasonable cost, within the timescales required to meet the proposed development programme.	<ul style="list-style-type: none"> Subject to further detailed assessments. Pending Statutory Undertakers requirements. 	<ul style="list-style-type: none"> Subject to further detailed assessments. Pending Statutory Undertakers requirements. Despite vertical alignment issues the overall scheme is relatively straight forward. 	<ul style="list-style-type: none"> Subject to further detailed assessments. Pending Statutory Undertakers requirements. The cost of access will be significantly more than W1 & W2 as one access.

2.2.4 Option W1, although increasing traffic movements at the existing Churchill Avenue junction, provides some additional benefits over Option W2 in terms of connectivity between land packages, maximisation of developable land, cycle/pedestrian access and alignment with MfS design principles.

2.2.5 Delivering Option W1 & W2 together offers similar benefits to W1 in terms of connectivity between land packages, cycle/pedestrian access and alignment with MfS design principles. Additionally, it provides greater flexibility in the phasing of the development of BRIH-3 and BRIH-4 allowing them to progress largely independently. It also helps create an improved block structure within the development and by introducing an internal loop between W1 and W2 it potentially reduces the length of internal links and the use of culs-de-sac that may be required to develop the site.

2.2.6 Notwithstanding the benefits, providing both W1 and W2 together would require the construction of two access junctions which would increase both capital and operational costs of the scheme.

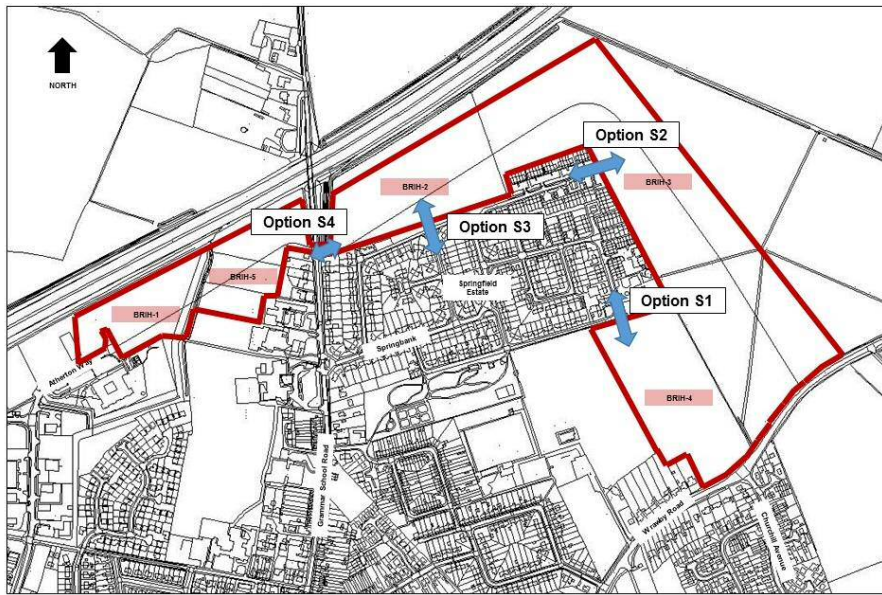
2.2.7 The proposed junction options on Wrawby Road and the results of the capacity assessments are discussed further in Section 4.

2.3 Site Access Options from Springfield Estate

2.3.1 Figure 4 shows the proposed access options to/from land packages BRIH-2, BRIH-3 and BRIH-4 from the Springfield Estate and include:

- **Option S1** – link via South View Avenue (opposite Horstead Avenue);
- **Option S2** – link via Western Avenue (eastern end);
- **Option S3** – link via Western Avenue (opposite Northern Avenue); and
- **Option S4** – access from Grammar School Road (see Section 3).

Figure 4: Site Access Options from Springfield Estate



2.3.2 Table 6 provides an assessment of the options against the proposed Link Road objectives.

Table 6: Springfield Estate Options: Assessment Against Link Road Objectives

Objective	Commentary
Provides and/or supports transport connectivity across all modes between the 5 No. land packages (BRIH-1 to 5).	<ul style="list-style-type: none"> Yes – would support improved connectivity between BRIH-2, 3 & 4 in particular for cycles/pedestrians.
Maximises land available for development within the 5 No. land packages.	<ul style="list-style-type: none"> Yes – proposed access options do not reduce availability of developable land.
Supports a phased approach to the development of 5 No. land packages.	<ul style="list-style-type: none"> Yes – would provide good secondary access points along the perimeter of the development site, in particular for cycles/pedestrians that could be developed in line with the development programme.
Supports transport connectivity to wider area and facilities across all modes.	<ul style="list-style-type: none"> Provides good facilities to improve access and connectivity to local schools and town centre in particular for cycles/pedestrians. Provide an opportunity to improve access and connectivity by public transport.
Minimises traffic impacts (e.g. congestion, delay, road safety) on the adjacent highway network.	<ul style="list-style-type: none"> Options S1, S2 and S3, if used as vehicular accesses, would potentially increase traffic on Springfield Estate roads in particular Springbank, South View Avenue and Horstead Avenue. Increased traffic on these roads would reduce local amenity and increase road safety risk. Option S4 would potentially support the removal of traffic from the Springfield Estate on Grammar School Road.
Aligns with the design principles of Manual for Streets with regards to Layout and Connectivity:	<ul style="list-style-type: none"> Yes – proposed access options provide for connected/permeable streets, walkable neighbourhoods and supports good external connectivity in particular for cycles/pedestrians. Provides an opportunity to improve access and connectivity by public transport.
Minimises the environmental impacts (e.g. air quality, noise/vibration, surface water) on adjacent premises.	<ul style="list-style-type: none"> If used as vehicular accesses would potentially increase air quality and noise/vibration impacts on Springfield Estate roads and Grammar School Road.
	<ul style="list-style-type: none"> Options S1, S2 & S3 have potential issues relating to land ownership that may impact on delivery costs and timescales.

Objective	Commentary
Provides a value for money solution in terms of both capital and operational costs.	<ul style="list-style-type: none"> In addition, the relocation of local garages would increase the cost of delivery of Option S2 as a vehicular access. However, delivery of Option 2 as a cycle/pedestrian access could be achieved without effecting the local garages.
	<ul style="list-style-type: none"> Notwithstanding land ownership issues, detailed design and Statutory Undertakers requirements Options S1, S3 and S4 are relatively simple schemes to implement.
Is deliverable, at reasonable cost, within the timescales required to meet the proposed development programme.	<ul style="list-style-type: none"> Options S1, S2 & S3 have potential issues relating to land ownership that may impact on delivery costs and timescales. In addition, the relocation of local garages would increase the cost of delivery of Option S2 as a vehicular access. However, delivery of Option 2 as a cycle/pedestrian access could be achieved without effecting the local garages.
	<ul style="list-style-type: none"> Notwithstanding land ownership issues, detailed design and Statutory Undertakers requirements Options S1, S3 and S4 are relatively simple schemes to implement.

- 2.3.3 The assessment shows that all options provide good accessibility to the development site packages and connectivity to wider area including town centre and local facilities particularly for cycles/pedestrians. The assessment also identified that the proposed access options might support future public transport access and connectivity to the proposed development.
- 2.3.4 The assessment recognises that access options S1, S2 and S3 potentially involves land that is not in the ownership of either NLC or the owners of BRIH-3 and BRIH-4. Although considered of value to the integrated development of BRIH-3 and BRIH-4 the delivery of these access options will be contingent on resolving land ownership issues and highway matters as part of future Transport Assessments.
- 2.3.5 Options S1, S2 and S3, if used as vehicular accesses, would potentially increase traffic on Springfield Estate roads in particular Springbank, South View Avenue and Horstead Avenue. It is considered that increased traffic on these roads would reduce local amenity and increase road safety risk. For this reason, it is considered inappropriate to utilise the proposed accesses for vehicular traffic and they should therefore be included within future design proposals as cycle/pedestrian, bus and emergency vehicle links.
- 2.3.6 Option S4 will provide the interface between the Link Road and Grammar School Road which is discussed further in Section 3.

3. DEVELOPMENT FROM GRAMMAR SCHOOL ROAD

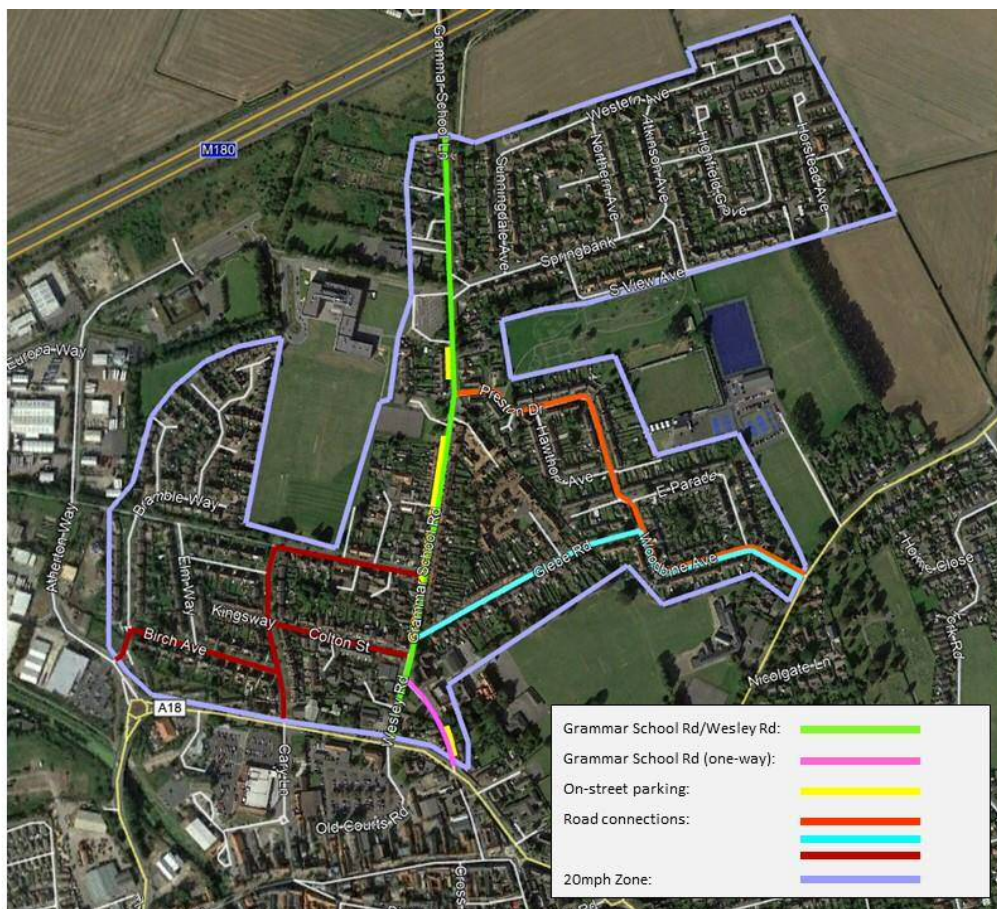
3.1 Introduction

- 3.1.1 Local residents have previously had concerns regarding the traffic impact on Grammar School Road relating to development proposals which featured primary vehicular access from Grammar School Road. In recent years, this has resulted in planning applications for housing development served by Grammar School Road being refused by NLC on highway grounds.
- 3.1.2 Consequently, a key consideration in the development of the housing allocation land packages is the resultant traffic impact on Grammar School Road. This principally applies to BRIH-2 and BRIH-5 that, through the Link Road proposals, would be directly accessed from Grammar School Road.
- 3.1.3 The 2016 Masterplan identified that it would be reasonable to introduce 60 new two-way vehicle trips in the AM peak hour on to Grammar School Road to return the traffic flows to the levels experienced when the road was used as the primary access and drop-off for Vale of Ancholme School (now known as The Vale Academy) captured during a traffic count survey undertaken in 2009. Based on a trip generation factor of 0.52 two-way trips per dwelling for a typical housing development, 60 two-way vehicle trips would equate to 115 properties that might potentially be accommodated on Grammar School Road without increasing the AM peak hour traffic levels beyond the captured 2009 traffic flows. These 115 residential properties represent the threshold level of development that the 2016 Masterplan identifies should take place within BRIH-2 & BRIH-5 from Grammar School Road, without the construction of additional links to either Atherton Way or Wrawby Road via the proposed Link Road.
- 3.1.4 The 2016 Masterplan also provided a traffic assessment of the Barnard Avenue/Wesley Road traffic signal junction that showed that the trips associated with these 115 dwellings together with traffic growth up to a Design Year of 2021 could be accommodated without significantly impacting the junctions' capacity. An update of this analysis is provided below that indicates that the junction would operate within capacity for a Design Year of 2038.
- 3.1.5 As part of this 2021 update, further investigation of standards and guidance has been undertaken to provide additional evidence to support the threshold development figure of 115 dwellings. This includes reference to NLC residential design standards and other national guidance on road capacity to identify the range of traffic flows that may be reasonably acceptable on Grammar School Road. The 2021 update also examines the collision history on Grammar School Road.

3.2 Grammar School Road Overview

3.2.1 Figure 5 shows the extents of Grammar School Road under consideration in the Masterplan, which includes an 830m length between M180 overbridge to the north and the A18 (Barnard Avenue) to the south. Prior to meeting Barnard Avenue, the two-way road that forms Grammar School Road becomes Wesley Road which connects with Barnard Avenue at a signalised crossroads junction. Grammar School Road continues in a south-easterly direction as a short one-way road section that joins Barnard Avenue at a simple priority T-junction.

Figure 5: Grammar School Road – 20mph zone, on-street parking and road connections



Source Imagery: Copyright Google Earth Pro (License Key-JCPMR5M58LXF2GE)

3.2.2 Grammar School Road forms part of a 20mph zone that commences immediately north of the Barnard Avenue junction and extends to the M180 overbridge together with all adjoining roads. The enforcement of the 20mph zone is supported through vertical traffic calming measures (e.g. speed humps/cushions) together with sections of on-street residential parking that serve to narrow the available carriageway requiring traffic to operate in a single direction at a time. The extents of the 20mph zone and locations where on-street parking that narrows the carriageway takes place is shown in Figure 5.

- 3.2.3 In addition to the traffic signal junction with Barnard Avenue, Grammar School Road also connects with the wider Brigg town centre at Wrawby Road to the east, Atherton Way to the west and a second access at the junction of Ash Grove and Barnard to the south. Although along traffic calmed residential roads these routes do provide alternative access opportunities to properties along Grammar School Road. The additional connection routes are indicated in Figure 5.
- 3.2.4 From the Ordnance Survey digital mapping for the area the carriageway width along Grammar School Road ranges from 5.8m to 7.5m with 545m (~65%) being generally wider than 6.5m and the 285m (~35%) section between Preston Drive and Colton Street being 5.8m to 6.0m. As previously stated, there are a number of sections along Grammar School Road where on-street parking takes place that reduces the effective carriageway to a single lane requiring vehicles to give way to one another. These sections are indicated in Figure 5 and comprise four sections along the main two-way length of Grammar School Road between Barnard Avenue and the M180 overbridge that create a total length 300m (~ 36%) of reduced carriageway width along the road. There is also a section of on-street parking on the length of Grammar School Road between Wesley Road and Barnard Avenue but as this is subject to a one-way traffic regulation order there is no impact on vehicle movement.

3.3 Existing Traffic Flows on Grammar School Road

- 3.3.1 Previously one of the main contentions for resisting development taking place off Grammar School Road has been the coincidence of additional traffic from a development and the volume of school traffic associated with the Vale of Ancholme School (now known as The Vale Academy) and the adjacent St Mary’s Catholic Primary School which is considered to be most prominent in the morning peak.
- 3.3.2 Traffic surveys undertaken in 2016 indicated that changes to school access on Grammar School Road, including the relocation of the primary vehicular access to the Vale of Ancholme School (now known as The Vale Academy) to Atherton Way had resulted in an overall net reduction of two-way traffic movements on Grammar School Road.
- 3.3.3 Due to the COVID-19 pandemic, representative traffic surveys cannot be undertaken currently to inform this updated study and therefore the most recent available traffic survey data has been utilised for the purposes of this report. Table 7 provides an analysis of traffic flows on Grammar School Road between 2009 and 2016.

Table 7: Comparison of Traffic Flows - 2009 to 2016

Direction	2009 (08:00-09:00)	2012 (08:00-09:00)		2016 (08:15-09:15)	Difference
	Grammar School Road (between Preston Drive and Springbank)	Grammar School Road ATC (between Redcombe Lane and Preston Drive)		Barnard Avenue/Wesley Road & Barnard Avenue/Grammar School Road	
		Average	Max		
Northbound	238	92	124	171	-67
Southbound	202	101	134	209	+7
Two-way	440	193	258	380	-60

- 3.3.4 The traffic flow data presented in Table 7 shows a reduction in two-way AM peak traffic movements of 60 vehicles (14%) since 2009. On the basis that the 2009 traffic flows (440 vehicles) represent an acceptable level of traffic on Grammar School Road it may be contended that, in the absence of other traffic generation on Grammar School Road, a residential development that generates a total of 60 vehicle arrivals/departures in the AM peak would not materially impact on the road’s performance, safety or amenity. Furthermore, if new highway infrastructure were to be introduced to provide alternative access/egress to Grammar School Road and the Springfield Estate then potential traffic reductions associated with that infrastructure may be taken up by further additional development traffic up to the 2009 threshold limit of 440 vehicles.
- 3.3.5 Based on a trip generation factor of 0.520 two-way trips per dwelling for housing development established utilising the industry-standard TRICS database, 60 trips would equate to 115 properties that might potentially be accommodated on Grammar School Road without increasing AM peak hour traffic flows beyond the 2009 values, as demonstrated in Table 8.

Table 8: Potential Traffic Impact of 115 Dwelling Development

Direction	2009	2016	115 dwellings		With Residential Development
			Vehicle Trip Rate	Vehicle Trips	
Northbound	238	171	0.106	+12	183
Southbound	202	209	0.414	+48	257
Two-way	440	380	0.520	+60	440

- 3.3.6 Typically, a development that generates a 60-vehicle two-way flow in the morning peak would not materially impact on the road’s performance or amenity. The addition of 12 northbound vehicle movements on Grammar School Road is the equivalent of 1 vehicle every 5 minutes and 48 additional southbound vehicles is the equivalent of 1 vehicle every 1 minute and 20 seconds and therefore the impact of the additional vehicle trips is not expected to create a significant road safety issue.
- 3.3.7 As mentioned previously, a residential development of circa 115 dwellings would be expected to result in traffic levels similar to those previously generated in 2009 and therefore the additional vehicle trips of a 115 dwelling development would not be expected to result in a significant road safety issue.

3.4 Standards and Guidance on Road Widths

- 3.4.1 The NLC Residential Design Guide (NLC, 2018) provides guidance on the requirements for new residential access roads, including recommended carriageway widths and the number of dwellings expected to be served via the various road types. It should be noted that this guidance is specifically relating to new developments and does not provide definitive standards, especially for existing developments/road networks. An overview of the characteristics for each road type within the NLC road hierarchy is outlined below:

- **Secondary Distributor Road (6.75m wide)** - The primary purpose of the Secondary Distributor Road is to provide a means of access to multiple sites and therefore frontage access to the road should be limited. The design guide (NLC, 2018) states that junctions onto SDR's should be limited, with roads providing access to individual sites. It is understood that this restriction may be relaxed in cases of large or high traffic generating concerns, however in these circumstances a higher standard of junction access would be required than normally expected for an individual site.
 - **Major Access Road (5.5m wide)** - A residential access road serving between 150 and 400 dwellings (from a cul de sac will be subject to satisfactory arrangements for emergency access). Additional numbers of dwellings will be considered subject to the provision of further satisfactory connections with priority roads and provided the traffic distribution and vehicle flows in the directions of these junctions are approximately equal. In all cases, a Transport Assessment would be required as part of the planning application submission.
 - **Minor Access Road (5.5m wide)** - A residential access road serving up to 150 dwellings (from a cul-de-sac will be subject to satisfactory arrangements for emergency access if considered to be appropriate). A Transport Assessment may be a requirement, but this will be dependent on the developments' location and sensitivity in impacting on the surrounding land uses. The local highway authority will establish the necessity and will notify the Developer accordingly.
 - **Shared Access Road (4.5m to 5.5m wide)** - Shared access roads may serve up to 35 dwellings in a cul-de-sac and up to 70 dwellings on a through road, provided vehicle flows are likely to be equally divided between both junctions.
- 3.4.2 From the above, Grammar School Road would be best categorised somewhere between a Major Access Road (5.5m) and Secondary Distributor Road (6.75m) capable of serving upwards of 400 dwellings. However, the effective carriageway over two-thirds of the road length is reduced to a single lane due to on-street parking activity and this will ultimately affect the operational capacity of the road thereby impacting on traffic delays as traffic flows increase.
- 3.4.3 There is limited UK guidance and research in relation to the road capacity of urban streets and narrow roads although the *'Design Manual for Roads and Bridges (DMRB): TA79/99 – Traffic Capacity of Urban Roads'* (HA: 1999) does provide some information on what may be considered potential ranges and thresholds for specific road types and situations. It is noted that TA79/99 is now withdrawn and has not been replaced within the DMRB, however, in the absence of other guidance/standards it is considered to provide a useful reference for assessing the potential capacity of urban streets through empirical methods.
- 3.4.4 TA79/99 provides a range of road design capacities by road type and carriageway width based on measurements taken from case study examples. Within TA79/99 the road type that most closely resembles Grammar School Road is the Urban All-Purpose Road: Category 4 (UAP4 that includes the following features:

- **General description:** Busy high street carrying predominately local traffic with frontage activity including loading and unloading.
- **Speed Limit:** 30mph
- **Side Roads:** More than 2 per km
- **Access to roadside development:** unlimited access to houses, shops & businesses
- **Parking and loading:** unrestricted
- **Pedestrian crossings:** frequent at grade
- **Bus stops:** at kerbside

3.4.5 In terms of road capacity TA79/99 provides a range of peak hour traffic flow capacities by road width for a type UAP4 road as shown in Table 9.

Table 9: DMRB TA79/99 – capacities for Road Type UAP4

Road Width (m)	Peak hour two-way traffic (vph)	Peak hour maximum one-way traffic (vph)
6.10	1,250	750
6.75	1,500	900
7.30	1,900	1140

Source: HA, 1999

3.4.6 In comparison to road type UAP4, Grammar School Road includes a number of features that are likely to further reduce the roads capacity, specifically:

- **Width:** Grammar School Road is 5.8m along its narrowest sections which is 5% less than the minimum UAP4 road width of 6.1m; and
- **On-street parking:** Grammar School Road is subject to on-street parking that effectively reduces the carriageway to a single lane for some 36% of its length.

3.4.7 Taking into account the proportions of reduced road width and extent of on-street parking, it may be reasonably estimated that, when compared with the values provided in TA79/99 the maximum two-way capacity of Grammar School Road is in the order of 450-500vph.

3.5 Impact on Barnard Avenue/Wesley Road Junction

3.5.1 An additional area of concern and a potential limiting factor on development from Grammar School Road is the performance of the Barnard Avenue/Wesley Road traffic signalised junction that provides the principal means of access to Grammar School Road and the existing residential areas that adjoin it.

3.5.2 The performance of the junction has been assessed in terms of Practical Reserve Capacity (PRC) using the LinSig v3 traffic signal model for the following scenarios during the AM peak hour:

- Base situation (2016);
- Future Year (2038) with forecast traffic growth; and

- Future Year (2038) with forecast traffic growth and development traffic associated with 115 dwellings.

3.5.3 The results of the modelling assessment are provided in Appendix 1 and summarised in Table 10.

Table 10: LinSig Modelling Results - Barnard Avenue/Wesley Road

Year	Scenario	TEMPRO Growth (%)	Development Traffic (PCU)	Practical Reserve Capacity (%)*
2016	Base	N/A	N/A	+23.2%
2038	With growth, without development	11.7%	N/A	+10.3%
2038	With growth, with development	11.7%	46**	+6.3%

* 90s signal cycle time

** proportion of development traffic going ahead/right from Wesley Road.

3.5.4 The LinSig v3 assessment indicates that the Barnard Avenue/Wesley Road junction would operate with 6.3% PRC in the 2038 Future Year with a 115-dwelling development served via Grammar School Road.

3.5.5 The operation of the Barnard Avenue/Wesley Road junction should therefore be not considered a limiting factor on the development of BRIH-2 and BRIH-5 up to 115 dwellings.

3.6 Assessment of Road Collisions

3.6.1 In terms of road collisions, analysis of Crashmap indicates that there have been five Personal Injury Collisions (PICs) involving six casualties on Grammar School Road in the 5-year period 2015-2019 including one PIC on Grammar School Road, three PICs at the Wesley Road/Barnard Avenue junction and one PIC at the Grammar School Road/Barnard Avenue junction. From this it is considered that there are no underlying road safety issues on Grammar School Road.

3.7 Public Transport (Bus) Access

3.7.1 Existing bus access to Grammar School Road and the Springfield Estate is limited with one public bus service currently serving the site. Service #91 (Brigg Town Loop) between Cary Lane and Poplar Drive taking in the town centre. There are currently 7 services per day on Tuesdays and Thursdays with 4 services on a Saturday. The route includes Grammar School Road and Springbank/Poplar Drive in the Springfield Estate.

3.7.2 To help support rural public transport, NLC also operate 'JustGo North Lincs' service (www.justgonorthlincs.co.uk) through which local residents may pre-book bus journeys to meet their specific requirement dependent on service availability and time of day. This service is available across North Lincolnshire, including residents of Grammar School Road and the Springfield Estate.

- 3.7.3 The 824 dwellings proposed within the development of the allocated BRIH sites provides a potential opportunity to introduce more economically sustainable bus services to serve both the development and the northern part of Brigg. The proposed Link Road will help maximise this opportunity providing a potential route for future bus services to serve all 5 No. land packages together with improved connections to Grammar School Road and the Springfield Estate. Indeed, the creation of through routes for buses to Grammar School Road and the Springfield Estate would directly support a more economically sustainable bus service to these areas. By providing improved routing and access options, the Link Road, and its potential public transport connections, would also support more efficient and effective operation of the 'JustGo North Lincs' service in this location.
- 3.7.4 To maximise these opportunities, the planning and design of the Link Road needs to reflect these requirements ensuring that the road alignment meet the needs of public transport vehicles and bus stops. MfS provides good guidance on these design principles.

3.8 Summary

- 3.8.1 Grammar School Road provides one of a number of access options to the residential areas to the north of Brigg that are bounded by Wrawby Road to the east, Barnard Avenue to the south and Atherton Way to the west. It has frontage residential development along most of its 830m length and a number of side roads that provide both access to other residential streets/areas together with connections to the wider local road network. Beyond Preston Drive, Grammar School Road provides a primary access to the Springbank residential area and various culs-de-sac developments serving an estimated 345 dwellings.
- 3.8.2 Grammar School Road is a two-lane single carriageway road with a carriageway width of between 5.8 and 7.5m with some 65% of the road being greater than 6.5m wide. Approximately 300m of the road (36%) is subject to on-street parking that reduces the affected lengths to one lane requiring opposing traffic to give-way to oncoming vehicles in order to negotiate the reduced carriageway width.
- 3.8.3 A comparison of traffic flows from 2009 and 2016 identifies that it would be reasonable to introduce 60 new two-way vehicle trips in the AM peak hour on to Grammar School Road to return the traffic to a two-way peak hour flow of 440 vph being the levels experienced when the road was used as the primary access and drop-off for Vale of Ancholme School (now known as The Vale Academy) as recorded in a 2009 traffic count for the road. These 60 trips would equate to 115 properties that might potentially be accommodated on Grammar School Road without increasing AM peak hour traffic beyond 2009 values. As a result of the current Covid-19 pandemic it has not been possible to obtain representative current (2021) traffic flows for Grammar School Road in order to update this assessment.

- 3.8.4 A review of NLC Residential Design Standards indicates that, notwithstanding traffic delays created by the on-street parking, Grammar School Road may be considered as having similar features to both a Major Access Road and Secondary Distributor Road capable of servicing residential developments of 400 dwellings and above.
- 3.8.5 Comparison with the highway capacities for similar infrastructure based on case study examples as referenced in TA79/99 (HA, 1999) together with consideration the impacts of the minimum road width and on-street parking on capacity indicates that a reasonable figure for the maximum peak hour capacity of Grammar School Road may be 450-500vph.
- 3.8.6 A traffic assessment of the Barnard Avenue/Wesley Road traffic signal junction that shows that the trips associated with these 115 dwellings together with traffic growth up to a Design Year of 2038 could be accommodated without significantly impacting the junctions' capacity.
- 3.8.7 An assessment of existing road collisions on Grammar School Road for the five-year period 2015-2019 indicates that there are no underlying road safety issues on Grammar School Road.
- 3.8.8 Taken the above factors into account, it may be considered reasonable to develop a further 115 dwellings within BRIH-2 and BRIH-5 that take primary access from Grammar School Road, however, traffic associated with development above this level is likely to result in the maximum capacity of Grammar School Road with existing on-street parking provision being exceeded.

4. WRAWBY ROAD ACCESS OPTIONS

4.1 Introduction

4.1.1 This section of the report considers the potential vehicle trip generation expected to utilise the proposed Link Road, including the residential allocations (BRIH-1 to BRIH-5) and the likely redistribution of vehicle trips to the Link Road accessing the existing educational, employment and retail facilities on Atherton Way and Grammar School Road, respectively. The vehicles expected to utilise the Link Road to bypass Brigg town centre have also been considered. Junction capacity modelling of the potential junction options on Wrawby Road has also been undertaken.

4.1.2 The estimated two-way Annual Average Daily Traffic (AADT) flows on Wrawby Road and on the proposed development access points are as follows:

- Major Road (Wrawby Road) = 8,888 (source: DfT 2018);
- Minor Road (Site Access) = ~4,000 (est.)

4.1.3 Based on the estimated AADT traffic flows, 'CD 123 - Geometric design of at-grade priority and signal controlled junctions' (HE, 2020a) suggests either a ghost island junction or other junction type (i.e. roundabout or traffic signals) would provide an appropriate junction design.

4.1.4 As requested by NLC, the junction arrangements on Wrawby Road that have been considered in further detail are outlined below:

- Wrawby Road Access 2 – Ghost Island priority junction (see Section 4.5);
- Wrawby Road Access 1 (combined with Churchill Avenue) – Compact Roundabout (see Section 4.6); and
- Wrawby Road Access 1 (combined with Churchill Avenue) – Signalised Junction (see Section 4.7).

4.2 Future Development Trips

4.2.1 The vehicle trip generation potential of each BRIH development parcel is outlined in Table 11 and has been based on the trip rates utilised in the Technical Note (PF, 2014).

Table 11: BRIH Residential Allocation Sites Vehicle Trip Generation

Development Parcel	AM Peak (08:00-09:00)			PM Peak (17:00-18:00)		
	Arrivals	Departures	Total	Arrivals	Departures	Total
Vehicle Trip Rates (per dwelling)	0.228	0.392	0.620	0.370	0.237	0.608
BRIH-1 Land North of Atherton Way (72 dwellings)	16	28	45	27	17	44
BRIH-2 Land at Western Avenue (186 dwellings)	42	73	115	69	44	113
BRIH-3 Land at Wrawby Road Phase 2 (333 dwellings)	76	131	206	123	79	202
BRIH-4 Land at Wrawby Road Phase 1 (152 dwellings)	35	60	94	56	36	92
BRIH-5 Land at Ancholme Park (81 dwellings)	18	32	50	30	19	49
Overall BRIH Development (824 dwellings)	188	323	511	305	195	501

4.2.2 Table 11 shows that the allocated BRIH residential sites have the potential to generate up to 511 two-way vehicle trips in the AM peak hour (08:00-09:00) and 501 in the PM peak hour (17:00-18:00).

4.2.3 The distribution of the BRIH vehicle trips has been based on Travel to Work census data and the key employment locations in surrounding wards within North Lincolnshire, North-East Lincolnshire, Kingston upon Hull, West Lindsey, East Lindsey, Lincoln, Doncaster and Bassetlaw. There are three main access roads serving Brigg comprising the A18 (Ancholme Way) to the west, the A18 (Wrawby Road) to the east and Bigby Road (A1084) to the south-east.

4.3 Link Road Redistribution

4.3.1 It is reasonable to assume that upon completion of the full link road between the A18 (Wrawby Road) and Atherton Way that a proportion of existing vehicle trips would utilise the link road in order to access the educational, employment and retail facilities on Atherton Way and also may be an alternative option for people to bypass Brigg town centre travelling east and west on the A18. The number of vehicle trips that are expected to utilise the link road is presented in Table 12.

Table 12: Link Road Redistribution

Via	AM Peak		PM Peak	
	Arrivals	Departures	Arrivals	Departures
Atherton Way	+47	+25	+6	+14
A18 Wrawby Road (W)	+2	+2	-	+1
A18 Wrawby Road (E)	+109	+52	+11	+30
Redistribution of Vehicle Trips	+158	+79	+17	+45

4.3.2 As demonstrated in Table 12, 237 two-way existing vehicle trips in the AM peak and 62 in the PM peak could be expected to utilise the link road once complete.

4.4 Assessment Scenarios

4.4.1 The assessment scenarios that have been considered within this report to test the various junction options on Wrawby Road for the weekday AM and PM peak hours are outlined below:

- **Scenario 1** - Vehicular access via BRIH-3 access junction only;
- **Scenario 2** - Vehicular access via BRIH-4 access junction only;
- **Scenario 3** - Vehicular access via BRIH-3 & BRIH-4 access options, with future traffic flows split evenly (50%/50%) across the two access points;
- **Scenario 4** - Vehicular access via BRIH-3 & BRIH-4 access options, with 75% of future traffic flows assigned to the BRIH-3 access and 25% to the BRIH-4 access; and
- **Scenario 5** - Vehicular access via BRIH-3 & BRIH-4 access options, with 25% of future traffic flows assigned to the BRIH-3 access and 75% to the BRIH-4 access.

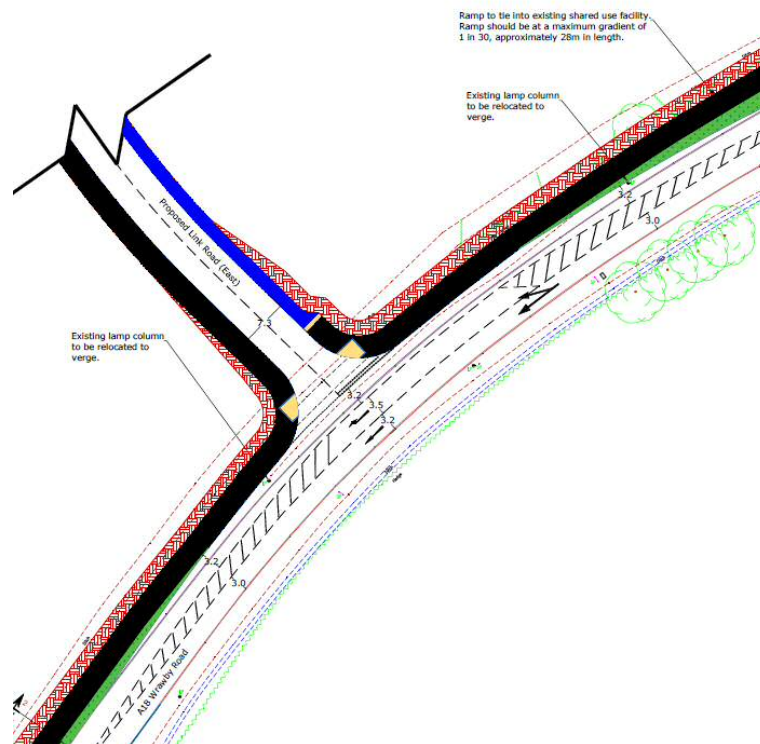
4.4.2 The traffic impact of each scenario has been assessed against a future year of 2038. The traffic flows at 2038 have been predicted using the DfT's 'National Traffic Model' (NTM) and 'Road Traffic Forecasts' (RTFs). The growth factor obtained from the NTM has been adjusted to reflect local circumstances from the local Middle-Layer Super Output Area (MSOA) 'North Lincolnshire 011', using TEMPro (v7.2b) software (Ref: Yorkshire & Humber Dataset Version 7.2).

4.5 Ghost Island Priority Junction (BRIH-3) Capacity Assessment

4.5.1 In order to assess the ability of the proposed ghost island priority junction on Wrawby Road (A18), to accommodate the projected future traffic flows, a junction capacity assessment has been undertaken using Junctions 9 modelling software (PICADY module), which is a software package produced by Transport Research Laboratory (TRL) that provides an industry-standard method for assessing capacity, queuing and delay at priority junctions and roundabouts.

4.5.2 The geometric input parameters used to create the Junctions 9 model have been measured from the feasibility design of the ghost island priority junction option which provides direct access to BRIH-3 is shown in Figure 6, with the complete drawing (ref: LTP/2494/P1/001.01 REV A) attached as Appendix 2.

Figure 6: Ghost Island Priority Junction (BRIH-3)



Source: LTP, 2017

4.5.3 The future peak hour traffic flows have been assessed against the proposed junction layout, the results of which are summarised in Table 13 and the complete modelling output in Appendix 3.

4.6.3 The future peak hour traffic flows have been assessed against the proposed junction layout, the results of which are summarised in Table 14 and the complete modelling output in Appendix 3.

Table 14: Wrawby Road Compact Roundabout Modelling Results

Arm	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
	Max. RFC	Max End Q	Max. RFC	Max End Q	Max. RFC	Max End Q	Max. RFC	Max End Q	Max. RFC	Max End Q
AM Peak (08:00-09:00)										
Site Access	-	-	32.2%	0.5	16.2%	0.2	12.8%	0.2	24.3%	0.4
Wrawby Road (NE)	-	-	59.3%	1.6	49.3%	1.1	44.4%	0.9	54.3%	1.3
Churchill Avenue	-	-	12.9%	0.2	11.7%	0.1	11.3%	0.1	12.3%	0.2
Wrawby Road (SW)	-	-	60.1%	1.6	56.4%	1.4	54.6%	1.3	58.4%	1.5
OVERALL	-	-	60.1%	1.6	56.4%	1.4	54.6%	1.3	58.4%	1.5
PM Peak (17:00-18:00)										
Site Access	-	-	19.7%	0.3	9.9%	0.1	5.1%	0.1	14.9%	0.2
Wrawby Road (NE)	-	-	67.0%	2.2	58.4%	1.5	53.9%	1.3	62.8%	1.8
Churchill Avenue	-	-	3.5%	0.0	3.3%	0.0	3.1%	0.0	3.4%	0.0
Wrawby Road (SW)	-	-	63.3%	1.9	59.8%	1.6	58.2%	1.5	61.5%	1.7
OVERALL	-	-	67.0%	2.2	59.8%	1.6	58.2%	1.5	62.8%	1.8

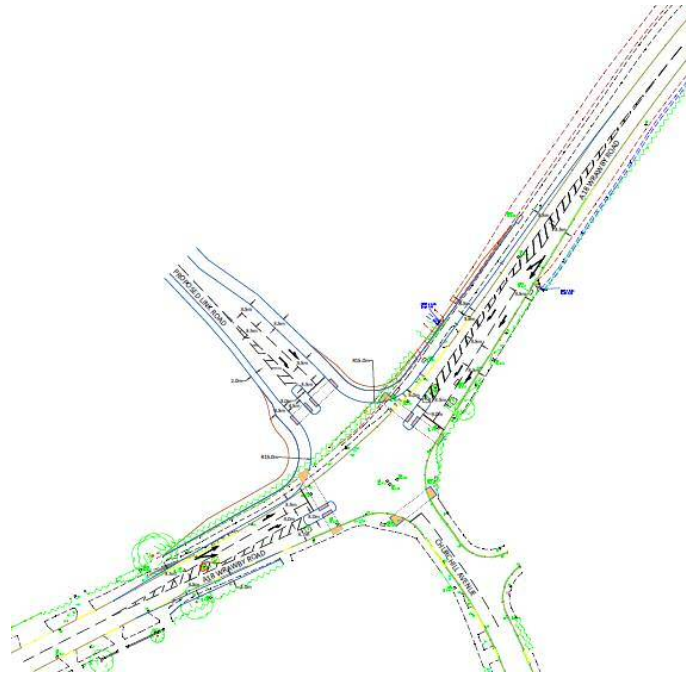
4.6.4 The capacity assessment results shown in Table 14 indicate that the compact roundabout option is expected to operate within capacity across all assessment scenarios, including Scenario 2 which considers the worst-case scenario of all vehicle movements associated with the link road utilising the junction as the sole point of access from Wrawby Road. The modelling results indicate that the maximum RFC during the peak hours is likely to be 67.0% (PM peak), which is below the typical target level of 85, and below the 100% RFC level of full capacity.

4.7 Signalised Junction (BRIH-4) Capacity Assessment

4.7.1 In order to assess the ability of the proposed signalised junction option to accommodate the traffic associated with the BRIH residential site allocations, a junction capacity assessment has been undertaken using the industry-standard LinSig v3, a design and assessment tool for traffic signal junctions.

4.7.2 The geometric input parameters for the model have been based on the feasibility design of the signalised junction option which incorporates Churchill Avenue as shown in Figure 8, with the complete drawing (ref: LTP/2494/P2/01.01) attached as Appendix 2.

Figure 8: Signalised Junction (BRIH-4)



Source: LTP, 2021

4.7.3 A total of three stages will be in operation at the junction during the AM and PM peak hours and it has been assumed that all stages are called every cycle with an assumed cycle time of 60 seconds. The stages are as follows:

- Stage 1: Wrawby Road (NE & SW);
- Stage 2: Wrawby Road (NE) only; and
- Stage 3: Churchill Avenue & Site Access.

4.7.4 The future peak hour traffic flows have been assessed against the proposed junction layout, the results of which are summarised in Table 15 and the complete modelling output is provided in Appendix 3.

Table 15: Wrawby Road Signalised Junction Modelling Results

Movement From	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)	DoS (%)	MMQ (PCU)
AM PEAK										
Site Access	-	-	66.0%	5.1	42.2%	2.4	37.0%	1.9	53.5%	3.6
Wrawby Road (NE)	-	-	47.7%	4.1	40.3%	3.5	36.9%	3.3	44.6%	3.9
Churchill Avenue	-	-	67.6%	2.6	53.6%	2.1	54.7%	2.2	54.8%	2.2
Wrawby Road (SW)	-	-	67.2%	8.7	58.6%	7.4	56.8%	7.0	62.9%	8.0
PRC	-		+33.1%		+53.5%		+58.4%		+43.2%	
PM PEAK										
Site Access	-	-	62.0%	3.4	31.0%	1.4	15.7%	0.7	46.7%	2.3
Wrawby Road (NE)	-	-	50.7%	4.4	46.6%	4.4	44.2%	4.3	48.8%	4.4
Churchill Avenue	-	-	28.7%	0.6	14.3%	0.5	11.5%	0.4	21.5%	0.5
Wrawby Road (SW)	-	-	61.8%	8.0	60.0%	7.6	60.0%	7.6	61.8%	8.0
PRC	-		+45.2%		+50.1%		+50.1%		+45.6%	

4.7.5 The Degree of Saturation (DoS) quoted within Table 15 is a ratio of the demand to capacity on each approach to the junction, with a value of 100% meaning that demand and capacity are equal. The Mean Max Queue (MMQ) is a measurement of the average maximum queue likely to occur across all cycles of the modelled scenario.

4.7.6 The results of the capacity assessments presented in Table 15 indicate that the signalised junction operates with levels of reserve capacity in all scenarios.

4.8 COBALT Assessment

4.8.1 COBALT (Cost and Benefit to Accidents - Light Touch) is a program developed by the DfT to undertake the analysis of the impact on accidents for new road schemes in accordance with the DfT's Transport Analysis Guidance; WebTAG. COBALT assesses the safety aspects of proposed junction schemes based on a comparison of accidents by severity and associated costs using criteria including junction characteristics, accident rates and costs and forecast traffic volumes by link and junction.

4.8.2 The compact roundabout and signalised junction options have been assessed using COBALT with an opening year of 2026 and a 15-year appraisal year of 2041. The results of the COBALT appraisal are summarised in in Table 16 below.

Table 16: COBALT Assessment

Arm	With Scheme			
	Number of Accidents			
	2026	2041	Total	Total Costs (£)
Compact Roundabout	1.4	1.4	83.5	2,539.8
Signalised Junction	2.3	2.3	136.4	4,737.7

*Costs and benefits discounted to 2010 in multiples of a thousand pounds.

4.8.3 The results show that the compact roundabout option would be predicted to have a lower road safety impact than the signalised junction option and therefore it is considered that the compact roundabout options is the preferred option.

4.9 Budget Cost Estimates

4.9.1 Table 17 provides a breakdown of the estimated cost of construction for the proposed junction improvements in 2021 prices.

4.9.2 The cost estimates exclude Statutory Undertakers costs that would need to be obtained from the affected bodies through C3/C4 notices.

4.9.3 The cost estimates include Optimism Bias of 44% to reflect the preliminary design stage of the junction and Link Road proposals. This value is consistent with DfT WebTAG guidance on local roads scheme costings at preliminary design stage.

Table 17: Wrawby Road Access Junctions: Budget Cost Estimates

Design Element	Ghost Island Priority Junction (BRIH-3) (£)	Compact Roundabout (BRIH-4) (£)	Traffic Signals (BRIH-4) (£)
Preliminaries (7.5%)	27,800	36,700	26,400
Site clearance	3,700	4,500	2,300
Drainage & ducting	75,000	79,800	71,700
Earthworks	40,900	97,700	78,200
Pavements	133,000	180,200	95,100
Kerbing & footways	82,800	52,300	69,600
Traffic signs & road markings	20,000	20,000	20,000
Traffic signals	0	33,100	0
Street lighting & electrical work	15,000	22,300	15,000
Estimated construction costs	398,300	526,500	378,300
Optimism Bias (44%)	175,200	231,700	166,400
Estimated construction costs inc. Optimism Bias	573,500	758,200	544,700

4.10 Wrawby Road Access Options Summary

4.10.1 The junction capacity modelling demonstrates that all junction options considered in this report have the potential to serve the BRIH residential site allocations and the likely redistribution of existing vehicle trips whilst accommodating the future traffic flows on Wrawby Road and Churchill Avenue, respectively. Notwithstanding the above, the provision of two vehicular access junctions providing direct access to parcels BRIH-3 and BRIH-4 would allow the two sites to progress largely independently and based on the expected development timescales as shown in Table 1 would be the preferred option for NLC. Furthermore, the provision of two access points from Wrawby Road would provide enhanced connectivity and accord with good practice set out in MfS. The NLC Residential Design Guide (NLC, 2016) also states that between 150 and 400 dwellings can be served from a single point of access/cul-de-sac, subject to satisfactory arrangements for emergency access. Therefore prior to the completion of the Link Road through to Atherton Way, it is likely that development on the BRIH-3 and BRIH-4 sites would be restricted to 400 dwellings unless two vehicular access points from Wrawby Road were provided.

4.10.2 As requested by NLC, a compact roundabout and signalised junction arrangement was considered at W1. Both options are expected to operate within capacity in 2038 with the Link Road complete and the BRIH sites coming forward, with the results of the COBALT appraisal showing that the compact roundabout option would be expected to have a better road safety record than the signalised junction. Therefore, it is considered that the compact roundabout is the preferred junction option at W1.

-
- 4.10.3 NLC's preference would be for the introduction of two access junctions on Wrawby Road, with a compact roundabout at W1 and a ghost island priority junction at W2. It is considered that providing two access junctions would enhance connectivity between land packages, maximise developable land and align with design principles within MfS. The provision of a compact roundabout would also allow the creation of a gateway feature into Brigg town centre which is a key aspiration for NLC.
- 4.10.4 As part of future planning applications relating to the BRIH sites, a detailed Transport Assessment would be required in order to assess the capacity of the preferred junction arrangements proposed by the Applicant. It should be noted that the preferred NLC access options on Wrawby Road need to be considered in the context of economic viability and affordability when the BRIH-3 and BRIH-4 sites come forward.

5. GRAMMAR SCHOOL ROAD ACCESS OPTIONS

5.1 Access Via Grammar School Road

- 5.1.1 The interface between the Link Road and Grammar School Road is largely dictated by the ability to provide a cost-effective arrangement taking account of the limitations on suitable available land for construction as a result of adjacent properties and avoiding encroachment into the land package to the north-west of the junction. The gradient of Grammar School Road on the approach to the M180 overbridge has also been factored into the feasibility design exercise.
- 5.1.2 In addition, given the potential resultant traffic impact from the creation of an interface at this location, the proposed junction needs to provide access/connectivity between the west and east sides of the whole development site whilst maintaining access to the north, encouraging egress of traffic from Springfield Estate and discouraging movements into Grammar School Road by development traffic.
- 5.1.3 Given the land constraints the following junction types have been considered:
- Simple priority crossroads (priority to the Link Road) (Option 5);
 - Ghost island priority crossroads (priority to Link Road) (Option 4);
 - Simple priority crossroads (with priority to Grammar School Road) (Option 2);
 - Ghost island crossroads (with priority to Grammar School Road) (Option 3); and
 - Mini or Compact Roundabout (Option 1).
- 5.1.4 Since the identification and production of the feasibility design drawings associated with the above options, NLC has specifically requested that access from the Link Road is prohibited as part of any future access to the Link Road, therefore making Grammar School Road one-way northbound within the vicinity of the Link Road. The original drawings have been updated with a note to highlight that the northbound one-way arrangement on Grammar School Road, south of the Link Road, will be implemented on during Phase 1C of the Link Road implementation plan (see Section 6). It should be noted that the preferred junction arrangement would need to initially allow two-way vehicle movements on Grammar School Road in order to access parcels BRIH- 2 and BRIH-5, and then as part of Phase 1C, the junction arrangement would be modified to prohibit southbound movements on Grammar School Road from the Link Road.
- 5.1.5 It should be noted that Option 4 outlined above could not be implemented as this junction arrangement would not be possible to operate with a one-way northbound arrangement and therefore has been discounted from the potential junction options.
- 5.1.6 Table 18 provides an assessment of the alternative junction types in terms of their suitability against the foregoing key criteria. The assessment considers the junction arrangements post Phase 1C of the Link Road implementation programme (i.e. with the southern arm of Grammar School Road one-way northbound).

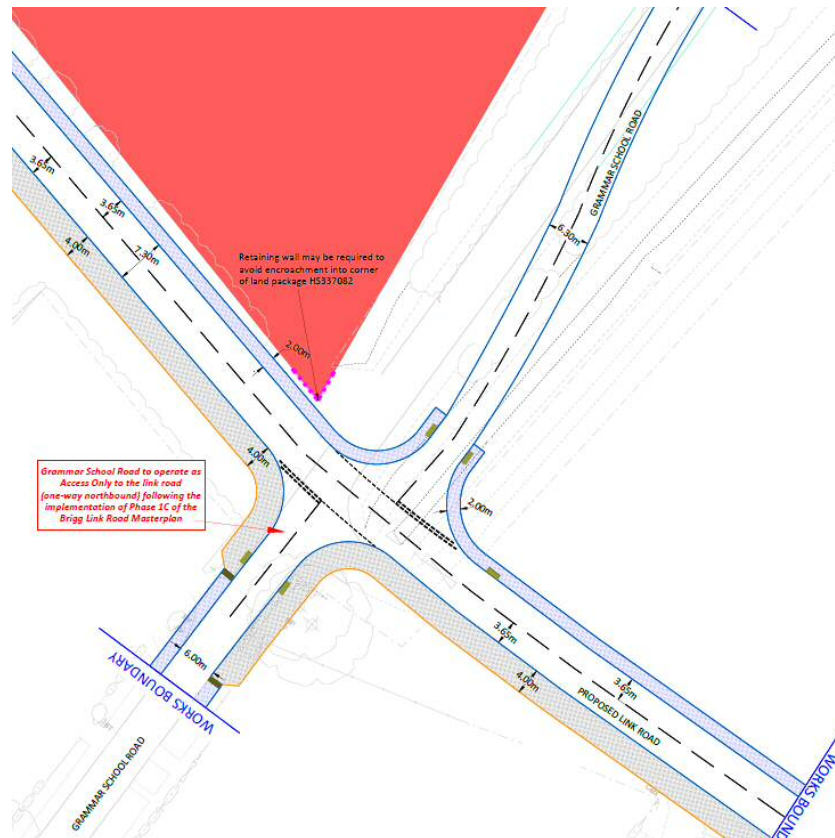
Table 18: Grammar School Road - Junction Type Assessment

Option	Benefits/Opportunities	Disbenefits/Issues
Simple priority crossroads (priority to Link Road)	<ul style="list-style-type: none"> Provides continuous route on Link Road. Small construction footprint. 	<ul style="list-style-type: none"> Restricts movements for residents on Grammar School Road as vehicles will be able to utilise the Link Road to depart but would still have to travel through the town centre junctions to access Grammar School Road. Slight increased delay for existing north/south traffic on Grammar School Road.
Simple priority crossroads (priority to Grammar School Road)	<ul style="list-style-type: none"> Can be accommodated in available land. Negligible delays to traffic turning onto the Link Road from Grammar School Road. 	<ul style="list-style-type: none"> Layout requires less conventional left-right offset to crossroads layout with potential risk of see-through between side roads. Discontinuous route reduces connectivity between development sites and along Link Road. Delay for vehicles exiting the development parcels to the east and west of Grammar School Road. Potential delays on Link Road due to turning vehicles. Layout provides limited access/movement for HGVs. Restricts movements for residents on Grammar School Road as vehicles will be able to utilise the Link Road to depart but would still have to travel through the town centre junctions to access Grammar School Road.
Ghost island priority crossroads (priority to Grammar School Road)	<ul style="list-style-type: none"> Can be accommodated in available land. Negligible delays to traffic turning onto the Link Road from Grammar School Road. 	<ul style="list-style-type: none"> Layout requires less conventional left-right offset to crossroads layout with potential risk of see-through between side roads. Discontinuous route reduces connectivity between development sites and along Link Road. Delay for vehicles exiting the development parcels to the east and west of Grammar School Road. Potential delays on Link Road due to turning vehicles. Layout provides limited access/movement for HGVs. Restricts movements for residents on Grammar School Road as vehicles will be able to utilise the Link Road to depart but would still have to travel through the town centre junctions to access Grammar School Road.
Mini or Compact Roundabout	<ul style="list-style-type: none"> Can be accommodated in available land. Helps manage traffic speeds on Link Road. 	<ul style="list-style-type: none"> Slight delay for existing north/south traffic on Grammar School Road. Layout provides limited access/movement for HGVs. Restricts movements for residents on Grammar School Road as vehicles will be able to utilise the Link Road to depart but would still have to travel through the town centre junctions to access Grammar School Road.

5.1.7 Feasibility designs have been developed to establish whether the access options can be delivered within the land available. It should be noted that the designs provided are for the initial junction arrangements required to service BRIH-2 and BRIH-5 in Phase 1A and 1B of the proposed Link Road delivery plan during which time the southern arm off Grammar School Road would operate with two-way traffic. These designs reflect the most onerous situation in terms of land requirements. Following Phase 1C, the preferred junction would be modified to accommodate a one-way northbound only arrangement on Grammar School Road to the south of the Link Road, as per NLC preferred requirements.

5.1.8 Options for providing a priority junction arrangement, with priority to the Link Road, as assessed in Table 18 have been considered as part of the 2021 update. Figure 9 provides an extract of the outline feasibility design for the proposed junction option, with the full drawing attached as Appendix 4.

Figure 9: Simple Priority Crossroads (Priority to Link Road)

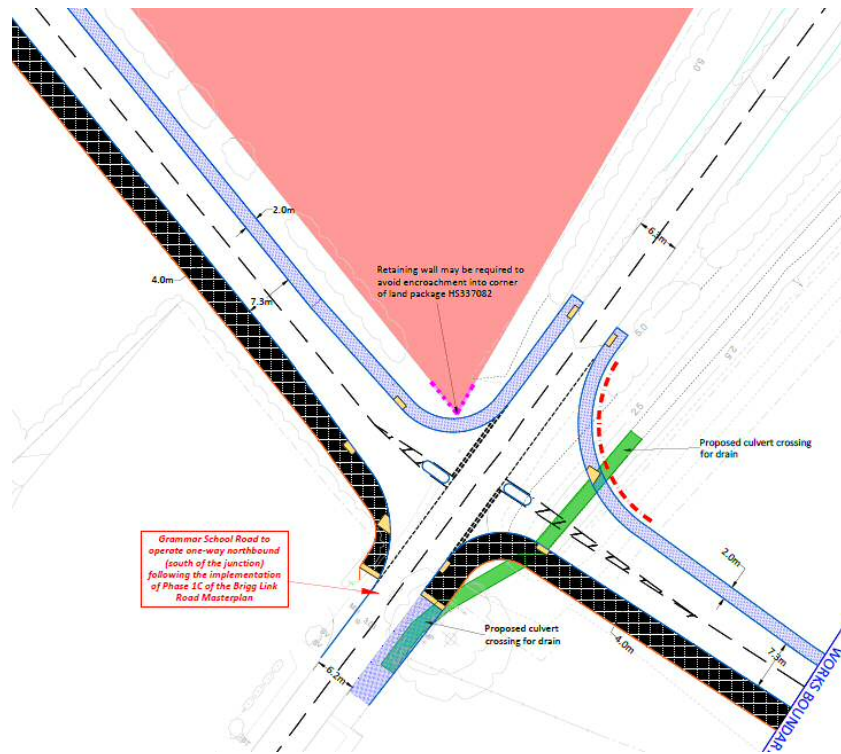


Source: LTP, 2021

5.1.9 The feasibility design indicates that the junction layout could be accommodated in the land available, however, the proximity of adjacent property boundaries and the gradient associated with the M180 overbridge results in a short right-left stagger that will require further careful design to avoid and mitigate road safety risks due to potential ‘see-through’ from the Grammar School Road side roads and hooking right turns to Grammar School Road (N).

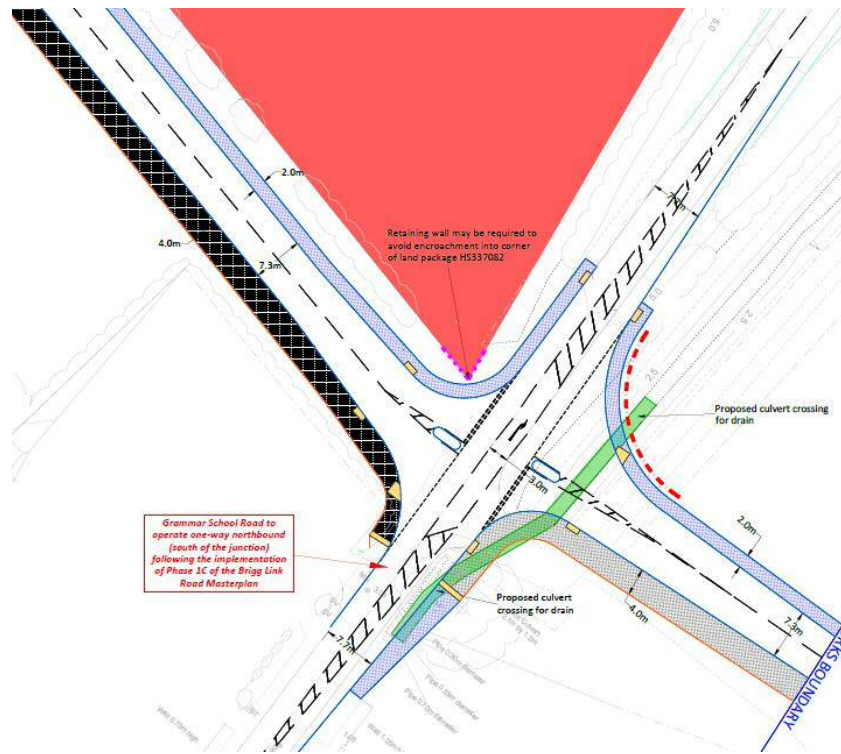
5.1.10 Options for providing a priority junction arrangement, with priority to Grammar School Road, as assessed in Table 18 have been considered as part of the 2021 update. Feasibility designs have been developed to establish whether the access options can be delivered within the land available. Figure 10 and Figure 11 provide outline feasibility designs for the proposed junction designs with the full drawings attached as Appendix 4.

Figure 10: Simple Priority Crossroads (Priority to Grammar School Road)



Source: LTP, 2021

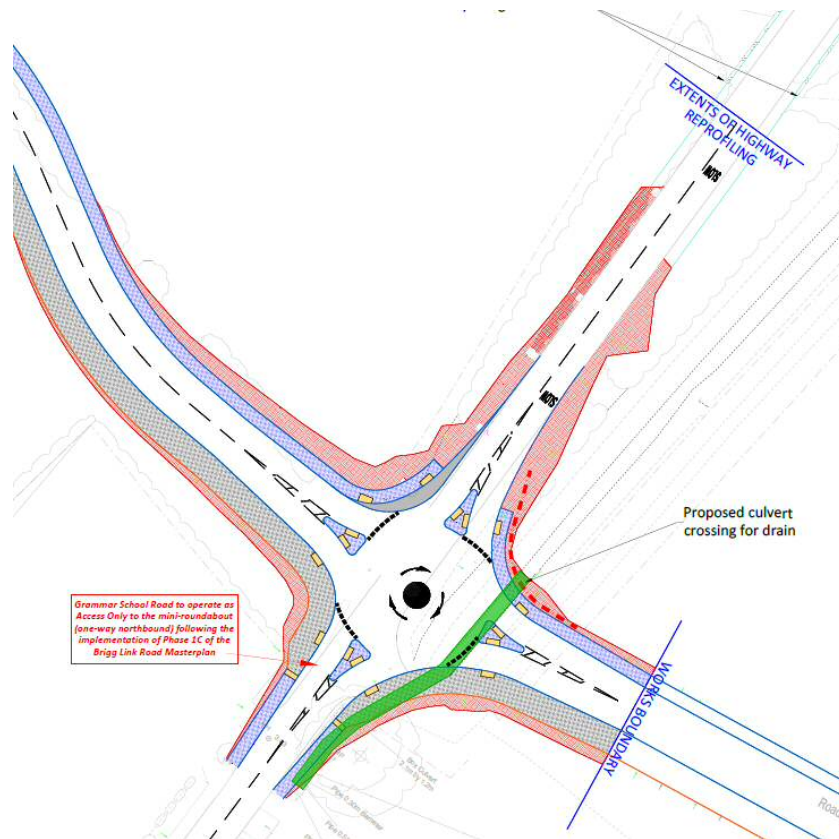
Figure 11: Ghost Island Right Turn Priority Crossroads (Priority to Grammar School Road)



Source: LTP, 2021

- 5.1.11 The feasibility design indicates that both junction layouts could be accommodated in the land available, however, the proximity of adjacent property boundaries results in an unconventional short left-right stagger that will require further careful design to avoid and mitigate road safety risks due to potential 'see-through' from the side roads.
- 5.1.12 In terms of vehicle movements, the limited space in which the junction layouts can be provided reduces the movements that can be made by large Heavy Goods Vehicles (HGVs), specifically 16.5m articulated lorries, potentially accessing the farms/properties on Grammar School Road to the north of the M180. These movements can only be accommodated between the northern arm of Grammar School Road and the western arm of the proposed Link Road. Again, some of these issues may be accommodated through further detailed design.
- 5.1.13 Figure 12 provides an outline feasibility design for the proposed mini-roundabout option at Grammar School Road with the full drawing attached as Appendix 4.

Figure 12: Mini-Roundabout (Grammar School Road/Link Road)



Source: LTP, 2017

5.2 Grammar School Road Access Options Summary

- 5.2.1 From the above assessments, it is considered that a mini-roundabout would be the preferred option by virtue of it being likely to encourage redistribution of existing vehicle movements on Grammar School Road to utilise the Link Road to access the A18 and also help manage traffic speeds on the proposed Link Road.

-
- 5.2.2 The main drawback with the prohibition of vehicles from the Link Road onto Grammar School Road is existing residents living on Grammar School Road/Springfield Estate would still need to utilise the town centre junctions in Brigg and therefore the potential redistribution benefits of the link road are restricted, although it is acknowledged that this option has been requested in order to limit the number of vehicles wanting to utilise Grammar School Road when the Link Road is operational. As mentioned previously, it should be noted that the one-way options on Grammar School Road can only be implemented post Phase 1C of the implementation plan as two-way access is required from Grammar School Road up to this point to serve development parcels BRIH-2 & BRIH-5.
- 5.2.3 It is considered that a detailed Transport Assessment that is likely to be required as part of future planning applications for the BRIH 2 and BRIH-5 development parcels, would need to consider the capacity impacts of the development on the preferred access option on Grammar School Road.

6. PROPOSED IMPLEMENTATION PLAN

6.1 Phasing Plan

6.1.1 The proposed phasing plan for the Link Road is shown in Appendix 5 and has been developed to align with the Link Road objectives outlined in Section 1 of this report with particular regard to:

- supporting a flexible and phased approach to the development of the 5 No. land packages that seeks completion of the Link Road within the refreshed local plan period (i.e. up to 2038);
- minimising traffic impacts on the local highway network; and
- reflecting best practice in street design.

6.1.2 The resultant plan identifies 5 No. key work phases sub-divided into 13 No. sub-phases to take account of parallel construction activity in each work package. The proposed phases/sub-phases coincide with key “trigger points” in the development of the site that require elements of the Link Road to be constructed in order to allow continuation of the site’s development. These “trigger points” are described in Table 19 in terms of key dependencies and proposed actions.

6.1.3 Table 19 provides the programme and timescale for the Phasing Plan. It is important to note that the timescale is indicative and has been developed to illustrate how the Link Road may be constructed within the refreshed local plan period (up to 2038). In order to achieve this, the development build-rates shown in Table 2 have been applied.

6.1.4 The proposed plan and programme also assume that:

- the Link Road is constructed alongside the “piecemeal” development of the 5 No. land packages over-time;
- development commences in all 5 No. land packages at the times outlined in Table 1; and,
- development progresses continually across all 5 No. land packages over the programme timescale.

6.1.5 Based on a proposed 2026 start date for BRIH-1, BRIH-4 & BRIH 5 and the foregoing assumptions the Link Road would be completed over a nine-year timescale with completion in 2034.

6.1.6 These timescales could be reduced through the construction of segments of Link Road in advance of housing development.

Table 19: Proposed Link Road Phasing Plan

Phase	Year	Scope of Works	"Trigger Point" Dependencies
1A	2026	<ul style="list-style-type: none"> Construction of primary access to BRIH-4. Proposed Compact Roundabout or Signalised Junction arrangement. 	<ul style="list-style-type: none"> Phase 1A is required prior to the commencement of development of BRIH-4 to provide the primary access to the site.
1B	2026	<ul style="list-style-type: none"> Construction of initial primary access to BRIH-2 and BRIH-5. Proposed Mini-roundabout or priority crossroad arrangements. 	<ul style="list-style-type: none"> Phase 1B is required prior to the commencement of development of either BRIH-2 or BRIH-5 to provide an initial primary access to the sites.
1C	2026-2028	<ul style="list-style-type: none"> Continuation of Atherton Way to provide primary access to BRIH-1 and BRIH-5. 	<ul style="list-style-type: none"> Phase 1C is required to support development of the proposed 72 dwellings in BRIH-1 and a primary access to BRIH-5 to supersede the Grammar School Road access.
2A	2028	<ul style="list-style-type: none"> Construction of primary access to BRIH-3. Proposed Ghost Island Priority junction arrangement. 	<ul style="list-style-type: none"> Phase 2A is required prior to the commencement of development of BRIH-3 to provide the primary access to the site.
2B	2028-2030	<ul style="list-style-type: none"> Construction of 150m of Link Road north from Wrawby Road into BRIH-3. 	<ul style="list-style-type: none"> Phase 2B is required to support development of the initial 30% of BRIH-3 adjacent to Wrawby Road (Approx. 100 dwellings, 3.46 ha).
2C	2028-2030	<ul style="list-style-type: none"> Construction of 150m of Link Road north from Wrawby Road into BRIH-4. 	<ul style="list-style-type: none"> Phase 2C is required to support development of BRIH-4 (152 dwellings, 4.29 ha).
2D	2028-2030	<ul style="list-style-type: none"> Construction of 150m of Link Road east from Grammar School Road into BRIH-2. 	<ul style="list-style-type: none"> Phase 2D is required to support the initial development of BRIH-2 adjacent to Grammar School Road at a level that maintains AM peak 2-way traffic on Grammar School Road at 2009 levels (i.e. 440 vph).
2E	2028-2030	<ul style="list-style-type: none"> Construction of 140m of Link Road west from Grammar School Road into BRIH-5. 	<ul style="list-style-type: none"> Phase 2E is required to support the initial development of BRIH-5 adjacent to Grammar School Road at a level that maintains AM peak 2-way traffic on Grammar School Road at 2009 levels (i.e. 440 vph).
3	2029	<ul style="list-style-type: none"> Construction of connection between Phase 2A and Phase 2B to create loop road (approx. 200m) 	<ul style="list-style-type: none"> Phase 3 creates a loop road between BRIH-4 and BRIH-3 supporting development of a high-quality street design within the development. Phase 3 should be programmed to coincide with the commencement of Phase 4A works.
4A	2029-2034	<ul style="list-style-type: none"> Construction of approx. 700m of Link Road north of Phase 2A/Phase 3 into BRIH-3. 	<ul style="list-style-type: none"> Phase 4A will support the continued development of BRIH-3 to the total 333 dwellings allocated (11.53 ha), which is consistent with NLC standards for single access developments.
4B	2029-2031	<ul style="list-style-type: none"> Construction of approx. 100m of Link Road east from Phase 1D into BRIH-5 to link with Phase 2D. 	<ul style="list-style-type: none"> Phase 4B is a continuation of Phase 1C and will support the continued development of BRIH-5 to completion from Atherton Way linking up with Phase 2E to complete the western section of the Link Road.
5	2032-2034	<ul style="list-style-type: none"> Construction of remaining section of Link Road east into BRIH-2 from Phase 2C to Phase 4A approx. 150 metres. 	<ul style="list-style-type: none"> Phase 5 can take place on completion of Phase 4B that provides access to BRIH-2 from the western section of the Link Road. Phase 5 is required to support the continued development of BRIH-2 to completion from a primary access on Wrawby Road. Phase 5 completes the eastern section of the Link Road.

Table 20: Proposed Link Road Construction Programme

Work Phase	2026	2027	2028	2029	2030	2031	2032	2033	2034
Phase 1A									
Phase 1B									
Phase 1C									
Phase 1D									
Phase 2A									
Phase 2B									
Phase 2C									
Phase 2D									
Phase 2E									
Phase 3									
Phase 4A									
Phase 4B									
Phase 5									

6.2 Scheme Costs

6.2.1 Table 21 provides a summary of the estimated capital cost of the Link Road broken down by construction phase.

6.2.2 Scheme cost estimates for design, construction and operations are provided in 2021 prices based on the junction access feasibility design provided in Sections 4 & 5 and typical highway construction costs taking account of the local topography and resultant vertical alignments.

6.2.3 In determining costs, it has been assumed that the Link Road will consist of a 7.3m carriageway with 2.0m footway and 4.0m footway/cycleway. It has also been assumed that the Link Road will include a collection sewer to support long term development of the site.

6.2.4 Optimism Bias of 44% has been applied to the costs to reflect the feasibility stage of the Link Road proposals. This value is consistent with DfT WebTAG guidance on local roads scheme costings at feasibility stage.

6.2.5 Design costs are calculated as being 15% of construction and annual operational costs have been determined on the basis of 3% of capital construction cost per annum.

6.2.6 The estimated total construction cost for all work phases is £8,909K.

Table 21: Estimated Scheme Costs

Work Phase	Construction (£K)	Optimism Bias @ 44% (£K)	Professional Fees @ 15% (£K)	Total (£K)	Annual Operational Costs (£K)
Phase 1A	378.0	166.3	56.7	601.0	18.0
Phase 1B	873.0	384.1	130.95	1,388.1	41.6
Phase 1C	533.0	234.5	79.95	847.5	25.4
Phase 1D	447.0	196.7	67.05	710.7	21.3
Phase 2A	286.0	125.8	42.9	454.7	13.6
Phase 2B	286.0	125.8	42.9	454.7	13.6
Phase 2C	286.0	125.8	42.9	454.7	13.6

Work Phase	Construction (£K)	Optimism Bias @ 44% (£K)	Professional Fees @ 15% (£K)	Total (£K)	Annual Operational Costs (£K)
Phase 2D	267.0	117.5	40.05	424.5	12.7
Phase 3	381.0	167.6	57.15	605.8	18.2
Phase 4A	1,334.0	587.0	200.1	2,121.1	63.6
Phase 4B	191.0	84.0	28.65	303.7	9.1
Phase 5	286.0	125.8	42.9	454.7	13.6
Total	5,548.00	2,441.12	832.20	8,821.32	264.64

6.3 Risk Assessment

- 6.3.1 Table 22 provides an initial assessment of scheme risks associated with the design and construction of the Link Road. Although there are a number of risks with medium probability and high impact it is considered that the risks could be adequately managed and mitigated.
- 6.3.2 The development of BRIH-2 and BRIH-5 from Grammar School Road ahead of the completion of the Link Road is contingent on the agreement and resolution of potential traffic impacts on Grammar School Road and in the Springfield Estate. Further traffic assessments will support management and mitigation of these issues although, until these are developed and agreed, it is considered that the risk to delivery of the proposed delivery plan and programme remain medium in both probability and impact.

Table 22: Risk Assessment

Risk	Inherent Risk		Mitigation	Residual Risk	
	Probability	Impact		Probability	Impact
Local objections to potential traffic impacts.	High	Medium	Detailed Transport Assessments and development of appropriate mitigation measures.	Medium	Medium
Consistency of standards and quality of build of Link Road over a 9-year period.	Medium	Medium	Development of a design standards for the proposed Link Road design and construction.	Low	Low
Reduced build-rates delay phased delivery of the Link Road.	Medium	Medium	Early agreement and construction of the Link Road or key segments of the Link Road ahead of the development timescales.	Low	Low
Development of cohesive agreements between land owners/developers to support phased/piecemeal development of the sites.	Medium	Medium	Early agreement and construction of the Link Road or key segments of the Link Road ahead of the development timescales.	Low	Low
Statutory Undertakes equipment impacts on costs and timescales	Low	Medium	Early identification of SU issues. Delivery of SU diversions/accommodation works ahead of construction timescale.	Low	Low

Risk	Inherent Risk		Mitigation	Residual Risk	
	Probability	Impact		Probability	Impact
Adequacy of design of highways drainage in Phase 1 to meet future requirements.	Medium	High	Early consideration of surface water management requirements for whole site.	Low	Low
Cost increases due to geo-technical and topographical issues during detailed design.	Medium	Medium	Application of suitable risk contingencies and Optimism Bias Value Engineering of scheme proposals during design development.	Low	Low
Environmental issues	Medium	Medium	Early consideration of environmental matters with appropriate mitigation measures.	Low	Low

7. CONCLUSIONS

- 7.1.1 This report provides a 2021 update to the original 2016 study to develop an evidence-based Highways Masterplan to support the development of a Link Road between Wrawby Road and Atherton Way in Brigg, North Lincolnshire.
- 7.1.2 An assessment of potential accesses to/from the Springfield Estate indicate that all options would support access and connectivity by cycles, pedestrians and emergency vehicles.
- 7.1.3 In terms of vehicular access, the assessment identifies that, with the exception of Option S4, the use of the proposed accesses by general vehicular traffic would reduce the amenity for local residents in the Springfield Estate and potentially impact on road safety. The assessment also recognises that the access from Grammar School Road (Option S4) as a vehicular route would be necessary in order to create the Link Road between Wrawby Road and Atherton Way.
- 7.1.4 A comparison of traffic flows from 2009 and 2016 identifies that it would be reasonable to introduce 60 new two-way vehicle trips in the AM peak hour on to Grammar School Road to return the traffic to a two-way peak hour flow of 440 vph being the levels experienced when the road was used as the primary access and drop-off for Vale of Ancholme School (The Vale Academy) as recorded in a 2009 traffic count for the road. These 60 trips would equate to 115 properties that might potentially be accommodated on Grammar School Road without increasing AM peak hour traffic beyond 2009 values. As a result of the current Covid-19 pandemic, it has not been possible to obtain representative current (2021) traffic flows for Grammar School Road in order to update this assessment.
- 7.1.5 A review of NLC Residential Design Standards indicates that, notwithstanding traffic delays created by the on-street parking, Grammar School Road may be considered as having similar features to both a Major Access Road and Secondary Distributor Road capable of servicing residential developments of 400 dwellings and above.
- 7.1.6 Comparison with the highway capacities for similar infrastructure based on case study examples as referenced in TA79/99 (HA, 1999) together with consideration the impacts of the minimum road width and on-street parking on capacity indicates that a reasonable figure for the maximum peak hour capacity of Grammar School Road may be 450-500vph.
- 7.1.7 A traffic assessment of the Barnard Avenue/Wesley Road traffic signal junction that shows that the trips associated with these 115 dwellings together with traffic growth up to a Design Year of 2038 could be accommodated without significantly impacting the junctions' capacity.
- 7.1.8 An assessment of existing road collisions on Grammar School Road for the five-year period 2015-2019 indicates that there are no underlying road safety issues on Grammar School Road.

- 7.1.9 Taken together, it may be considered reasonable to develop a further 115 dwellings within BRIH-2 and BRIH-5 that take primary access from Grammar School Road, however, traffic associated with development above this level is likely to result in the maximum capacity of Grammar School Road with existing on-street parking provision being exceeded.
- 7.1.10 The potential junction options between the Link Road, Wrawby Road and Grammar School Road have been considered and feasibility designs developed. The junction arrangements that have been considered in further detail are:
- Wrawby Road Access 1 (combined with Churchill Avenue) – Compact Roundabout;
 - Wrawby Road Access 1 (combined with Churchill Avenue) – Signalised Junction;
 - Wrawby Road Access 2 – Ghost Island Priority junction;
 - Grammar School Road/Link Road – Mini-roundabout;
 - Grammar School Road/Link Road – Priority Crossroads (Priority to Link Road); and
 - Grammar School Road/Link Road – Priority Crossroads (Priority to Grammar School Road).
- 7.1.11 The junction capacity modelling demonstrates that all junction options considered in this report have the potential to serve the BRIH residential site allocations and the likely redistribution of existing vehicle trips whilst accommodating the future traffic flows on Wrawby Road and Churchill Avenue, respectively. Notwithstanding the above, the provision of two vehicular access junctions providing direct access to parcels BRIH-3 and BRIH-4 would allow the two sites to progress largely independently and based on the expected development timescales would be the preferred option for NLC. Furthermore, the provision of two access points from Wrawby Road would provide enhanced connectivity and accord with good practice set out in MfS. The NLC Residential Design Guide (NLC, 2016) also states that between 150 and 400 dwellings can be served from a single point of access/cul-de-sac, subject to satisfactory arrangements for emergency access. Therefore prior to the completion of the Link Road through to Atherton Way, it is likely that development on the BRIH-3 and BRIH-4 sites would be restricted to 400 dwellings unless two vehicular access points from Wrawby Road were provided.
- 7.1.12 As requested by NLC, a compact roundabout and signalised junction arrangement have been considered at W1. Both options are expected to operate within capacity in 2038 with the Link Road complete and the BRIH sites coming forward, with the results of the COBALT appraisal showing that the compact roundabout option would be expected to have a better road safety record than the signalised junction option. Therefore, it is considered that the compact roundabout is the preferred junction option at W1.

- 7.1.13 NLC's preference would be for the introduction of two access junctions on Wrawby Road, with a compact roundabout at W1 and a ghost island priority junction at W2. It is considered that providing two access junctions would enhance connectivity between land packages, maximise developable land and align with design principles within MfS. The provision of a compact roundabout would also allow the creation of a gateway feature into Brigg town centre which is a key aspiration for NLC. In terms of phasing, it is considered favourable to implement the compact roundabout at Churchill Avenue prior to the new junction on Wrawby Road coming forward as this would be the modification of an existing junction rather than the creation of a new junction on the A18. This approach would help maximise the wider network management benefits on the A18 by ensuring the gateway feature is implemented at an early stage of the build-out of the BRIH sites.
- 7.1.14 As part of future planning applications relating to the BRIH sites, a detailed Transport Assessment would be required in order to assess the capacity of the preferred junction arrangements proposed by the Applicant. It should be noted that the preferred NLC access options on Wrawby Road need to be considered in the context of economic viability and affordability when the BRIH-3 and BRIH-4 sites come forward.
- 7.1.15 A proposed phasing plan has been developed to align with the Link Road objectives with particular regard to supporting a phased approach to the development of the 5 No. land packages, minimising traffic impacts on the local highway network and reflecting best practice in street design. The phasing plan assumes that the Link Road is constructed alongside the "piecemeal" development of the 5 No. land packages over-time.
- 7.1.16 The plan identifies 5 No. key work phases sub-divided into 12 No. sub-phases that take account of parallel Link Road construction activity that may take place independently in each land package. A series of "Trigger Points" have been identified within the phasing plan that describe the dependencies and relationship between the development of the land packages and the construction of the various phases of the Link Road.
- 7.1.17 The phasing plan also includes an indicative programme and timescale for the implementation of the Link Road. This plan shows that, based on a proposed 2026 start, it would be feasible to complete the Link Road within nine years. This would see completion in 2034 within the refreshed local plan period (up to 2038).
- 7.1.18 These timescales could be reduced through construction of segments of Link Road in advance of housing development.
- 7.1.19 The estimated total cost of the Link Road including junctions with the existing highway network is £8,821K. This cost estimate includes for both design and construction and includes an Optimism Bias of 44% consistent with DfT WebTAG guidance.

8. REFERENCES

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