



A601(M)

Option Assessment Report

| v4

August 2019



A601(M)

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Document history and status

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Executive Summary

This Options Assessment Report (OAR) outlines the possible options for the future of the A601(M) route and structures within its extents. It describes the process of analysing the transport and maintenance challenges, defines the scheme objectives and identifies and assesses potential interventions to tackle these challenges.

Background

The A601(M) is a 1.3 mile (2.1km) Special Road in Lancashire, linking M6 junction 35 to the A6 north-east of Carnforth. The following structures on the A601 (M) have current maintenance issues - Brewers Barn West, Brewers Barn East, Higher North Road and Elpha bridges.

Highway maintenance budgets are reducing, highway authorities can no longer maintain all their assets to the same standard or carry out cyclic activities at the same frequency as in the past. The reducing budgets require management of aging assets and management of risk, in order to provide a safe and as reliable highway asset network as resources will allow.

Current and future situation

The A601(M) is a key road from M6 junction 35, linking the M6 to the A6, providing access to the Truck Haven located on the junction of the A601(M) and A6, as well as Carnforth itself. The A601(M) also forms part of the official M6 motorway diversion route between junctions 35 and 36. Parts of central Carnforth has been designated as an Air Quality Management Area (AQMA).

There are no significant congestion issues identified along the A601(M), with the existing capacity of the road catering for the current levels of traffic. Nether Beck, which runs over Higher North Road also operates well within the capacity of the road.

Committed developments in and around Carnforth have been identified to help inform the potential future traffic demand growth, along with TEMPro growth figures. Assessment shows that the capacity of the A601(M) will be sufficient to accommodate future demand.

Need for intervention

If these assets are left to further deteriorate, access along the A601(M) and Nether Beck (over Higher North Road bridge) will have to be constrained through weight and/or lane restrictions, which will impact HGVs particularly along the A601(M) accessing Truck Haven (as well as part of the M6 diversionary route) and could cause non-HGV traffic to divert via Carnforth itself (central area designated as an AQMA).

Scheme objectives have been identified to assist in the sifting of options and identification of preferred options for consideration within the Strategic Outline Business Case:

- To facilitate lower life costs and reduce public sector expenditure.
- Secure the best solution for the long-term management and safety of the structures along the route, namely:
 - Brewers Barn East & West
 - Higher North Road
 - Elpha
- To not prejudice/preclude future development

Generating and initial sifting

The potential six options for A601(M) were developed in discussion with LCC. Consideration has been given to the temporary infrastructure measures and monitoring, the level of repair/refurbishment to each bridge, the retention or removal (despecialisation) of M status of A601(M), the potential requirement for weight or traffic restrictions and proposals for road-space reallocation.

The sifting assessment considers the most suitable options for further consideration, using a multi-criteria assessment matrix. A spreadsheet matrix has been used for the long-list sifting, using a combination of project objectives, WebTAG and EAST criteria to ensure the most suitable decision is made regarding the future of the A601(M) route. The study area site observations and issues were used to inform the sifting process, along with indicative capital costs and level of maintenance burden.

The best scoring options as Options 3, 4 and 5. Scoring has not been based purely on capital expenditure alone. Option 3 proposes to undertake major repairs and refurbishment to all the bridges (except Brewer Barn West widening), including resurfacing the entire route and removing the M status (despecialisation) of the A601(M).

Options 4 and 5 are two of the more expensive options and both include removal of M status (despecialisation) and major repairs to Brewer Barn West and East bridges, along with Elpha Bridge. The options also include the removal of Higher North Road Bridge and Brewer Barn West widening, as well as the installation of an at-grade crossing (circa £1.2m), which increases the capital expenditure over Options 2 and 3.

However, the key determining element involves the proposals to either retain the dual carriageway (Option 5) or reallocate carriageway space to facilitate improved footpath/bridleway links and consequently reduce the A601(M) to a single carriageway road (Option 4). As there is little difference between Options 4 and 5, it was concluded that both should be taken through for further assessment, along with Option 3, which provides a suitably different proposal.

At the request of LCC, the Do Minimum Scenario (Option 1) will be considered as part of the further assessment. Option 1 involves continued monitoring of bridges and management of permitted traffic loading implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in number of lanes.

Option development and assessment

The short-listed options were further developed with regards to capital cost and maintenance requirements, as well as assessed in terms of high-level environmental considerations.

Capital costs have been developed with LCC and informed by the condition reports following PBI bridge surveys and engineering judgement. All costs are assumed to be at 2019 prices and include a 25% contingency assumption.

A601(M) short-listed options	Capital costs (years 1/2)	Capital costs (year 20)	Capital costs Total
Option 1	£ 1.6m	£ 8.5m	£ 10.1m
Option 3	£ 6.3m	£ 0.0m	£ 6.3m
Option 4	£ 7.4m	£ 0.0m	£ 7.4m
Option 5	£ 7.5m	£ 0.0m	£ 7.5m

Option 3 provides the most cost-effective option in terms of capital costs, with Option 1 the most expensive capital expenditure. However, consideration of capital costs alone will not determine the most suitable option to facilitate lower life costs and reduce public sector expenditure, as well as secure the best solution for the long-term management and the safety of the structures. Maintenance and renewal considerations, along with impacts on traffic/users and the environment, as well as delivery of scheme objectives are also key to determining the most suitable option for the A601(M).

A601(M) short-listed options	Maintenance & renewal costs (years 1-20)	Maintenance & renewal costs (years 20-60)*	Maintenance and renewal total (60 years*)
Option 1	£ 3.1m	£ 4.4m	£ 7.5m
Option 3	£ 1.0m	£4.8m	£ 5.8m
Option 4	£ 0.7m	£ 2.5m	£ 3.2m
Option 5	£ 1.0m	£ 3.3m	£ 4.3m

* 60-year costs do not include for growth and are undiscounted

Maintenance and renewal costs have been considered over a 60-year period (undiscounted). Option 4 provides the most cost-effective option in terms of maintenance expenditure. This is due to the reduced maintenance and renewal requirements for Higher North Road bridge, as a result of the removal of the bridge. Another saving is a consequence of the road reallocation of the A601(M) from a dual carriageway to a single carriageway road, which has lower renewal and maintenance requirements.

Findings and Next steps

Option 1 would have the most impact on traffic and the environment, with the reassignment of vehicles following the implementation of weight restrictions and reduction in remaining capacity as a result of lane restrictions. It is also the most expensive of the options, in terms of capital expenditure, due to temporary interventions, ongoing monitoring and the cost increased related to the deferred works, as well as the ongoing maintenance burden due to retention of the special road status.

Option 3 maintains all the current access arrangements, therefore having limited impact on traffic and the environment, including the capacity of the A601(M). The despecialisation reduces the maintenance requirements and therefore ongoing expenditure. However, the retention of Higher North Road bridge does require ongoing maintenance and renewal expenditure when compared to its removal and replacement with an at-grade junction. The retention also has implications on the location of access associated with opportunities for future development.

Option 4 maintains all access arrangements, with an alternative access for Nether Beck, via an at-grade junction. This alternative access will have limited impact on traffic, in terms of reassignment. However, the introduction of the road space reallocation to a single carriageway and a footway/cycleway will change the way the A601(M) currently operates, in terms of capacity, which could have implications on further future development opportunities, as well as more significantly the use of the A601(M) as the SRN diversionary route for M6 motorway (between junction 35 and 36). The despecialisation and the removal of Higher North Road bridge reduces the maintenance requirements and therefore ongoing expenditure. The road space reallocation also reduces the maintenance requirements, when compared to a dual-carriageway.

Option 5 maintains all access arrangements, with an alternative access for Nether Beck, via an at-grade junction. This alternative access will have limited impact on traffic, in terms of reassignment and existing capacity of the A601(M) will be maintained due to the retention of the dual carriageway, which has the potential to benefit further future development opportunities, as well as the use of the A601(M) as the SRN diversionary route for M6 motorway (between junction 35 and 36). The despecialisation and the removal of Higher North Road bridge reduces the maintenance requirements and therefore ongoing expenditure.

In collaboration with LCC officers, it was concluded that Options 3 and 5 provide optimal solutions for the future of the A601(M) route and structures within its extents to be taken forward to SOBC. Both options provide a balance between initial capital expenditure and ongoing maintenance burden, whilst maintaining the capacity of the A601(M).

1. Introduction

1.1 Purpose of this report

This Options Assessment Report (OAR) outlines the possible options for the future of the A601(M) route and structures within its extents. It describes the process of analysing the transport and maintenance challenges, defines the scheme objectives and identifies and assesses potential interventions to tackle these challenges.

This OAR has been structured in line with the transport appraisal process, which sets out a stepped process to analyse the issues and identify and assess potential options. This report has considered best practice for transport studies, as documented in the Department for Transport's Transport Analysis Guidance (WebTAG)¹ and Early Assessment and Sifting Tool (EAST)². This guidance has been used to inform the multi-criteria assessment matrix for the initial qualitative sifting process and further high-level quantitative assessment of short-listed options.

1.2 Structure of this report

This report outlines the sifting process and assessment results to identify the most suitable options for the future of the A601(M) route and structures within its extents. The remaining structure of the report consists of:

- Section 2: Background
- Section 3: Understanding current situation
- Section 4: Understanding future transport situation
- Section 5: Need for intervention and objectives
- Section 6: Generating and initial sifting of options
- Section 7: Option development and assessment
- Section 8: Summary

¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712965/WebTAG-transport-appraisal-process-may-2018.pdf

³ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/4475/east-guidance.pdf

2. Background

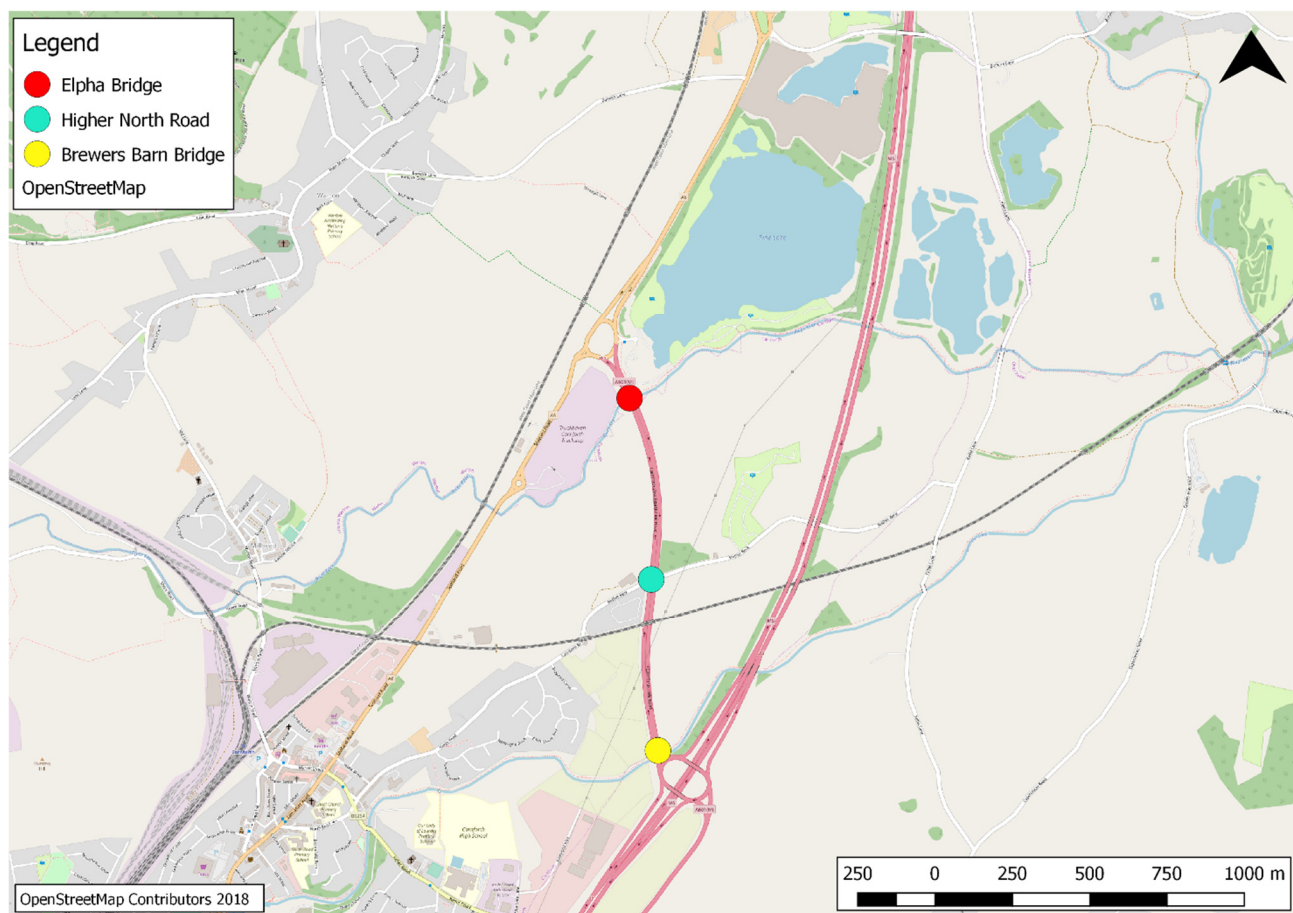
The geographical study area is limited to the A601(M) and any local routes that would be affected by changes to the A601(M). The A601(M) is a 1.3 mile (2.1km) Special Road in Lancashire, England. A Special Road is the official classification of motorways in the United Kingdom. As per the Special Roads Act 1949, later merged by the Highways Act 1980, the A601(M) is protected by Special Road Status.

Lancashire County Council (LCC) have advised that the following structures on the A601 (M) have current maintenance issues:

- Brewers Barn West (5387B1)
- Brewers Barn East (5381B1)
- Higher North Road (5383B1)
- Elpha Bridge (5384B1)

The railway bridge on Carnforth Brow is a Network Rail asset and is therefore omitted from this assessment. The location of the LCC structures are shown in Figure 2.1.

Figure 2.1: LCC Bridges with Current Maintenance Issues



2.1 Policy framework

Lancashire County Council's (LCC) Asset Management service currently identifies the optimal allocation of resources to extract best value to manage and prioritise the whole highway asset including highways, bridges, lighting and drainage.

LCC have recently published their Highways Asset Management Plan (Jan 2019)³ which has been drawn up in response to the UK Roads Liaison Group document 'Well-managed Highway Infrastructure: Code of Practice' (WMHICoP) published in October 2016. This replaces, updates and combines the contents of three previously separate codes of practice relating to the maintenance of highways ('Well-Maintained Highways') Structures ('Management of Highway Structures') and street lighting ('Well-Lit Highways').

The HMP recognises that maintaining highway assets involves more than filling potholes and repairing defects, as reducing budgets requires management of aging assets and manage risk in order to provide a safe and as reliable highway asset network as resources will allow. The WMHICoP acknowledges that as highway maintenance budgets are reducing, highway authorities can no longer maintain all their assets to the same standard or carry out cyclic activities at the same frequency as in the past. As a result, the WMHICoP advocates that each highway authority adopts its own a risk-based approach to highway management.

As such, LCC's philosophy is based on 'prevention is better than cure'. By intervening at the right time with the right treatment LCC will reduce 'whole-life' costs so more can be done with less. This is a significant departure from a traditional 'worst first' approach in that intervention could be more frequent at an earlier stage in an asset's life-cycle. This will enable the use of more cost-effective treatments and allow money to go further.

The HMP outlines the policies, procedures, guidance documents and operational practices LCC have put in place, to help manage and maintain highway assets in the best condition within the financial and resource constraints the county council operates. In order to overcome these constraints, LCC will where possible, look to secure additional funding through 'invest to save' projects, grants, developer contributions and the submission of competitive funding bids.

2.2 Approach

Stage 1 of the project consisted of a qualitative long list sift of six potential options for the future of the A601(M) route, which were agreed between LCC and Jacobs. This approach was concluded within the Options Sifting Report, which is summarised in section 6 and presents the results of a long-list sift of the six options shown in Table 2.1.

The six options were qualitatively sifted based on identified objectives and issues/considerations, with the most suitable options taken forward for further assessment in Stage 2 (reported in this OAR). As part of this assessment, the potential options identified will consider the ongoing maintenance burden to LCC, as well as future maintenance requirements. As part of this OAR process, a recommendation will be provided on options to be taken forward for Strategic Outline Business Case (SOBC) development and benefit cost ratio (BCR) calculations.

At the request of LCC, the Do Minimum Scenario (Option 1) has been assessed within this OAR. Option 1 involves continued monitoring of bridges, management of permitted traffic loading implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in number of lanes.

³ <https://www.lancashire.gov.uk/media/908726/highway-management-plan.doc>

Table 2.1: Long List Sift Options

Options	Option Title	Description
Option 1	Do Minimum	Continued monitoring of bridges. Temporary propping of Brewers Barn West and Higher North Road Management of permitted traffic loading could be implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in the number of lanes.
Option 2	Major Refurbishment of all bridges Keep M Status	Major repairs to the bridges. Resurfacing entire route. Upgrading central reservation barrier to bring route up to required motorway standards.
Option 3	Major refurbishment of all bridges Remove M Status	Major repairs to the bridges. Resurfacing entire route. Removal of M Status.
Option 4	Major Redesign of A601(M) Route A – reallocation of carriageway Remove M Status	Removal of M Status Major repairs to Brewers Barn West Bridge, Brewers Barn East and Elpha Bridge. Removal of Higher North Road overbridge and replacement with at grade junction Closure of one carriageway on A601(M) and conversion of the other carriageway to two-way running. Enable old carriageway to be converted to foot/cycleway link.
Option 5	Major Redesign of A601(M) Route B – retention of dual carriageway Remove M Status	Removal of M Status. Major repairs to Brewers Barn West Bridge, Brewers Barn East and Elpha Bridge. Removal of Higher North Road overbridge and replacement with at grade junction. Retention of dual carriageway along A601(M)
Option 6	Major Redesign of A601(M) Remove M Status Stop up Nether Beck	Removal of M Status. Major repairs to all bridges excluding Higher North Road Bridge. Stop up Nether Beck Road to obstruct access to Higher North Road Bridge. This does not include the removal of Higher North Road Bridge.

3. Understanding the Current Situation

3.1 Background

Carnforth is a small historic town located in the north of Lancashire.

The town is well connected by road and is located west of Junction 35 of the M6 and A601(M).⁴ In 2007 LCC, in exercise of the powers conferred on it by Section 83(1) of the Environment Act 1995, declared central Carnforth an Air Quality Management Area (AQMA).⁵ The roads associated with this Order are:

- Market Street (between the Haws Hill junction and the A6 Scotland Road / Lancaster Road junction);
- A6 Lancaster Road (between the Market Street junction and the North Road Junction);
- A6 Scotland Road (between the Market Street Junction and the Booths supermarket access road junction).

The B6254, at the south of the study area, is subject to a 7.5 tonne weight restriction (except for loading) at the access to the Kellet Road Industrial Estate. This is to prevent HGVs using the section to the west of the Industrial Estate to travel through the town centre to the A6.

The Carnforth Truck Haven is located on the A6 Scotland Road, west of the M6 Junction 35. The 24-hour service station also encompasses a petrol filling station, hotel, restaurant, shop and conference facilities. The Truck Haven provides facilities principally for HGV drivers, however these are also accessible to the public.

3.2 Site visit and constraints

A site visit was undertaken along the A601(M) and the surrounding study area on the 10 July 2018 and a number of physical constraints were identified. The study area and location of identified physical constraints are shown in Figure 3.1 and Table 3.1.

Table 3.1: Study Area Constraints

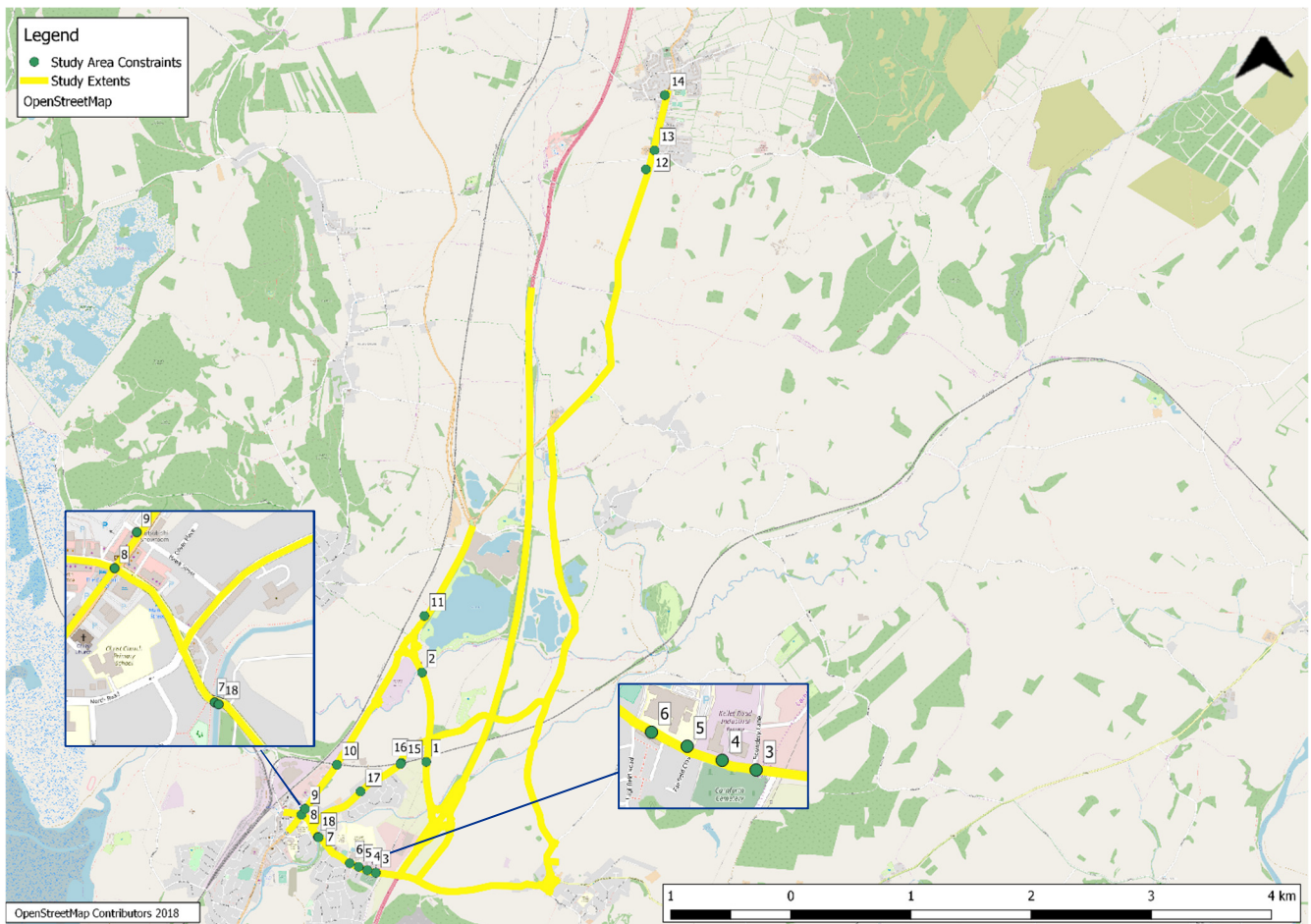
Location Point	Observation
1	Low bridge – restriction to high vehicles on the minor road
2	Speed limit change to 50mph from National Speed Limit
3	Change to 30mph
4	Weight restriction zone 7.5 tonnes along the eastern extents of B6254 Kellet Road
5	Change to 20mph
6	Cars parked on side of the road – width restrictions
7	Signalised one-way canal bridge – tight bends
8	Two-way crossroad junction – traffic building up on A6 southbound from traffic lights
9	Change to 50mph
10	Low curving bridge – high vehicles will only be able to pass through middle of lanes (15ft9in)
11	Two lanes merge into one
12	Change to 40mph
13	Change to 30mph
14	Narrow lanes – houses close to road either side, cars parked on side of road

⁴ <https://planningdocs.lancaster.gov.uk/NorthgatePublicDocs/00930527.pdf>

⁵ Air Quality Management Area (Carnforth) (No.1) Order 2007

Location Point	Observation
15	Bridge under railway – unsuitable for some HGVs – 3.9m
16	Change to 20mph
17	Unmarked narrow road, houses either side – parked cars on road – tight junctions with cars either side will make it almost impossible for HGVs to travel through
18	Environmental Weight restriction – 7.5 tonnes

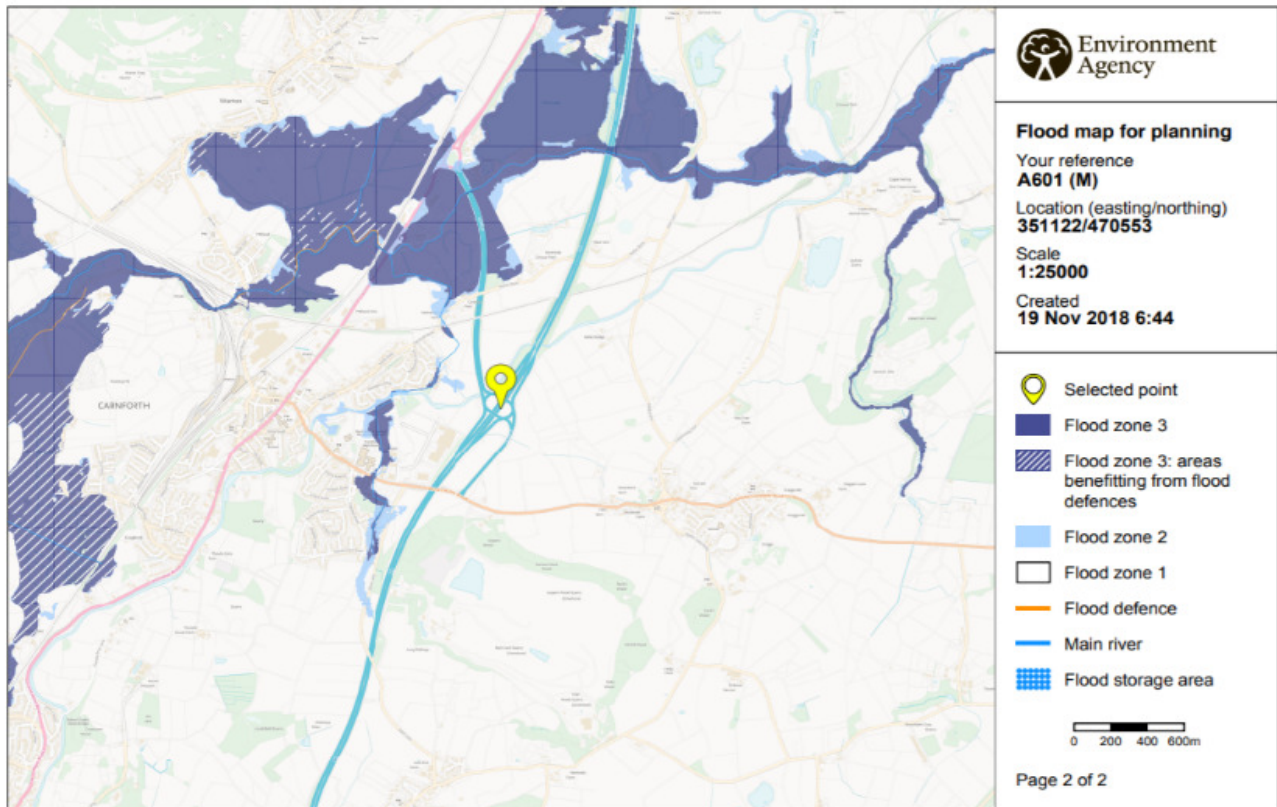
Figure 3.1: Study Area Constraints



3.3 Flood Risk

Figure 3.2 shows the study area is largely located within Flood Zone 1. The north west extents of the study area however, are located within Flood Zone 3.

Figure 3.2: Environment Agency Flood Risk



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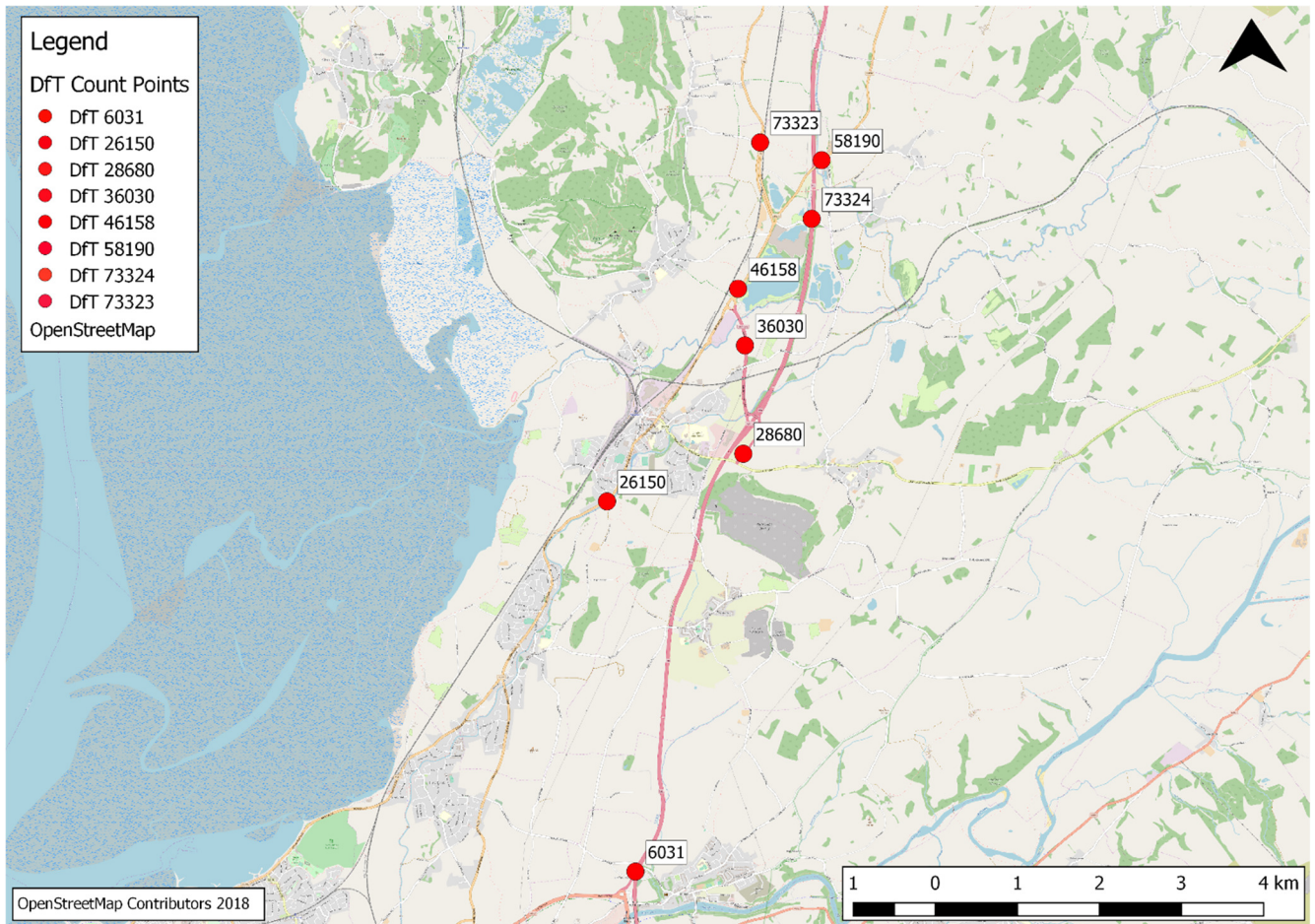
3.4 Traffic flows and collisions

The A601(M) is a key road from M6 junction 35, linking the M6 to the A6, providing access to the Truck Haven located on the junction of the A601(M) and A6, as well as Carnforth itself. The A601(M) also forms part of the official M6 motorway diversion route between junctions 35 and 36.

Baseline traffic flows for the Carnforth A601 (M) study area were obtained from the Department for Transport (DfT) website as bi-directional peak hour traffic data and Annual Average Daily Traffic (AADT) data. The data was used for eight sites between 07:00 - 19:00. The DfT count point locations are shown in Figure 3.3.

LCC provided data for one Automatic Traffic Count (ATC) over a 7-day period in January 2018 and two Manual Classified Turning Counts (MCCs) over a one-day period for January 2018. The LCC count points were used to validate the DfT data. LCC count point locations are shown in Figure 3.4.

Figure 3.3: DfT Count Points



The AADT flows for the eight DfT sites are outlined in Table 3.2. DfT Count Point 6031, located north west of Halton, does not have available AADT flows for 2017. Therefore, 2016 flows have been used in their place as it has been assumed there was unlikely to be a significant change in traffic flows between these years.

Table 3.2: Annual Average Daily Traffic of DfT Sites

DfT Reference	Location Description	Collection Year	AADT Flows	HGVs (%)
73324	M6 North of Junction 35	2017	69,191	9
58190	A6070 to the east of the M6	2017	3,768	2
73323	A6 North	2017	9,075	4
46158	North of A6 / A601(M) Roundabout	2017	13,941	3
36030	A601(M) North Arm	2017	10,471	10
28680	A601(M) South Arm	2017	9,296	11
26150	A6 South	2017	15,019	3
6031	M6 North of Junction 34	2016	63,751	12

As shown in Table 3.2, the highest AADT flows were recorded on the M6 (north of Junction 35 and 34) with two-way flows of 69,191 and 63,751 respectively. The presence of increased traffic volumes represents the role of the M6 as one of the key arterial routes on the strategic road network (SRN) as well as being one of the busiest.⁶

DfT count point 6031, located north west of Halton, does not have available AADT flows for 2017. Therefore 2016 AADT flows have been used in their place, as it has been assumed that there is not a significant increase in flows between 2016 and 2017.

As per the AADT data, the following sites recorded the highest proportion of HGVs:

- A601(M) North arm;
- A601(M) South arm; and
- M6 North of Junction 34.

These are logical routes that HGVs would use heading northbound from the M6 and A601(M) towards the Truck Haven located on the A6 Scotland Road off the A601(M) western arm. Therefore, the highest proportion of HGV traffic would likely be found along these routes.

As shown by Figure 3.4, the Truck Haven is located on Scotland Road, west of the M6 Junction 35. The 24-hour service station also encompasses a petrol filling station, hotel, restaurant, shop and conference facilities. The Truck Haven provides facilities principally for HGV drivers, however these are also accessible to the public.

Table 3.3: LCC Traffic Data

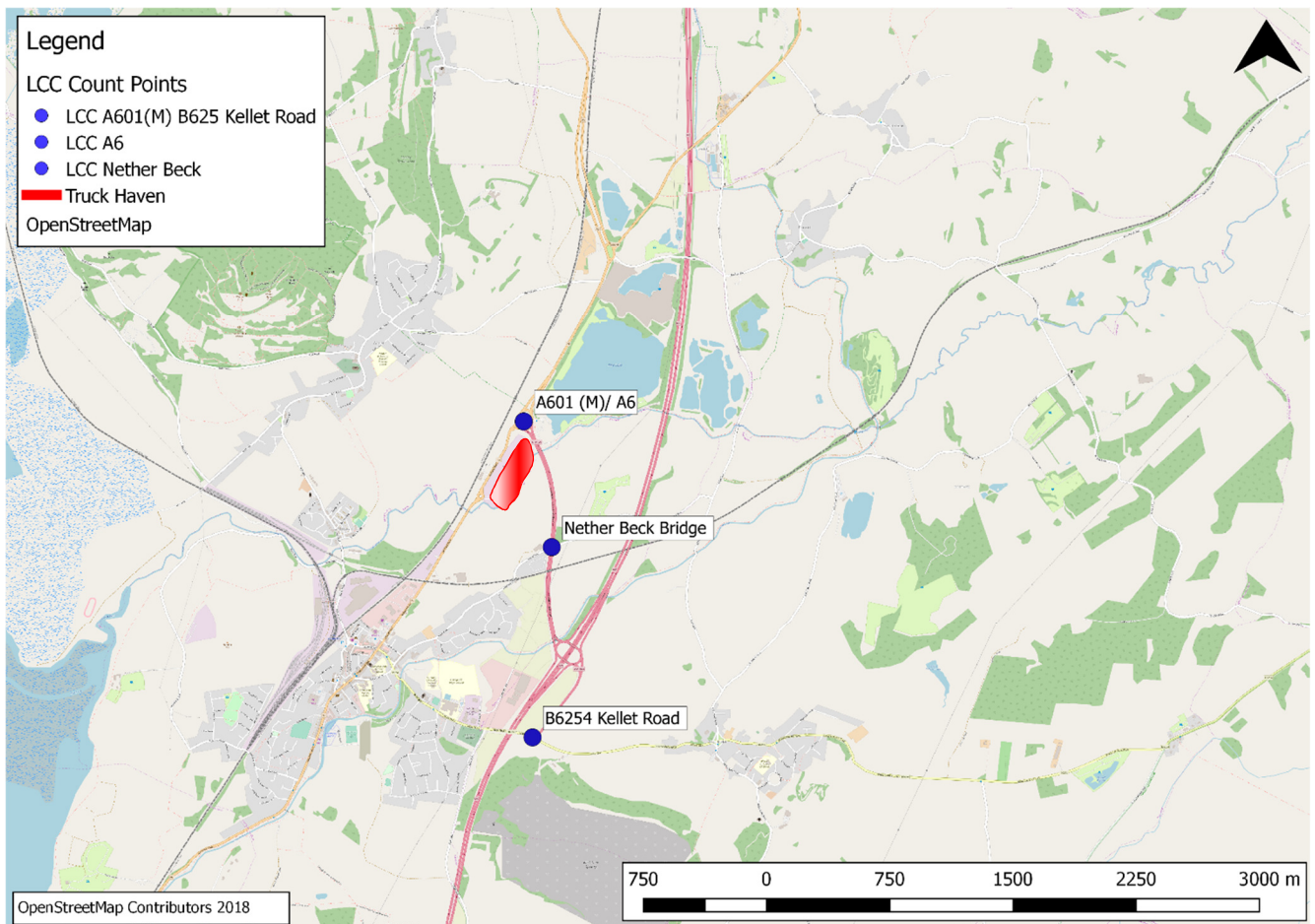
LCC Count Point Location	Direction	Collection Year	Average (daily)	HGVs (%)
Nether Beck Road East of Motorway Bridge	Eastbound	2018	215	3
	Westbound	2018	181	5
A601(M)/ Kellet Road (East Arm(M) Kellet Road (West Arm)	Northbound	2018	3,540	16
	Southbound	2018	3,034	13
A601(M)/ A6	Northwest bound	2018	4,031	13
	Southeast bound	2018	4,332	10

The LCC count point data were used to validate the DfT data. In both the DfT and LCC data the highest flows were recorded along the A601(M) and the A6 junction with the A601(M). As the LCC data does not include data for the M6 these flows are not compared.

The DfT and LCC data was not directly comparable due to the difference in count point locations, and differing data collection timescales. Notwithstanding this, the LCC data is a useful benchmark to assess for trends in flows and percentages of HGVs.

⁶ "M6 junctions 16-19: smart motorway". Highways England. Highways England. Retrieved 5 January 2018.

Figure 3.4: LCC Count Point and Truck Haven Locations



3.4.1 Journey Times

Journey times for the Carnforth A601(M) study area were obtained from LCC in the form of 2016 TrafficMaster data⁷. The data was provided in the following time periods:

- AM peak: 07:00 – 09:00;
- Inter-peak: 11:00 – 13:00; and
- PM peak: 16:00 – 18:00.

The data was broken down into 15-minute segments throughout the day and analysed by link. Locations of these links are shown in Figure 3.5, and the results of the assessment are shown in Table 3.4. Note that Route B, from the south of Junction 35 A601(M)/ M6 to Kellet Lane Bridge, was not assessed as TrafficMaster data for this route was not provided. Notwithstanding this, it is not considered that this route would be significantly affected by the options proposed.

⁷ TrafficMaster is a Global Positioning System (GPS) sourced dataset which provides detailed analysis of journey times.

Figure 3.5: Baseline Link Journey Times

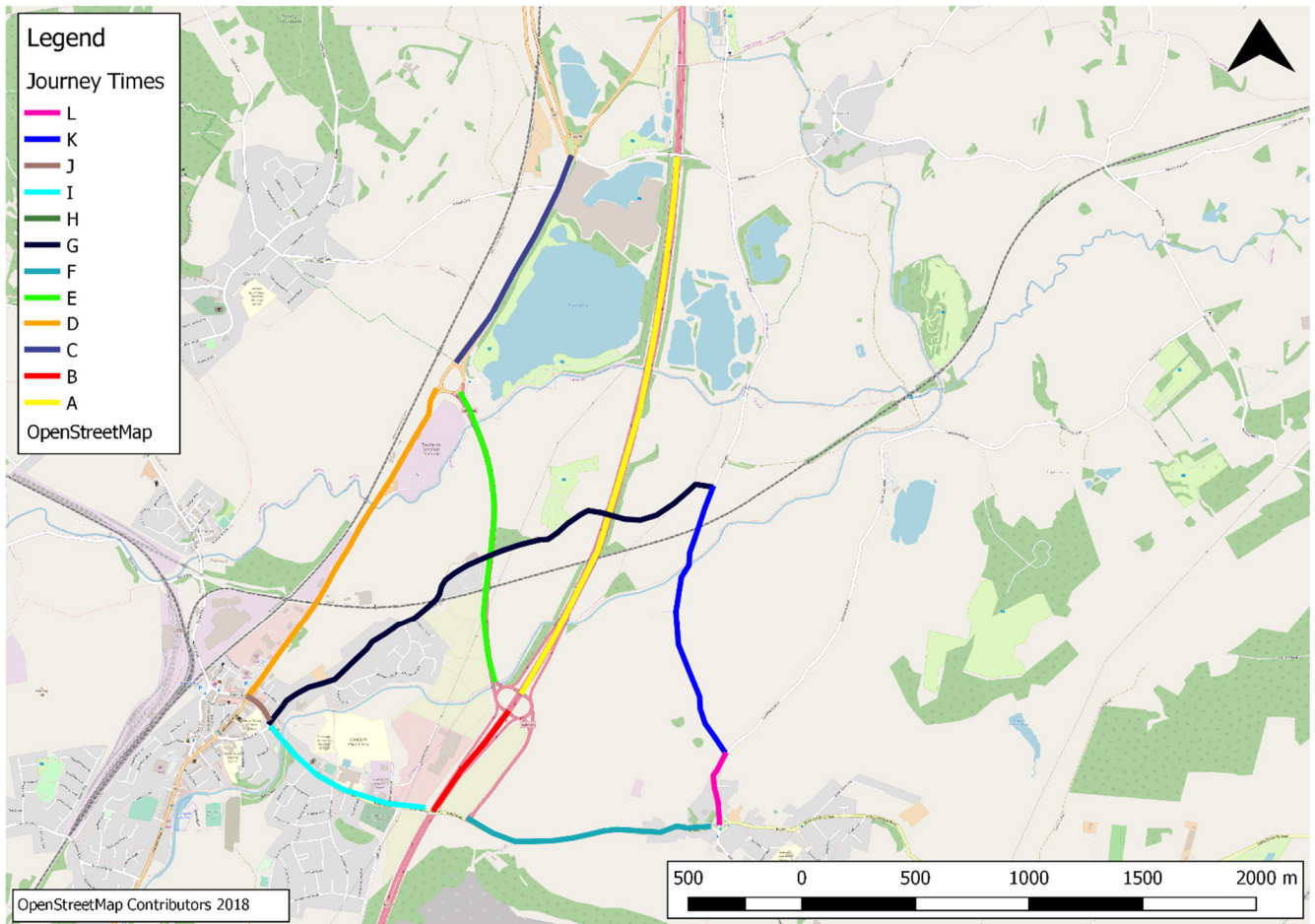


Table 3.4: Baseline Link Journey Times

Route	Direction	Description	Speed Limit	Time (s)			Link Length (m)
				AM	Interpeak	PM	
A	Northbound	Junction 35 M6/ A601 (M) to Borwick Lane	National Speed Limit	78	79	77	2483
	Southbound	Borwick Lane to Junction 35 M6/ A601 (M)	National Speed Limit	80	85	89	2494
C	Northbound	Junction 35a A601(M)/ A6 to A6/ A607 Roundabout	50mph	59	61	59	1070
	Southbound	A6/ A607 Roundabout to Junction 35a A601(M)/ A6	50mph	61	66	63	1067
D	Northbound	A6 Carnforth Town Centre to A6 Truck Haven/ A601 (M) Roundabout	30mph and 50mph	111	119	116	1629
	Southbound	A6 Truck Haven/ A601 (M) Roundabout to A6 Carnforth Town Centre	30mph and 50mph	138	201	287	1647

Route	Direction	Description	Speed Limit	Time (s)			Link Length (m)
				AM	Interpeak	PM	
E	Northbound	Junction 35 M6/ A601 (M) to A6 Truck Haven/ A601 (M) Roundabout	National Speed Limit	60	62	62	1392
	Southbound	A6 Truck Haven/ A601 (M) Roundabout to Junction 35 M6/ A601 (M)	National Speed Limit	61	61	63	1382
F	Westbound	A601 (M) junction with Kellet Road junction to B6254 Over Kellet junction with	National Speed Limit	86	115	80	1152
	Eastbound	B6254 Over Kellet to A601 (M)/ Kellet Road	National Speed Limit	79	88	83	1152
G	Northeast bound	North Road junction with B6254 to Higher North Bridge	20mph and 30mph	225	227	219	2341
	Southwest bound	Higher North Bridge to North Road junction with B6254	20mph and 30mph	202	231	195	2341
H	Northbound	A601 (M) junction with Kellet Road to Junction 35 A601 (M)/ M6	National Speed Limit	39	38	38	557
	Southbound	Junction 35 M6/ A601 (M) to A601 (M) junction with Kellet Road	National Speed Limit	44	41	94	586
I	Westbound	Kellet Road Bridge over the M6 to North Road junction with B6254	30mph and 20mph	122	109	124	1007
	Eastbound	North Road junction with B6254 to Kellet Road Bridge over the M6	30mph and 20mph	108	108	128	1007
J	Westbound	North Road junction with B6254 to A6 junction with Market Street and B6254	20mph	44	53	51	153
	Eastbound	A6 junction with Market Street and B6254 to North Road junction with B6254	20mph	18	19	19	153
K	Northbound	Kellet Lane junction with Capernwray Road to Kellet Lane junction with Nether Beck	National Speed Limit	104	104	102	1257
	Southbound	Kellet Lane junction with Nether Beck to Kellet Lane junction with Capernwray Road	National Speed Limit	109	113	110	1257
L	Northbound	Capernwray Road junction with B6254 to Capernwray Road junction with Kellet Lane	30mph	33	31	31	324
	Southbound	Capernwray Road junction with Kellet Lane to Capernwray Road junction with B6254	30mph	39	39	37	324

There is a general incidence of higher journey times travelling southbound and westbound on the links assessed. This is likely due to vehicles travelling towards Carnforth Town Centre. Congestion at these locations, principally the A6 and B6254 Kellet Road (Routes D and I) and the A601 (M) and B6254 Kellet Road junctions (Route F), are highlighted in the District of Lancaster Highways and Transport Masterplan 2016⁸.

The highest journey times were experienced travelling eastbound and westbound between the North Road junction with B6254 to Higher North Road Bridge (along Route G). This is likely due to the 20mph and 30mph speed limits.

Table 3.4 shows that the inter-peak journey times were generally higher than the AM and PM peak journey times. This could be a result of the routes largely not being used as commuting routes during the AM and PM peaks.

3.4.2 Collisions

LCC provided Jacobs with a five-year period of collision data (01 January 2013 - 31 December 2017). During this period, 66 collisions were recorded within the extents shown in Figure 3.6. The collisions were distributed as follows:

- 43 collisions were slight;
- 21 collisions were serious; and
- 2 collisions were fatal.

Of the 66 collisions, 13 collisions involved non-motorised users (NMUs). One involved an adult cyclist which resulted in a slight casualty, eight involved an adult pedestrian which resulted in two serious casualties and six slight casualties, two involved a child cyclist and two involved a child pedestrian. The remaining collisions involved motorised vehicles. Of the 13 NMU collisions, 10 were located in the urban area of Carnforth.

71% of the recorded collisions occurred during the PM (between 12:00 - 0:00). Notably, 68% of these collisions occurred between 16:00 – 00:00 which suggests that a loss of natural light/ increase in driver stress associated with driving in the dark may have contributed to the collisions.

With the exclusion of the road network within the urban area of Carnforth it is noted that the rest of the network in the study area is unlit. Road markings, road studs and signs may also be nearing the end of their design life.

As shown by Figure 3.6, the recorded 66 collisions are clustered in following three locations:

- M6/ A601 Junction 35;
- A6 junction with Market Street and B6254; and
- A6 junction with A601 (M) western arm.

There appears to be a correlation between locations which have been identified in the District of Lancaster Highways and Transport Masterplan 2016 as being areas of congestion and with clusters of collisions, as shown in Figure 3.6.

⁸ <https://www.lancashire.gov.uk/media/899614/final-lancaster-highways-and-transport-master-plan.pdf>

Figure 3.6: LCC Collision Locations 01 January 2013 - 31 December 2017



3.5 Condition of Infrastructure

Through engagement with LCC, the following information on the current condition of the bridge infrastructure has been identified.

Table 3.5 shows approximate capital expenditure costs of repairing the structures. Additional information regarding on-going maintenance costs has been provided to inform the long-list sifting and for the option assessment in section 7, particularly where a 'Deterioration Forecast' or 'Strategy for Managing Decline' data or information is incorporated. To supplement this table, further information obtained from LCC also provides the deterioration status of each of the structures, both in tabular and figure form. This is present to support the data in Table 3.5. It has been assumed for this exercise that these are based on 2019 prices and include a 43% contingency assumption.

Table 3.5: Current Condition of Infrastructure

Bridge	Condition	Repair Works Description	Upfront Capital Expenditure for repairs in Yr 1
5381 B1 - Brewers Barn West	The main defects noted were failure of the bearings and failure of the waterproofing system which require urgent renewal to prevent further damage occurring to the structure.	Essential maintenance is required to Brewers Barn West bridge to maintain the capacity of the bridge and to prevent the implementation of propping in place of failed bearings and restrictions to Abnormal Loads and HGVs in the near future. The propping would also restrict the Lancaster Canal beneath.	£890,000
5381 B2 - Brewers Barn West (Widening)	Brewers Barn West (Widening) does not carry an adopted highway. It is a legacy structure from the original Lancaster bypass road configuration. It has therefore not been subjected to the same inspection and assessment regime as the other structures on the route. The bridge is however of the same age and construction as Brewers Barn West and general inspection carried out in 2014 indicates similar problems with the bearings.	Assumption that the costs to repair the bridge will be approximately the same as for Brewers Barn West.	£860,000
		As the bridge serves no purpose for the highway in its current configuration the preferred solution would be to remove the existing deck and make safe the abutments.	£500,000
5387B1 – Brewers Barn East	The latest inspection scores were good, but some works are required to the parapets as well as concrete repairs. As extensive resurfacing will likely be taking place the opportunity should also be taken to renew the waterproofing.	Some works are required to the parapets as well as concrete repairs. As extensive resurfacing will likely be taking place the opportunity should also be taken to renew the waterproofing.	£150,000
Higher North Road	The condition of the bearings is poor with extensive corrosion throughout and in some cases have failed. The bearings have failed and the lack of connection and support at some of the bearing positions will be placing undue stress on the remaining bearings positions and will weaken the superstructure and increase the rate of fatigue shortening the design life of the bridge.	Essential maintenance is required to Higher North Road to maintain the capacity of the bridge and to prevent the implementation propping in place of failed bearings. Due to the proximity of the piers to the A601(M) carriageway the propping would take each carriageway down to a single lane. A weight restriction of 3 tonnes may be required to be implemented on the road above.	£2,470,000
		Removal of the bridge.	£1,000,000
		The bridge carries a number of statutory undertakers (BT and Water) services which will likely need to be diverted if the bridge is removed. There is also a low-pressure gas main running beneath the highway to the west of the bridge that would likely need to be diverted if the road is lowered to the same level as the A601(M). Statutory undertaker's diversions for removal.	£500,000
		Potential installation of at grade crossing (roundabout or signals) following removal of the bridge	£1,200,000

Bridge	Condition	Repair Works Description	Upfront Capital Expenditure for repairs in Yr 1
5384B1 – Elpha		Essential maintenance is required to the southwest and northeast parapet mounting beams and metal parapets along with general concrete repairs to deck soffit and drainage repair works.	£750,000

To supplement the information summarised in Table 3.5 more detailed information received from LCC on the current status of the bridges have been received. Table 3.6 to Table 3.9 and Figure 3.7 to Figure 3.10 were obtained from Inspection Data to show the deterioration rate for each of the structures.

The narrative which is contained within this section was obtained through LCC on the current status of each of the structures. This text remains broadly unchanged, apart from formatting tables and figures within the body and context of this reporting.

3.5.1 Brewers Barn West – Structure Status

The bridge was last assessed in 1995 with a capacity of 40 tonnes and 45 units of HB.

The latest inspection score gives the bridge the following scores:

- BClav – 70.88
- BClcrit – 22.12

The BClcrit score of less than 40 would indicate failure or possible failure of critical element. In the case of Brewers Barn West, the bearings have failed but a risk assessment would indicate collapse of the structure due to this failure mode would not be catastrophic so can remain open. The lack of movement in the bearings will however weaken the superstructure and increase the rate of fatigue shortening the design life of the bridge.

Essential maintenance is required to Brewers Barn West bridge to maintain the capacity of the bridge and to prevent the implementation of propping in place of failed bearings and restrictions to Abnormal Loads and HGVs in the near future. The propping will also restrict the Lancaster Canal beneath.

Temporary propping (in lieu of bearings) would cost around £300,000 in capital costs along with £50,000 in escalated concrete repairs and on-going maintenance of £1000 per annum. It would also require an increased bridge inspection regime for this structure from two-yearly to yearly (at £100 per annum).

It is difficult to predict the future intervention date for the structure as the problem is localised to one element of the structure. However, for the options assessment all invention years for upfront capital expenditure have been assumed to be in 2020.

The bridge was subject to a Principal Bridge Inspection (PBI) and Post Tension Special Inspection (PTSI) in 2014. The main defects noted were 'failure of the bearings' and 'failure of the waterproofing system' which require urgent renewal to prevent further damage occurring to the structure.

The PBI recommends £601,700 costs for the identified structural works. The capital cost estimate for all repair works to Brewers Barn West is £890,000. It is assumed that this figure is exclusive of ongoing revenue maintenance requirements, which are captured in section 7 later in this report.

3.5.2 Brewers Barn West (Widening) – Structure Status

Brewers Barn West (Widening) does not carry an adopted highway. It is a legacy structure from the original Lancaster bypass road configuration. It has therefore not been subjected to the same inspection and assessment regime as the other structures on the route. The bridge is however of the same age and construction as Brewers Barn West and a general inspection carried out in 2014 indicates similar problems with the bearings.

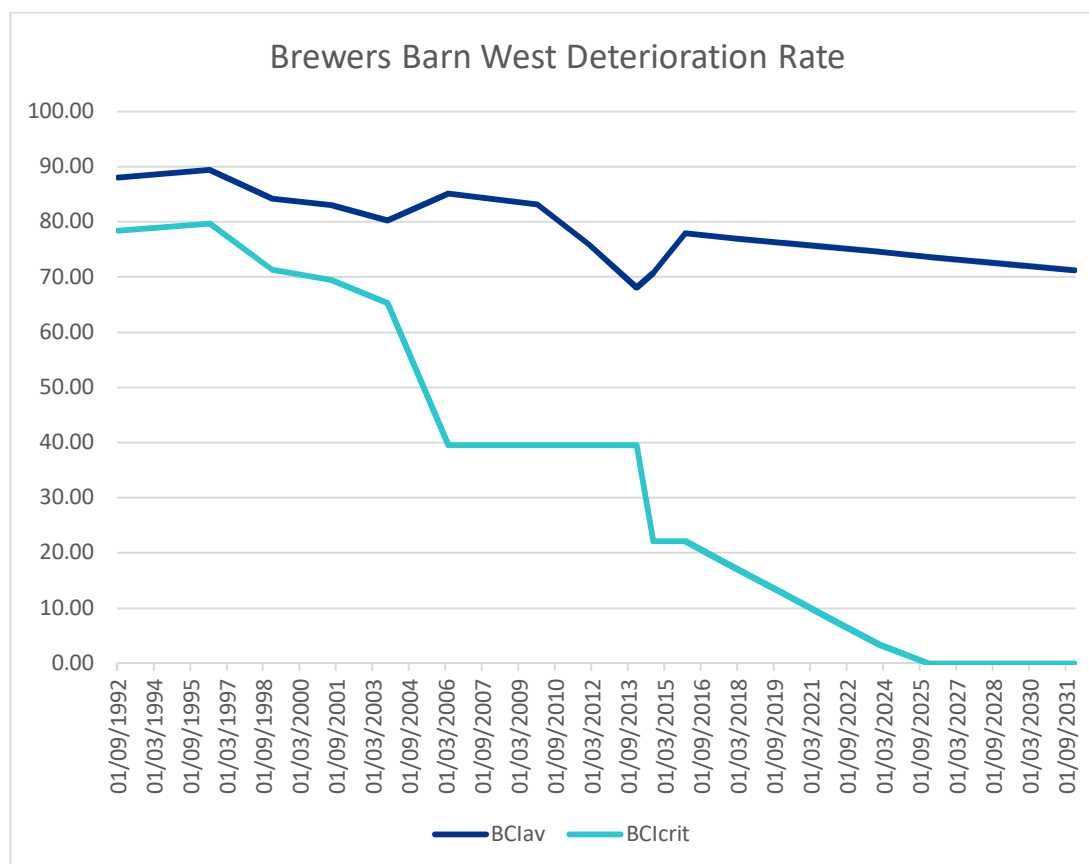
For the purposes of this exercise, it should be assumed that costs to repair the bridge will be approximately the same as for Brewers Barn West. As the bridge serves no purpose for the highway in its current configuration the preferred solution would be to remove the existing deck and make safe the abutments.

The capital cost estimate for all repair works to Brewers Barn West (Widening) is £890,000. The capital cost estimate for removing Brewers Barn West (Widening) is £500,000. It is assumed that this figure is exclusive of ongoing revenue maintenance requirements, which are captured in section 7 later in this report.

Table 3.6: Deterioration Rate for Brewers Barn West

Inspection Date	BCIav	Interpretation	BCIcrit	Interpretation
16/09/1992	88.00	Very Good	78.40	Very Good
27/06/1996	89.40	Very Good	79.70	Good
05/01/1999	84.20	Very Good	71.30	Good
26/06/2001	83.00	Very Good	69.50	Good
09/10/2003	80.20	Good	65.30	Fair
03/04/2006	85.1	Good	39.5	Poor
15/12/2009	83.2	Good	39.5	Fair
04/01/2012	76	Fair	39.5	Poor
08/01/2014	68.1	Fair	39.5	Poor
11/09/2014	70.7	Fair	22.1	Poor
15/01/2016	77.9	Fair	22.1	Poor
14/01/2018	77.06	Fair	17.41	Poor
14/01/2020	76.22	Fair	12.72	Poor
13/01/2022	75.38	Fair	8.03	Poor
13/01/2024	74.53	Fair	3.33	Poor
12/01/2026	73.69	Fair	0.00	Poor
12/01/2028	72.85	Fair	0.00	Poor
11/01/2030	72.01	Fair	0.00	Poor
11/01/2032	71.17	Fair	0.00	Poor

Figure 3.7: Brewers Barn West Deterioration Rate



The information shown in Table 3.6 and Figure 3.7 respectively demonstrate that bridge inspection scores indicate that the critical element is already beyond serviceability. The bridge can remain in use as there would be temporary measures protecting the public from the weak area.

3.5.3 Brewers Barn East – Structure Status

The bridge was last assessed in 1995 with a capacity of 40 tonnes and 33 units of HB

The latest inspection score gives the following scores:

- BClav – 82.57
- BClcrit - 100

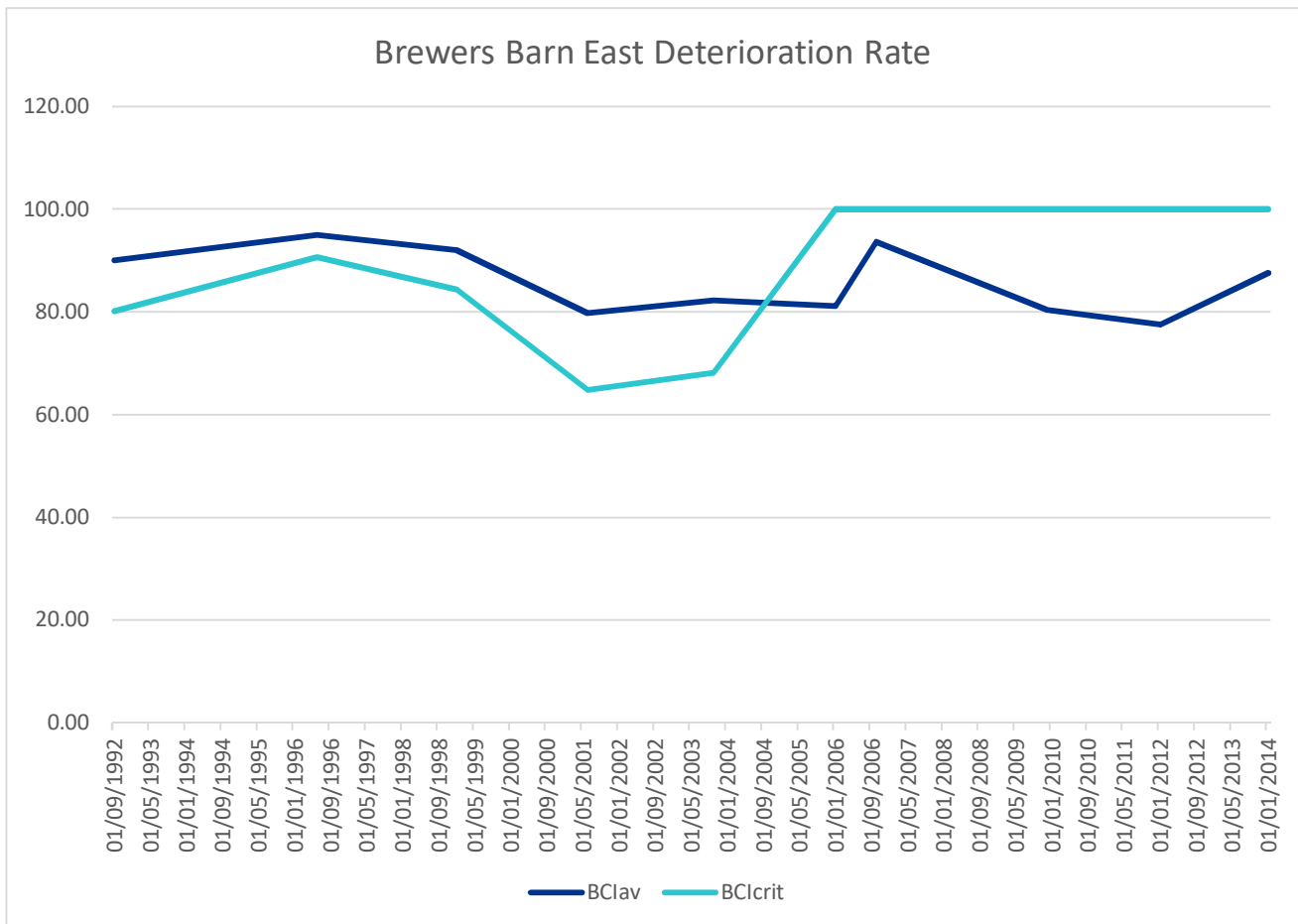
Brewers Barn West has not been subject to a detailed PBI recently.

The capital cost estimate for all repair works to Brewers Barn East is £150,000. It is assumed that this figure is exclusive of ongoing revenue maintenance requirements, which are captured in section 7 later in this report.

Table 3.7: Deterioration Rate for Brewers Barn East

Inspection Date	BCIav	Interpretation	BCIcrit	Interpretation
16/09/1992	90.00	Very Good	80.20	Very Good
27/06/1996	95.00	Very Good	90.70	Good
05/01/1999	92.00	Very Good	84.40	Good
26/06/2001	79.80	Very Good	64.80	Good
09/10/2003	82.20	Good	68.20	Fair
26/10/2006	93.6	Good	100	Excellent
15/12/2009	80.4	Good	100	Excellent
04/01/2012	77.5	Good	100	Excellent
08/01/2014	87.6	Good	100	Excellent
15/01/2006	81.1	Good	100	Excellent

Figure 3.8: Brewers Barn East Deterioration Rate



The latest inspection scores which are shown in Table 3.7 and Figure 3.8 respectively are good, but some works are required to the parapets as well as concrete repairs. As extensive resurfacing will likely be taking place the opportunity should also be taken to renew the waterproofing (capital costs have been included).

3.5.4 Higher North Road – Structure Status

The bridge was last assessed in 1991 with a capacity of 40 tonnes and 25 units of HB.

The latest inspection score gives the bridge the following scores:

- BClav – 84.44
- BClcrit – 78.88

The BCI scores show that the structure is in overall Good to Fair condition.

However, the individual element score for the bearings is 4E which shows that the condition of the bearings is poor with extensive corrosion throughout and in some cases have failed. In the case of Higher North Road, the bearings have failed but a risk assessment would indicate collapse of the structure due to this failure mode would not be catastrophic so can remain open. However, the lack of connection and support at some of the bearing positions will be placing undue stress on the remaining bearings positions and will weaken the superstructure and increase the rate of fatigue shortening the design life of the bridge.

Essential maintenance is required to Higher North Road to maintain the capacity of the bridge and to prevent the implementation propping in place of failed bearings. Due to the proximity of the piers to the A601(M) carriageway, the propping would take each carriageway down to a single lane on the A601(M). A weight restriction of 3 tonnes may be required to be implemented on Higher North Road (above).

Bridge propping (in lieu of bearings) would cost around £700,000 in capital costs and on-going maintenance of £1000 per annum, along with £250,000 in carriageway restrictions every 20 years and a permanent weight restriction costed at £5000 in year two, then £1000 every five years. It would also require an increased bridge inspection regime for this structure from two-yearly to yearly (at £100 per annum).

It is difficult to predict the future intervention date for the structure as the problem is localised to one element of the structure.

It should be noted that if the bridge is removed there could be long-term savings. This could for example incorporate journey time savings or financial savings. This has been quantified in section 7 of this report.

The bridge carries a number of statutory undertakers' services which will need to be diverted if the bridge is removed. These are BT and Water. There is a low-pressure gas main running beneath the highway to the west of the bridge that may need to be diverted if the road is lowered to the same level as the A601(M).

Option A - The capital cost estimate for all repair works to Higher North Road is £2,470,000.

Option B - The capital cost estimate for removal of Higher North Road is £1,500,000 (including a cost estimate for Statutory Undertakers Diversions of £500,000).

It is assumed that this figure is exclusive of ongoing revenue maintenance requirements, which are captured in section 7 later in this report.

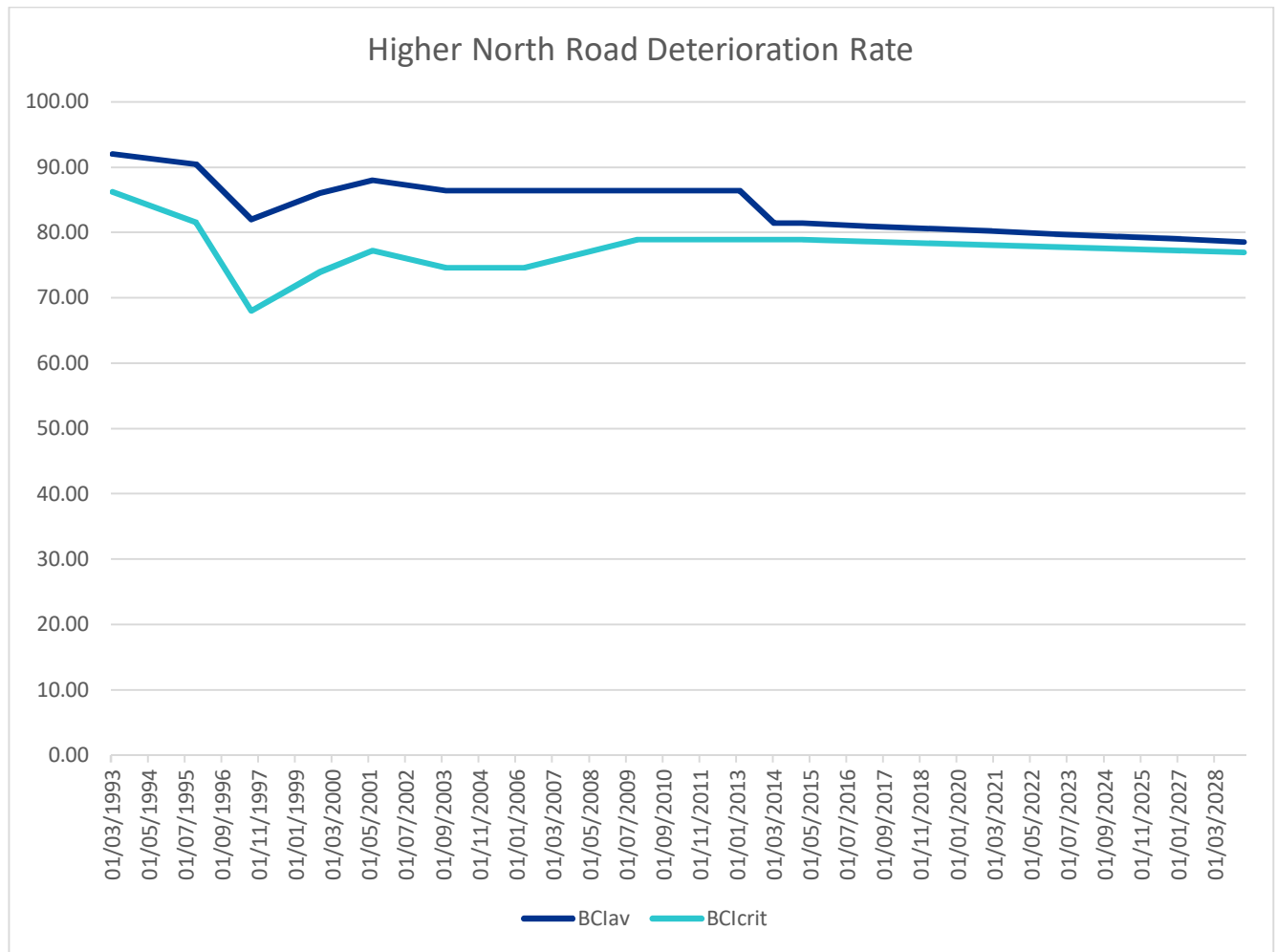
An indicative capital costs have also been included for the potential installation of an at-grade crossing (roundabout or signals) if Higher North Road is removed, this is estimated at £1,200,000.

Further discussion of these options has been included in sections 6 and 7 of this report.

Table 3.8: Deterioration Rate for Higher North Road

Inspection Date	BCIav	Interpretation	BCIcrit	Interpretation
22/03/1993	92.00	Very Good	86.20	Very Good
07/11/1995	90.40	Very Good	81.50	Good
28/08/1997	82.00	Very Good	68.00	Good
25/10/1999	86.00	Very Good	73.90	Fair
26/06/2001	88.00	Good	77.20	Fair
23/10/2003	86.40	Good	74.60	Fair
03/04/2006	86.40	Good	74.60	Fair
10/11/2009	86.40	Good	78.90	Fair
23/02/2011	86.40	Good	78.90	Fair
19/02/2013	86.40	Good	78.90	Fair
19/03/2014	81.40	Good	78.90	Fair
25/02/2015	81.40	Good	78.90	Fair
24/02/2017	80.99	Good	78.62	Fair
24/02/2019	80.58	Good	78.34	Fair
23/02/2021	80.18	Good	78.06	Fair
23/02/2023	79.77	Fair	77.78	Fair
22/02/2025	79.36	Fair	77.50	Fair
22/02/2027	78.95	Fair	77.22	Fair
21/02/2029	78.55	Fair	76.93	Fair
21/02/2031	78.14	Fair	76.65	Fair
20/02/2033	77.73	Fair	76.37	Fair
20/02/2035	77.32	Fair	76.09	Fair
19/02/2037	76.92	Fair	75.81	Fair
19/02/2039	76.51	Fair	75.53	Fair
18/02/2041	76.10	Fair	75.25	Fair
18/02/2043	75.69	Fair	74.97	Fair
17/02/2045	75.28	Fair	74.69	Fair
17/02/2047	74.88	Fair	74.41	Fair
16/02/2049	74.47	Fair	74.13	Fair
16/02/2051	74.06	Fair	73.85	Fair
15/02/2053	73.65	Fair	73.57	Fair
15/02/2055	73.25	Fair	73.28	Fair
14/02/2057	72.84	Fair	73.00	Fair

Figure 3.9: Higher North Road Deterioration Rate



The data in Table 3.8 and Figure 3.9 shows the deterioration rate of the structure shows the structure should remain in a 'fair' condition for a considerable amount of time. As previously mentioned this is unlikely to be an accurate forecast as the defects are localised to the bearings.

3.5.5 Elpha – Structure Status

A PBI was undertaken in 2018. Essential maintenance is required to the southwest and northeast mounting beams and metal parapets along with general concrete repairs to the deck soffit and drainage repairs is required. The cost estimate for the required structural works is £750,000.

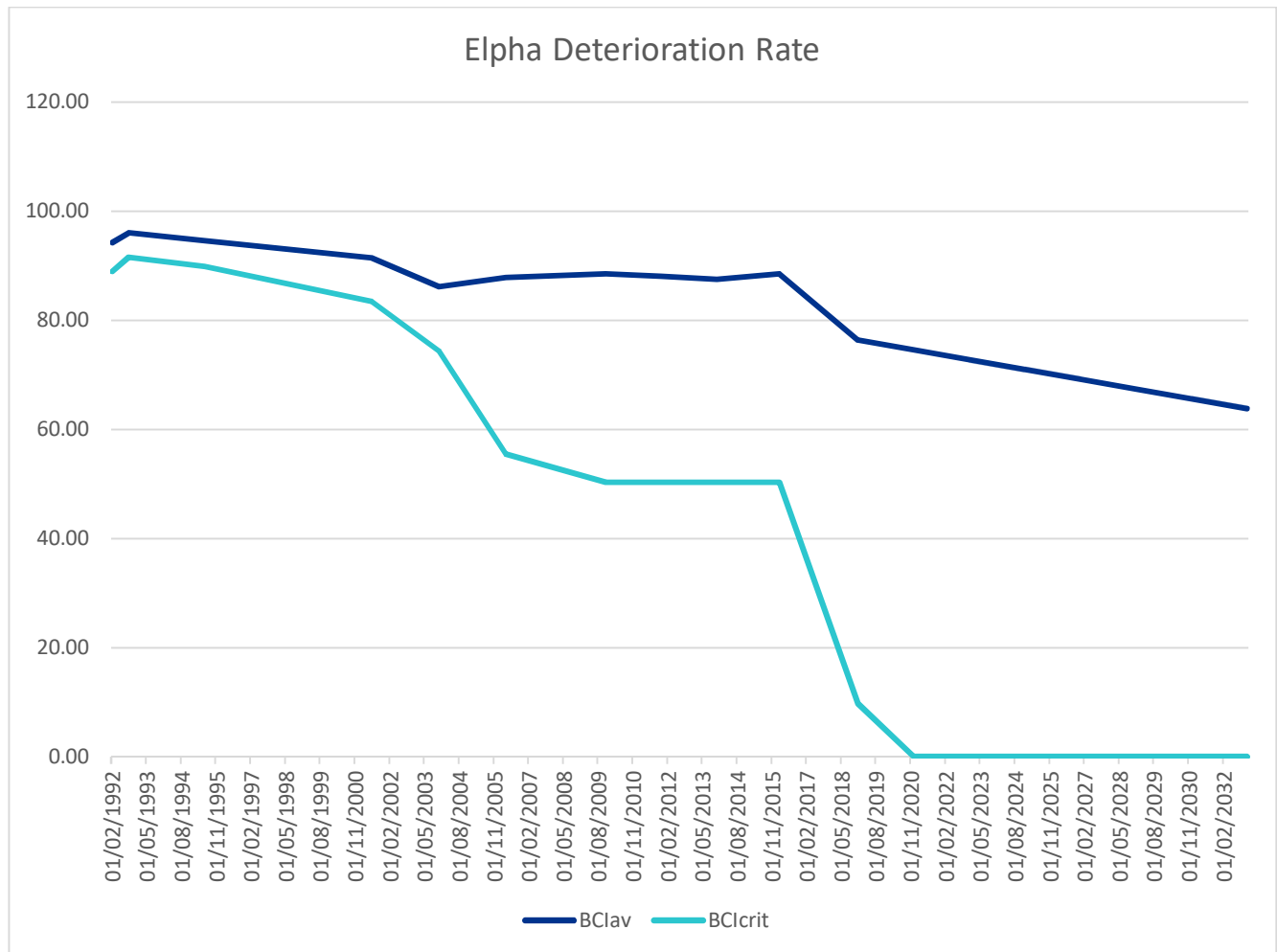
The latest inspection score gives the bridge the following scores:

- BClav – 76.33
- BClcrit – 9.72

Table 3.9: Deterioration Rate for Elpha

Inspection Date	BClav	Interpretation	BCIcrit	Interpretation
16/09/1992	96.00	Very Good	91.50	Very Good
27/06/1995	94.60	Very Good	89.90	Good
03/02/1992	94.20	Very Good	89.00	Good
26/06/2001	91.40	Very Good	83.40	Good
04/11/2003	86.20	Good	74.40	Fair
03/04/2006	87.80	Good	55.50	Poor
10/11/2009	88.50	Good	50.32	Fair
23/11/2011	88.10	Good	50.30	Poor
11/11/2013	87.50	Good	50.30	Poor
24/02/2016	88.50	Good	50.30	Poor
19/12/2018	76.33	Good	9.72	Very Poor
18/12/2020	74.54	Good	0.00	
18/12/2022	72.75	Good	0.00	
17/12/2024	70.97	Good	0.00	
17/12/2026	69.18	Fair	0.00	
16/12/2028	67.39	Fair	0.00	
16/12/2030	65.60	Fair	0.00	
15/12/2032	63.81	Fair	0.00	

Figure 3.10: Elpha Deterioration Rate



The bridge inspection scores show in both Table 3.9 and Figure 3.10 show that the critical element is already beyond serviceability. The bridge can remain in use as there are temporary measures protecting the public from the weak area.

The capital cost estimate for all repair works to Elpha bridge is £750,000. It is assumed that this figure is exclusive of ongoing revenue maintenance requirements, which are captured in section 7 later in this report.

3.5.6 Additional cost considerations

The options identified for consideration also include proposals and upfront capital expenditure as follows:

- despecialisation/removal of M status of A601(M) - **£1,500,000**;
- retention of M status resulting in upgrade of central reservation - **£1,300,000**; and
- resurfacing costs of A601(M) dependent on whether it is reallocated between Higher North Bridge and A6 as a:
 - single carriageway road - **£170,000**, or
 - retained as dual carriageway - **£220,000**.

4. Understanding the Future Transport Situation

4.1.1.1 Background Traffic Growth

For this assessment, a design year of 2022 (2017 + 5 years) has been adopted for the assessment of the effects of the background traffic growth on the local highway network. 2017 was selected as most of the data available was obtained in 2017.

The Trip End Model Presentation Programme (TEMPro) Version 7.2 was used to apply background traffic growth factors for the 2022 design year. Table 4.1 shows the TEMPro factors applied to the baseline traffic flows.

Table 4.1: TEMPro Lancaster 001 Growth Figures

Local Growth Figure	Local Growth Figure
AM Peak (07:00 – 09:59)	1.06
Inter-Peak (10:00 – 15:59)	1.07
PM Peak (16:00 – 18:59)	1.07

4.1.2 Future Traffic Growth

Table 4.2 shows the baseline LCC peak hours derived from the ATC and MCC data provided by LCC. The AM peak, inter-peak and PM peak TEMPro factors were applied to the respective periods to calculate the absolute increase in traffic flows.

The inter-peak has been selected per location as the peak hour between the AM and PM peak with the highest flows. Therefore, there is variation between the inter-peak hours on different areas of the network. The AM and PM peaks have also been selected per location based on the AM or PM hour with the highest traffic flows. As a result of this, there is variation between the peak hours which may impact the data and analysis.

The results show that there is not likely to be a significant increase between the baseline year and design year (2022).

Table 4.2: LCC Future Do Minimum (Without Committed Development)

Location Description	Direction	Peak Period	Baseline	Future (Baseline x TEMPro)	Increase (Absolute)
A6/ A601(M) Junction 35a	Northbound	AM Peak (08: 00 – 09:00)	403	426	23
		Inter-Peak (15:00 – 16:00)	336	354	18
		PM Peak (17:00 – 18:00)	511	538	27
	Southbound	AM Peak (08: 00 – 09:00)	481	509	28
		Inter-Peak (15:00 – 16:00)	395	416	21
		PM Peak (16:00 – 17:00)	460	484	24
A601/ B6254 Kellet Road	Northbound	AM Peak (08:00 – 09:00)	325	344	19
		Inter-Peak (15:00 – 16:00)	330	348	18
		PM Peak (17:00 – 18:00)	504	530	26
	Southbound	AM Peak (07:00 – 08:00)	465	492	27
		Inter-Peak (15:00 – 16:00)	255	269	14
		PM Peak (16:00 - 17:00)	262	276	14

Location Description	Direction	Peak Period	Baseline	Future (Baseline x TEMPro)	Increase (Absolute)
Nether Beck Road	Eastbound	AM Peak (08:00 – 09:00)	11	11	1
		Inter-Peak (15:00 – 16:00)	24	25	1
		PM Peak (17:00 – 18:00)	19	20	1
	Westbound	AM Peak (08:00 – 09:00)	16	16	1
		Inter-Peak (15:00 – 16:00)	18	19	1
		PM Peak (16:00 – 17:00)	16	17	1

Table 4.3 shows the baseline bi-directional peak hour data. The data includes a mix of AADT and Major-Raw from a range of baseline years. Therefore, a factor had to be applied to the data to ensure it reflects the same baseline year (2017). The AM, Inter-Peak and PM Peak TEMPro factors were applied to the respective periods to calculate the absolute increase in traffic flows.

The results show that there is not likely to be a significant increase between the baseline year and design year (2022).

Table 4.3: DfT Future Do Minimum (Without Committed Development)

Location Description	Direction	Peak Hour	Baseline	With TEMPro	Increase (Absolute)
M6 North of Junction 35	Northbound	No bi-directional traffic flow data available from the DfT for this location			
	Southbound				
A6070 to the east of the M6	Northbound	AM Peak (08:00 – 09:00)	243	257	14
		Inter-Peak (14:00 – 15:00)	240	253	13
		PM Peak (17:00 – 18:00)	480	505	25
	Southbound	AM Peak (08:00 – 09:00)	473	500	27
		Inter-Peak (15:00 – 16:00)	262	276	14
		PM Peak (17:00 – 18:00)	296	312	15
A6 North	Northbound	AM Peak (08:00 – 09:00)	637	674	37
		Inter-Peak (14:00 – 15:00)	577	608	31
		PM Peak (17:00 – 18:00)	808	850	42
	Southbound	AM Peak (08:00 – 09:00)	720	762	41
		Inter-Peak (14:00 – 15:00)	569	600	30
		PM Peak (17:00 – 18:00)	890	936	46
North of A6 / A601(M) Roundabout	Northbound	AM Peak (08:00 – 09:00)	615	560	35
		Inter-Peak (12:00 – 13:00)	928	977	49
		PM Peak (17:00 – 18:00)	1503	1581	78
	Southbound	AM Peak (08:00 – 09:00)	1561	1650	90
		Inter-Peak (15:00 – 16:00)	917	966	49
		PM Peak (17:00 – 18:00)	1189	1251	62

Location Description	Direction	Peak Hour	Baseline	With TEMPro	Increase (Absolute)
A601(M) North Arm	Northbound	AM Peak (08:00 – 09:00)	439	465	25
		Inter-Peak (15:00 – 16:00)	575	605	31
		PM Peak (17:00 -18:00)	1243	1308	65
	Southbound	AM Peak (08:00 – 09:00)	1318	1394	76
		Inter-Peak (15:00 -16:00)	970	1022	52
		PM Peak (16:00 – 17:00)	792	834	41
A601(M) South Arm	Northbound	AM Peak (08:00 - 09:00)	1370	1448	79
		Inter-Peak (15:00 – 16:00)	373	393	20
		PM Peak (16:00 – 17:00)	386	407	20
	Southbound	AM Peak (08:00 - 09:00)	747	790	43
		Inter-Peak (15:00 – 16:00)	1099	1158	58
		PM Peak (17:00 – 18:00)	1942	2043	101
A6 South	Northbound	AM Peak (08:00 – 09:00)	1927	2038	111
		Inter-Peak (14:00 – 15:00)	1916	2018	102
		PM Peak (17:00 – 18:00)	1902	2001	99
	Southbound	AM Peak (09:00 – 10:00)	1143	1209	66
		Inter-Peak (15:00 – 16:00)	1848	1954	106
		PM Peak (18:00 – 19:00)	1920	2030	110
M6 North of Junction 34	Northbound	AM Peak (07:00 – 08:00)	4446	4701	256
		Inter-Peak (12:00 – 13:00))	3453	3652	199
		PM Peak (17:00 -18:00)	3604	3811	207
	Southbound	AM Peak (08:00 -09:00)	4177	4418	240
		Inter-Peak (14:00 – 15:00)	4033	4265	232
		PM Peak (16:00 – 17:00)	4140	4378	238

4.1.2.1 Committed Development

The committed developments shown by Table 4.4 and Figure 4.1 include a Porsche garage and residential development comprising circa 370 dwellings. The trip generations associated with these developments been added into the background traffic growth. Trip rates shown in this table have been extracted from the respective Transport Assessments, where they were available, which were submitted to LCC.

Trip distributions were derived from the Transport Assessments for the respective developments, as shown in Table 2.13. These trip distribution rates were built into a bespoke network model derived for the purposes of the Project and added onto the Future Do Minimum flows for 2022 (design year). The Transport Assessments did not provide Inter-Peak flows for the committed developments therefore these values have not changed.

Lancaster 001 was selected as the Super Output Area from which the National Trip End Model (NTEM) was applied to. This area was used to ensure consistency in the assessment, as this is the area the committed developments also used.

The trip rates and distribution for the Porsche Garage are based on worst case scenarios all three uses (car dealership, business park and industrial units) operating simultaneously i.e. the worst-case development of the total site. The Transport Assessment highlights that in practice, the traffic generation is likely to be very low given the highly specialised nature of the development. For the purposes of this assessment however, the worst-case rates have been modelled.

Table 4.4: Lancaster City Council Planning Applications

Reference	LCC Decision	Description	Trip Rates AM Peak Hour	Trip Rates PM Peak Hour
16/00335/OUT	Outline Permission Granted	Outline application for residential development comprising 158 dwellings (Use Class C3) with an associated vehicular access off the A601(M) incorporating a new roundabout and access road into the site with pedestrian/cycle and emergency access points to North Road and the Whelmar Estate and pedestrian/cycle links to the canal towpath.	Arrivals: 0.165 (26 trips) Departures: 0.400 (63 trips)	Arrivals: 0.364 (58 trips) Departures: 0.219 (35 trips)
17/01133/FUL	Full Permission Granted & Conditions discharged (split decision)	Erection of car showroom (Use Class Sui Generis), maintenance workshop and preparation building (Use Class B2), display area, storage compound with associated access and landscaping.	Car Dealership	
			Arrivals: 1.454 (30 trips) Departures: 0.0969 (20 trips)	Arrivals: 0.722 (15 trips) Departures: 0.812 (16 trips)
			Business Park	
			Arrivals: 2.106 (177 trips) Departures: 0.206 (18 trips)	Arrivals: 0.159 (15 trips) Departures: 1.841 (162 trips)
			Industrial Units	
			Arrivals: 0.921 (81 trips) Departures: 0.873 (77 trips)	Arrivals: 0.291 (26 trips) Departures: 0.969 (85 trips)

Reference	LCC Decision	Description	Trip Rates AM Peak Hour	Trip Rates PM Peak Hour
18/00365/OUT	Awaiting Decision	Outline application for residential development comprising 213 dwellings (Use Class C3) with associated vehicular and cycle/pedestrian access to Scotland Road and cycle/ pedestrian access to Carnforth Brow/Nether beck, public open space, creation of wetlands area, construction of attenuation basins, erection of sub-station, installation of a pumping station and associated earth works and land regrading and landscaping	Arrivals: 0.112 (24 trips) Departures: 0.344 (73 trips)	Arrivals: 0.310 (66 trips) Departures: 0.163 (39 trips)

Figure 4.1: Committed Developments

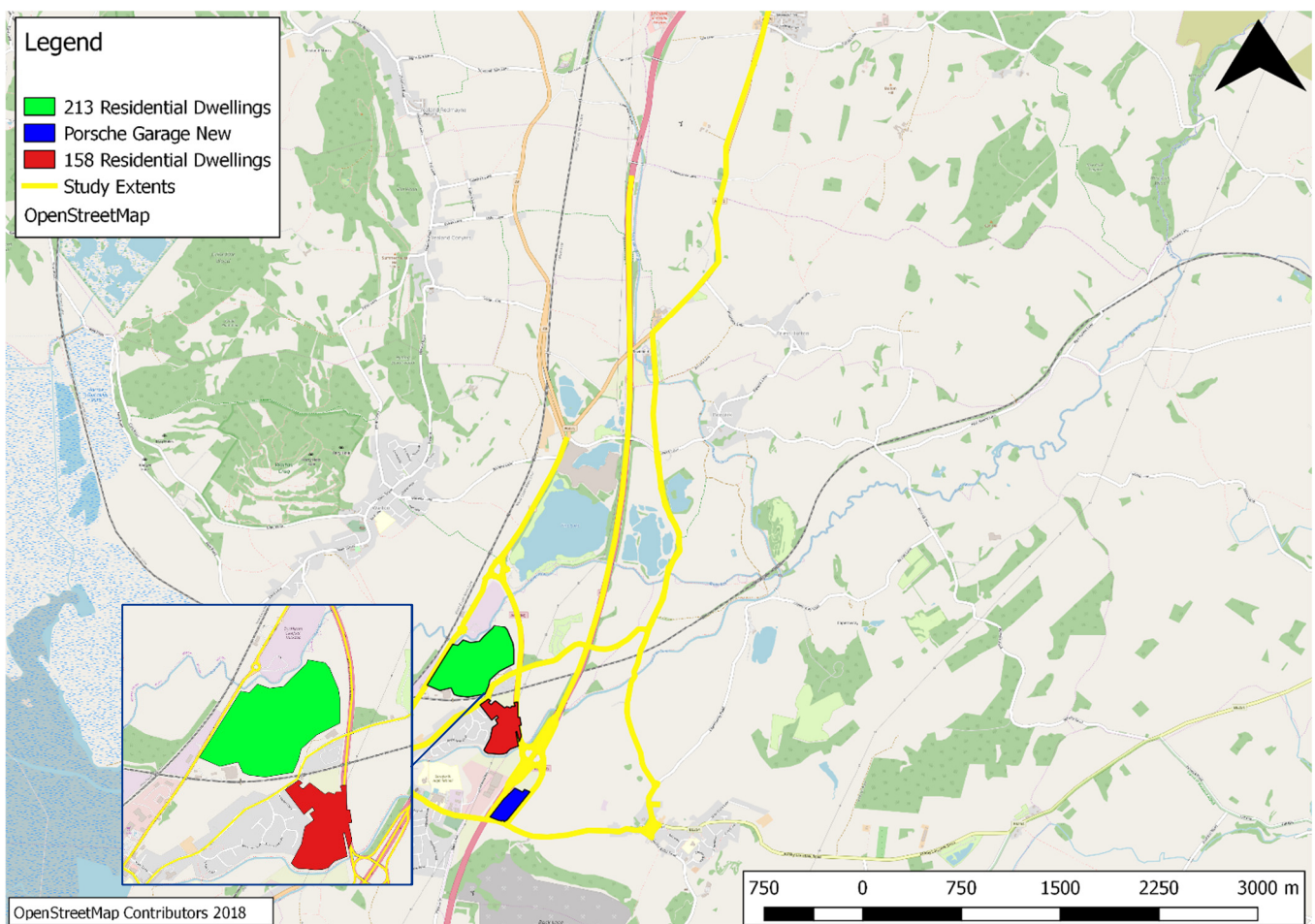


Table 4.5 shows the impact on the Future Do Minimum flows the committed developments shown in Table 4.4 have on the LCC traffic data. As per the trip distribution in the respective Transport Assessments, the A601/ B6254 Kellet Road count point was the only location where flows were impacted by the committed developments.

Table 4.5: LCC Counts Future Do Minimum with Committed Development

Location	Direction	Peak Period	Without Committed Development (Baseline * TEMPro)	With Committed Development (Baseline * TEMPro + CD)	Difference (Absolute)
A601/ B6254 Kellet Road	Northbound	AM Peak (08:00 – 09:00)	344	453	109
		PM Peak (17:00 – 18:00)	530	757	227
	Southbound	AM Peak (07:00 – 08:00)	492	596	104
		PM Peak (16:00- 17:00)	276	333	57

Table 4.6 shows the impact on the committed developments shown in Table 2.13 have on the Future Do Minimum traffic flows.

Table 4.6: DfT Counts Future Do Minimum with Committed Development

Location	Direction	Peak Period	Without Committed development (Baseline * TEMPro)	With Committed Development (Baseline * TEMPro + CD)	Difference (Absolute)
A601(M) North Arm	Northbound	AM Peak (08:00 – 09:00)	465	510	45
		PM Peak (17:00 -18:00)	1308	1369	61
	Southbound	AM Peak (08:00 – 09:00)	1394	1491	97
		PM Peak (16:00 – 17:00)	834	885	51
A601(M) South Arm	Northbound	AM Peak (08:00 - 09:00)	1448	1562	114
		PM Peak (16:00 – 17:00)	407	894	487
	Southbound	AM Peak (08:00 - 09:00)	790	894	104
		PM Peak (17:00 – 18:00)	2043	2060	17
A6 South	Northbound	AM Peak (08:00 – 09:00)	2038	2052	14
		PM Peak (17:00 – 18:00)	2001	2037	36
	Southbound	AM Peak (09:00 – 10:00)	1209	1261	52
		PM Peak (18:00 – 19:00)	2030	2055	25

4.1.3 Future Traffic Flows Summary

The committed developments are not likely to have a significantly increase on the Future Do Minimum traffic flows for design year 2022 within the extents of the study area. These flows were assessed against the Design Manual for Roads and Bridges (DMRB) *Assessment and Preparation of Road Schemes Volume 5 Section 1 TA 46/9*, which provides industry standard guidance for the classification of roads. Table 4.7 outlines the DMRB road classification based on AADT traffic flows for the design year assessment. When the modelled background growth and additional flows from committed developments for design year 2022 are applied AADT flows (shown in Table 3.2), are significantly below the guideline minimum AADT flows for a motorway (between D2M and D4M).

These results reflect the worst case 2022 Future Do Minimum traffic flows due to the cumulative assessment of background traffic flows and committed developments.

Table 4.7: DMRB TA 46/ 97 Design year AADT Flow Ranges

Carriageway Standard	Description	Design year AADT	
		Minimum	Maximum
S2	Single 7.3 metres	Up to 13,000	
WS2	Wide single 10 metres	6,000	21,000
D2AP	2 lane all purpose	11,000	39,000
D3AP	dual 3 lane all purpose	23,000	54,000
D2M	Dual 2 lane motorway	Up to 41,000	
D3M	Dual 3 lane motorway	25,000	67,000
D4M	Dual 4 lane motorway	52,000	90,000

Lancaster's Highways and Transport Masterplan (October 2016) outlines Lancaster City Council needs to plan for around 13,000 to 14,000 new homes in the district over the 20-year period from 2011 to 2031. One of the options suggested to meet this requirement would involve a large extension of Carnforth southwards into the Green Belt that could provide for more than 1,250 new homes and employment land. This is not a committed allocation for housing, just an option for potential location, therefore no quantitative consideration has been given to further growth after 2022 at this stage.

5. Need for Intervention and objectives

5.1 Summary of current and future issues

The A601(M) is a 1.3 mile (2.1km) Special Road in Lancashire, linking M6 junction 35 to the A6 north-east of Carnforth. The following structures on the A601 (M) have current maintenance issues - Brewers Barn West, Brewers Barn East, Higher North Road and Elpha Bridge.

Highway maintenance budgets are reducing, highway authorities can no longer maintain all their assets to the same standard or carry out cyclic activities at the same frequency as in the past. The reducing budgets require management of aging assets and management of risk, in order to provide a safe and as reliable highway asset network as resources will allow. Whole life costs, as well as the ongoing maintenance burden to LCC and future maintenance requirements are considered within the sifting and assessment of the options.

If these assets are left to further deteriorate, access along the A601(M) and Nether Beck (over Higher North Road bridge) will have to be constrained through weight and/or lane restrictions, which will impact HGVs particularly along the A601(M) accessing Truck Haven and could cause non-HGV traffic to divert via Carnforth itself (central area designated as an AQMA).

5.2 Scheme objectives

Scheme objectives have been developed with the Client⁹ to assist in the option sifting assessment, which considers the most suitable options using a multi-criteria assessment matrix. This matrix includes scheme objectives, criteria based on DfT's Early Assessment and Sifting Tool (EAST) as well as initial whole life costs considerations and a preference to minimise maintenance cost over the next 60 years. Table 5.1 outlines these objectives.

Table 5.1: Scheme objectives

Objective	Description
Objective 1	To facilitate lower life costs and reduce public sector expenditure.
Objective 2	Secure the best solution for the long-term management and safety of the structures along the route, namely: • Brewers Barn East & West • Higher North Road • Elpha
Objective 3	To not prejudice/preclude future development.

⁹ Objectives were established as part of the inception meeting between Jacobs and the Client (LCC) – 10th July 2018

6. Generating and Initial Sifting of Options

6.1 Generation of options

The potential options for A601(M) were developed in discussion with LCC, these are summarised in Table 6.1 below. Consideration has been given to the temporary infrastructure measures and monitoring, the level of repair/refurbishment to each bridge, the retention or removal (despecialisation) of M status of A601(M), the potential requirement for weight or traffic restrictions and proposals for road-space reallocation.

Table 6.1: Long List Options

Options	Option Title	Description
Option 1	Do Minimum	Continued monitoring of bridges. Temporary propping of Brewers Barn West and Higher North Road Management of permitted traffic loading could be implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in the number of lanes.
Option 2	Major Refurbishment of all bridges Keep M Status	Major repairs to the bridges. Resurfacing entire route. Upgrading central reservation barrier to bring route up to required motorway standards.
Option 3	Major refurbishment of all bridges Remove M Status	Major repairs to the bridges Removal of Brewer Barn West (widening) bridge deck and make safe the abutments. Resurfacing entire route. Removal of M Status.
Option 4	Major Redesign of A601(M) Route A – reallocation of carriageway Remove M Status	Removal of M Status Major repairs to Brewers Barn West Bridge, Brewers Barn East and Elpha Bridge. Removal of Brewer Barn West (widening) bridge deck and make safe the abutments Removal of Higher North Road overbridge and replacement with at grade junction Closure of one carriageway on A601(M) and conversion of the other carriageway to two-way running. Enable old carriageway to be converted to foot/cycleway link.
Option 5	Major Redesign of A601(M) Route B – retention of dual carriageway Remove M Status	Removal of M Status. Major repairs to Brewers Barn West Bridge, Brewers Barn East and Elpha Bridge. Removal of Brewer Barn West (widening) bridge deck and make safe the abutments Removal of Higher North Road overbridge and replacement with at grade junction. Retention of dual carriageway along A601(M)
Option 6	Major Redesign of A601(M) Remove M Status Stop up Nether Beck	Removal of M Status. Major repairs to all bridges excluding Higher North Road Bridge. Stop up Nether Beck Road to obstruct access to Higher North Road Bridge. This does not include the removal of Higher North Road Bridge.

6.2 Description of the long-list sifting process

The sifting assessment considers the most suitable options for further consideration, using a multi-criteria assessment matrix. A spreadsheet matrix has been used for the long-list sifting, which was designed to incorporate the three objectives (outlined in Table 5.1) and enable a further analysis as per key criteria taken from WebTAG¹⁰ and EAST¹¹. Specific guidance for transport studies is documented in The Transport Appraisal Process (DfT, 2018), which sets out analysis of the issues and identification and assessment of potential options.

The combination of the project objectives, WebTAG and EAST criteria were used to ensure the most suitable decision is made regarding the future of the A601(M) route. The selected WebTAG and EAST criteria are outlined in Table 6.2. The study area site observations and issues were used to inform the sifting process, along with indicative capital costs and level of maintenance burden.

Table 6.2: Long list sifting criteria – WebTAG and EAST

Overarching Theme	Criteria
Strategic	Fit with wider government objectives
	Fit with other objectives (local)
Economic	Economic growth
	Carbon Emissions
	Socio-distributional impacts and the regions
	Local environment
	Wellbeing
Management	Public acceptability
	Practical feasibility
Financial	Capital Expenditure
	Maintenance Burden
Commercial	Flexibility of option

The following high-level scoring system was established using symbology in order to rank the options:

- ++ (most beneficial)
- +
- ⊖
- -
- -- (least beneficial)

This then formed the basis of the qualitative sifting process through ascribing a ranking system to each criteria assessment per option. The options with the highest scores were considered to be the most advantageous options regarding the future of the A601(M) route, given the information available at the time of the assessment.

The long-list sifting also includes capital costings for the scheme, these are indicative to assist with the sift and do not account for all capital expenditure at this stage for the options. This, along with maintenance costings will be considered in the option development and assessment in section 7. Table 6.3 summarises the long-list scoring of the six options against the sifting criteria.

¹⁰ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/712965/WebTAG-transport-appraisal-process-may-2018.pdf

¹¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/4475/east-guidance.pdf

Table 6.3: Long List Sift - Multi-Criteria Assessment

	Strategic				Economic						Management		Financial		Commercial
	Project Objectives				EAST/WebTAG										
	Remove 'M' Status to facilitate lower life costs and reduce public sector expenditure.	Secure the best solution for the long-term management and safety of the term management and safety of the structures along the route.	To not prejudice future development	Fit with wider government objectives	Fit with other objectives	Economic Growth	Carbon Emissions	Socio-distributional impacts and the regions	Local Environment	Wellbeing	Public Acceptancy	Practical Feasibility	Indicative Capital Expenditure	Maintenance Burden	Flexibility of option
Option 1	⊖	--	⊖	⊖	-	-	-	⊖	⊖	-	-	-	£8.2m ¹²	££££	⊖
Option 2	--	+	--	-	+	⊖	⊖	⊖	⊖	⊖	+	-	£7.3m	£££	⊖
Option 3	+	+	+	+	+	+	⊖	⊖	⊖	⊖	+	+	£7.6m	££	⊖
Option 4	+	++	++	+	+	+	⊖	⊖	⊖	+	+	+	£7.7m ¹³	£	+
Option 5	+	++	++	+	+	+	⊖	⊖	⊖	⊖	+	+	£7.8m ¹⁴	£	+
Option 6	+	++	+	⊖	+	-	⊖	--	⊖	-	-	⊖	£5.1m	£	-

¹² Option 1 includes the deferred Year 20 capital expenditure as an indicator.
¹³ Option 4 includes capital costs for a new at-grade junction for Nether Beck, as a result of the removal of Higher North Road Bridge.
¹⁴ Option 5 includes capital costs for a new at-grade junction for Nether Beck, as a result of the removal of Higher North Road Bridge.

Table 6.3 outlines the best scoring options as Options 3, 4 and 5. Scoring has not been based purely on capital expenditure alone. Option 3 proposes to undertake major repairs and refurbishment to all the bridges (except Brewer Barn West widening), including resurfacing the entire route and removing the M status (despecialisation) of the A601(M).

Options 4 and 5 are two of the more expensive options and both include removal of M status (despecialisation and major repairs to Brewer Barn West and East bridges, along with Elpha Bridge. The options also include the removal of Higher North Road Bridge and Brewer Barn West widening, as well as the installation of an at-grade crossing (circa £1.2m), which increases the capital expenditure over Options 2 and 3. However, the key determining element involves the proposals to either retain the dual carriageway (Option 5) or reallocate carriageway space to facilitate improved footpath/bridleway links and consequently reduce the A601(M) to a single carriageway road (Option 4).

As there is little difference between Options 4 and 5, it has been concluded that both should be taken through for further assessment, along with Option 3, which provides a suitably different proposal.

At the request of LCC, the Do Minimum Scenario (Option 1) will be considered as part of the further assessment. Option 1 involves continued monitoring of bridges and management of permitted traffic loading implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in number of lanes.

The next section further investigates the capital and maintenance costs of the short-listed options, along with implications of the proposals on traffic and environmental considerations.

6.3 Summary

This section has outlined the process and results of a qualitative long-list sifting assessment into six potential options regarding the future of the A601(M) route, with regards to maintenance and operations. The short-listed options are summarised in Table 6.4 below.

Table 6.4: Short-listed options for further assessment

Options	Option Title	Description
Option 1	Do Minimum	Continued monitoring of bridges. Temporary propping of Brewers Barn West and Higher North Road Management of permitted traffic loading could be implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in the number of lanes.
Option 3	Major refurbishment of all bridges Remove M Status	Major repairs to the bridges. Resurfacing entire route. Removal of M Status.
Option 4	Major Redesign of A601(M) Route A – reallocation of carriageway Remove M Status	Removal of M Status Major repairs to Brewers Barn West Bridge, Brewers Barn East and Elpha Bridge. Removal of Higher North Road overbridge and replacement with at grade junction (roundabout or signal junction) Closure of one carriageway on A601(M) and conversion of the other carriageway to two-way running. Enable old carriageway to be converted to foot/cycleway link.

Options	Option Title	Description
Option 5	Major Redesign of A601(M) Route B – retention of dual carriageway Remove M Status	Removal of M Status. Major repairs to Brewers Barn West Bridge, Brewers Barn East and Elpha Bridge. Removal of Higher North Road overbridge and replacement with at grade junction (roundabout or signal junction) Retention of dual carriageway along A601(M)

7. Option Development and Assessment

This section of the report investigates the capital cost and maintenance requirements of the short-listed options, along with high-level environmental considerations.

7.1 Capital costs

Capital costs have been developed with LCC and informed by the condition reports following PBI bridge surveys and engineering judgement. All costs are assumed to be at 2019 prices and include a 25% contingency assumption. Table 7.1 summarises the capital costs identified for each of the short-listed options, these will be taken forward as part of the strategic outline business case (SOBC). More information is available in **Appendix A**.

7.1.1 Option 1 (do minimum)

Option 1 (do minimum) has assumed that temporary works, carriageway/weight restrictions and continued maintenance works will initially be undertaken, with the deferment of the main capital works for 20 years. Therefore, capital costs include for:

- Temporary propping of bridges in years 1 and 2 – (£1.6m):
 - Brewers Barn West in lieu of bearings replacement - £0.38m
 - Higher North Road in lieu of bearings replacement, as well as carriageway/weight restrictions - £1.2m
- Deferred capital expenditure in year 20, costs have been assumed at an increase of 50% on 2019 prices – (£8.5m):
 - Refurbishment of bridges - £5.69m

▪ Brewer Barn West and West (widening) ▪ Brewer Barn East	▪ Higher North Road ▪ Elpha
--	--
 - Retention of M status and central reservation upgrade - £2.44m
 - Resurfacing costs - £0.41m

7.1.2 Option 3 (refurbishment of all bridges and despecialisation)

Option 3 has assumed that the capital expenditure for the refurbishment works to all bridges, along with despecialisation and resurfacing occurs within year 1 – (£6.3m). Therefore, the capital costs include for:

- Refurbishment of bridges - £3.7m

○ Brewer Barn West ○ Brewer Barn East	○ Higher North Road ○ Elpha
--	--
- Removal of Brewer Barn West (widening) - £0.43m
- Removal of M status - £1.86m
- Resurfacing costs - £0.28m

7.1.3 Option 4 (refurbishment of all bridges, except Higher North Road, with new at grade junction, road reallocation and despecialisation)

Option 4 has assumed the capital expenditure for the refurbishment of three bridges (and widening), removal of Higher North Road bridge, despecialisation and the reallocation of A601(M) road-space, resurfacing and the installation of an at-grade junction – (£7.4m). Therefore, the capital costs include for:

- Refurbishment of bridges - £1.54m
 - Brewer Barn West
 - Elpha
 - Brewer Barn East
- Removal of Brewer Barn West (widening) - £0.43m
- Removal of Higher North Road Bridge – £1.9m
- At-grade junction installation - £1.5m
- Removal of M status - £1.9m
- Resurfacing costs (single carriageway) - £0.21m

7.1.4 Option 5 (refurbishment of all bridges, except Higher North Road, with new at grade junction and despecialisation)

Option 5 has assumed the capital expenditure for the refurbishment of three bridges (and widening), removal of Higher North Road bridge, despecialisation, resurfacing and the installation of an at-grade junction – (£7.5m). Therefore, the capital costs include for:

- Refurbishment of bridges - £1.5m
 - Brewer Barn West
 - Elpha
 - Brewer Barn East
- Removal of Brewer Barn West (widening) - £0.43m
- Removal of Higher North Road Bridge – £1.9m
- At-grade junction installation - £1.5m
- Removal of M status - £1.9m
- Resurfacing costs (single carriageway) - £0.26m

7.1.5 Summary of capital costs

Option 3 provides the most cost-effective option in terms of capital costs, with Option 1 the most expensive capital expenditure. However, consideration of capital costs alone will not determine the most suitable option to facilitate lower life costs and reduce public sector expenditure, as well as secure the best solution for the long-term management and the safety of the structures. Maintenance and renewal considerations, along with impacts on traffic/users and the environment, as well as delivery of scheme objectives are also key to determining the most suitable option for the A601(M).

Table 7.1: Summary of capital costs for short-listed options

A601(M) short-listed options	Capital costs (years 1/2)	Capital costs (year 20)	Capital costs Total
Option 1	£ 1.6m	£ 8.5m	£ 10.1m
Option 3	£ 6.3m	£ 0.0m	£ 6.3m
Option 4	£ 7.4m	£ 0.0m	£ 7.4m
Option 5	£ 7.5m	£ 0.0m	£ 7.5m

7.2 Ongoing maintenance costs

Ongoing maintenance and renewal costs have been developed with LCC and informed by the asset management records and engineering judgement. All costs are assumed to be at 2019 prices and include a 25% contingency assumption, where stated. Table 7.2 summarises the maintenance and renewal costs identified for each of the short-listed options over a 60-year lifecycle, these will be taken forward as part of the strategic outline business case (SOBC). More information and a breakdown of annual maintenance and renewal costs are available in **Appendix A**.

7.2.1 Option 1 (do minimum)

Maintenance and renewal costs include for both temporary initial work (years 1-20) and post-deferred work (years 20-60):

- Continued monitoring of bridges - £100 per year (not including contingency), per bridge deferred work is undertaken in year 20 (this is an increase from standard cost of £100 per bridge every two years)
- Maintenance of temporary propping - £1000 per year (not including contingency), per bridge until deferred work is undertaken in year 20
- Management of permitted traffic loading could be implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in the number of lanes – costs have been assumed for traffic management of carriageway restriction and weight restriction TRO(s).
- Annual general maintenance of A601(M) - £0.11m per year (not including contingency), assumed to reduce by 50% after year 20 following resurfacing works.
- Cyclic maintenance costs over a 60-year lifecycle:
 - Resurfacing and painting – renewal every 30 years
 - Bridge bearing replacement – renewal every 30 years (elastomeric) or 50 years (roller)
 - Concrete deck maintenance repairs – every 20 years

7.2.2 Option 3 (refurbishment of all bridges and despecialisation)

Maintenance and renewal costs include for:

- Continued monitoring of bridges - £100 every two years (not including contingency), per bridge following refurbishment in year 1 (not including Brewer Barn West widening, following removal)
- Annual general maintenance of A601(M) - £0.04m per year (not including contingency), assumed for a despecialised dual carriageway following resurfacing works
- Cyclic maintenance costs over a 60-year lifecycle:
 - Resurfacing and painting – renewal every 30 years
 - Bridge bearing replacement – renewal every 30 years (elastomeric) or 50 years (roller) Concrete deck maintenance repairs – every 20 years

7.2.3 Option 4 (refurbishment of all bridges, except Higher North Road, with new at grade junction, road reallocation and despecialisation)

Maintenance and renewal costs include for:

- Continued monitoring of bridges - £100 every two years (not including contingency), per bridge following refurbishment in year 1 (not including Higher North Road and Brewer Barn West widening, following removal)
- Annual general maintenance of A601(M) - £0.03m per year (not including contingency), assumed for a despecialised single carriageway following resurfacing works
- Cyclic maintenance costs over a 60-year lifecycle:
 - Resurfacing and painting – renewal every 30 years
 - Bridge bearing replacement – renewal every 30 years (elastomeric) or 50 years (roller)
 - Concrete deck maintenance repairs – every 20 years

7.2.4 Option 5 (refurbishment of all bridges, except Higher North Road, with new at grade junction and despecialisation)

Maintenance and renewal costs include for:

- Continued monitoring of bridges - £100 every two years (not including contingency), per bridge following refurbishment in year 1 (not including Higher North Road and Brewer Barn West widening, following removal)
- Annual general maintenance of A601(M) - £0.04m per year (not including contingency), assumed for a despecialised dual carriageway following resurfacing works
- Cyclic maintenance costs over a 60-year lifecycle:
 - Resurfacing and painting – renewal every 30 years
 - Bridge bearing replacement – renewal every 30 years (elastomeric) or 50 years (roller)
 - Concrete deck maintenance repairs – every 20 years

7.2.5 Summary of maintenance and renewal costs

Maintenance and renewal costs have been considered over a 60-year period (undiscounted), with 25% contingency. Option 4 provides the most cost-effective option in terms of maintenance expenditure. This is due to the reduced maintenance and renewal requirements for Higher North Road bridge, as a result of the removal of the bridge. Another saving is a consequence of the road reallocation of the A601(M) from a dual carriageway to a single carriageway road, which has lower renewal and maintenance requirements.

Table 7.2: Summary of maintenance and renewal costs for short-listed options

A601(M) short-listed options	Maintenance & renewal costs (years 1-20)	Maintenance & renewal costs (years 20-60)*	Maintenance and renewal total (60 years*)
Option 1	£ 3.1m	£ 4.4m	£ 7.5m
Option 3	£ 1.0m	£4.8m	£ 5.8m
Option 4	£ 0.7m	£ 2.5m	£ 3.2m
Option 5	£ 1.0m	£ 3.3m	£ 4.3m

* 60-year costs do not include for growth and are undiscounted

7.3 Assessment

In order to further determine the most suitable option or options for consideration as part of the strategic outline business case, a high-level assessment has been conducted to identify impacts of the proposed options on traffic and the environment

7.3.1 Impacts on traffic

The future implications of each of the short-listed options have been outlined in Table 7.3 below, including consideration of capacity of A601(M) and access both on A601(M) and Nether Beck.

When comparing the four options, Option 1 has the most impact on traffic and road users, particularly HGVs. There is very little difference between the other three options, with access maintained on both A601(M) and Nether Beck (whether grade separated or at-grade). Slight differences in capacity when comparing Option 4, to Options 3 and 5, however the impact is not considered to be significant. Although Options 3 and 5 would maintain the existing level of capacity for future additional traffic demand and also maintain the road capacity, which is particularly important as the A601(M) is currently designated as an official strategic road network (SRN) diversionary route.

Table 7.3: Impacts on traffic of the short-listed options

A601(M) short-listed options	Impact on traffic
Option 1	The initial temporary propping of Brewers Barn West and Higher North Road bridges, along with traffic management resulting from carriageway and weight restrictions will have implications on future traffic using the A601(M) and Nether Beck. Depending on the level of weight restrictions, this may have implications on HGVs accessing Truck Haven and Carnforth from M6 junction 35. HGVs would have to route via junction 36 and the A6 which is approximately a 34km diversionary route (following Highways England HGV diversionary route from junction 36). Baseline AADT traffic flows for A601(M) outlines 10% of circa 10,000 two-way traffic movements are by HGVs, therefore it has been assumed approximately 1,000 HGVs on an average day would be impacted by weight restrictions of 7.5T on Brewers Barn West bridge. If Brewers Barn West further declines, without temporary propping and weight restrictions, it could result in a critical failure, which would close the road completely. This would sever access further for all vehicles, causing diversions via Carnforth (LGVs/cars) and M6 diversionary route (HGVs) to access the A6. This would also be a case with Elpha and Brewers Barn East bridges, if nothing is done. A601(M) is part of the approved M6 diversionary route, therefore any closures/weight restrictions would impact on the effectiveness of this diversionary route and the operation of the SRN. Nether Beck which runs over Higher North Road Bridge, if subject to weight restrictions, would impact HGVs (over 7.5T), likely farm vehicles, and potentially LGVs (over 3.5T) travelling over the bridge. The diversionary route via Over Kellet (approximately 6km) would be available for LGVs, but due to the weight restriction on the B6254 Kellet Road would not be available to HGVs. The diversion would not impact a significant number of vehicles using Nether Beck, therefore the diversionary impact is likely to be limited. However, there is no other HGV diversionary route to access Nether Beck from the west, due to low bridges and weight restrictions on roads accessing Carnforth. This severance would likely impact a small proportion of vehicles, (3-5% have been identified as HGVs, circa 10 HGVs per day).
Option 3	Apart from the temporary impacts of the refurbishment of bridges and resurfacing works, there is limited impact to users/traffic. Capacity of the A601(M) is maintained as a dual carriageway. Access is maintained along A601(M) and Nether Beck.
Option 4	The temporary impacts of the refurbishment/removal of bridges and resurfacing works are unlikely to have a significant impact to users/traffic. Access along the A601(M) is maintained as a single carriageway, although the capacity of the proposed road is still sufficient to accommodate the future traffic levels. However, there are likely to be capacity implications if the M6 SRN diversionary route is enacted, as the design year capacity of the revised road-space would be circa. 21,000 vehicles (AADT) a day, with more than three-times the number of vehicles (AADT) using the M6. There are likely to be negligible changes to journey times of users along A601(M) as a result of the road-space reallocation to single carriageway and new at-grade junction (roundabout or signal junction). Access is maintained along Nether Beck, via the at-grade junction. Added beneficial impact of improved segregated access for non-motorised users, as a result of the proposed reallocation of carriageway to provide a footway/cycleway.

A601(M) short-listed options	Impact on traffic
	The introduction of an at-grade junction with the A601(M) could potentially increase the likelihood of collisions, over the existing situation, due to the introduction of conflicting movements. However, the risk is not considered to be significant, due to the number of vehicles currently using Nether Beck throughout the day. If this option is taken forward for development, concept design and detailed design would require sufficient levels of consideration with regards to road safety.
Option 5	The temporary impacts of the refurbishment/removal of bridges and resurfacing works are unlikely to have a significant impact to users/traffic. Access and capacity of the A601(M) is maintained as a dual carriageway, although there are likely to be negligible changes to journey times of users along A601(M) as a result of the new at-grade junction (roundabout or signal junction). Access is maintained along Nether Beck, via the at-grade junction. The existing road capacity is maintained for future demand, including as yet unplanned development – which could potentially come forward as an extension to Carnforth (circa. 1250 houses) outlined in Lancaster’s highway and transport masterplan (October 2016). The existing road capacity is generally maintained for use if the M6 SRN diversionary route is implemented. The introduction of an at-grade junction with the A601(M) could potentially increase the likelihood of collisions, over the existing situation, due to the introduction of conflicting movements, particularly with a dualled A601(M), unless speeds are adjusted. However, the risk is not considered to be significant, due to the number of vehicles currently using Nether Beck throughout the day. If this option is taken forward for development, concept design and detailed design would require sufficient levels of consideration with regards to road safety.

7.3.2 Environmental considerations

Consideration of environmental impacts as a result of the proposed options, have been aligned with DfT’s EAST categories. Currently these considerations are high-level, following selection of a preferred option, development of SOBC and development of concept designs (if relevant), it is recommended that further assessment of environmental impacts are carried out.

Table 7.4 illustrates the limited differences between the short-listed options with regards to environmental considerations, particularly between Options 3, 4 and 5.

Table 7.4: Environmental considerations of the short-listed options

A601(M) short-listed options	Carbon emissions	Socio-distributional impacts	Local environment	Wellbeing
Option 1	Carnforth has an AQMA designation, any diversionary traffic as a result of this option (HGVs in particular) are seen as a minor negative impact due to minor increases in vehicle kilometres/hours.	No significant impacts. Lancaster is not considered a weak region. Not considered to be any major negative effects on access for vulnerable groups if temporary	Potential minor negative impact to AQ. No change to noise, townscape or landscape over the existing situation.	Weight restrictions on A601 (M) may lead to an increase in driver stress due to the unsuitability of surrounding roads for increased HGV flows. No

A601(M) short-listed options	Carbon emissions	Socio-distributional impacts	Local environment	Wellbeing
	Not seen as significant. Greater levels of increased maintenance on the A601(M), due to deferment of works, could result in greater levels of traffic management and therefore slow-moving traffic/stationary traffic at times which could impact carbon emissions.	propping is undertaken and weight restrictions are in place. In the case of critical failure, road closure to traffic would have an impact on access for all users.		change in severance or for physical activity.
Option 3	No significant impacts as no increase in vehicle kilometres or hours. Not requirement for diversions due to access being maintained.	No significant impacts. Lancaster is not considered a weak region. Not considered to be any major negative effects on access for vulnerable groups.	No change to air quality, noise, townscape or landscape over the existing situation	No change to wellbeing over the existing situation
Option 4	No significant impacts as no increase in vehicle kilometres or hours. Not requirement for diversions due to access being maintained.	No significant impacts. Lancaster is not considered a weak region. Not considered to be any major negative effects on access for vulnerable groups.	No change to air quality or noise over the existing situation. Minor beneficial changes to townscape/landscape along A601(M) due to installation of at-grade junction, removal of Higher North Road bridge and road space reallocation. Not considered to be significant.	Improved non-motorised user access provides opportunities for improved physical activity for users with an improved provision through a new segregated access.
Option 5	No significant impacts as no increase in vehicle kilometres or hours. Not requirement for diversions due to access being maintained.	No significant impacts. Lancaster is not considered a weak region. Not considered to be any major negative effects on access for vulnerable groups.	No change to air quality or noise over the existing situation. Minor beneficial changes to townscape/landscape along A601(M) due to installation of at-grade junction and removal of Higher North Road bridge. Not considered to be significant.	No change to wellbeing over the existing situation.

7.3.3 Fit with scheme objectives

The short-listed options have been considered against the scheme objectives, in Table 7.5, with regards to their contribution to the success of delivering the objectives.

Table 7.5: Fit with scheme objectives

A601(M) short-listed options	Objective 1: Facilitate lower life costs and reduce public sector expenditure	Objective 2: Secure the best solution for the long-term management and safety of the structures along the route	Objective 3: Not prejudice/ preclude future development
Option 1	This option is the most expensive of the short-listed options, with capital expenditure initially for temporary works, extended additional maintenance and surveys, until the deferred works can be undertaken (year 20). These overall capital costs and ongoing maintenance & renewal costs are considerably more than those options where repair works are undertaken up-front (i.e. years 1 & 2), this is also due to the retention of the M status of the road and the ongoing maintenance burden it requires.	Although the temporary propping, weight restrictions and additional surveys continue to maintain the safety of the bridges in the short-medium term, however this is not a long-term management solution.	The retention of the M status of the A601(M) results in existing standards being maintained and therefore no additional access is possible onto the road, to facilitate future development opportunities along the corridor.
Option 3	This option is the most cost-effective of those short-listed, in terms of capital expenditure. However, the ongoing maintenance and renewal burden is somewhat more than the other despecialised options (4 & 5), predominately as a result of the maintenance and renewal burden of the retained structure of Higher North Road.	The despecialisation of the A601(M) would reduce the ongoing maintenance burden considerably, along with the bridge repair works – this option delivers on the safety considerations in the short, medium and long-term. However, the on-going management of the bridges is increased with the renewals and maintenance requirements for Higher North Road bridge, which is removed in options 4 & 5.	The removal of the M status of the A601(M) does not preclude opportunities for additional access onto the A601(M). However, the retention of Higher North Road bridge and the proximity between other bridges could impact on the location of any potential access, brought forward as a result of future development opportunities.
Option 4	The removal of Higher North Road bridge and the introduction of the at-grade junction increases the overall capital expenditure of this option when compared to the option to retain Higher North Road bridge (Option 3). However, the maintenance and renewal burden is considerably lower due to the despecialisation, the implementation of an at-grade junction and the road-space reallocation to provide a single carriageway road and footpath/cycleway along the A601(M).	The despecialisation of the A601(M) would reduce the ongoing maintenance burden considerably, along with the bridge repair works – this option delivers on the safety considerations in the short, medium and long-term. The removal of Higher North Road and implementation of an at-grade junction also reduces the ongoing renewal and maintenance burden of an additional bridge, however there are additional reductions in maintenance requirements resulting from the road space reallocation to a single carriageway.	The removal of the M status of the A601(M) and provision of an at-grade junction with A601(M) and Higher North Road provides opportunities for access to the A601(M) from future development. Although current level of future predicted traffic demand can be catered for by the revised capacity of the A601(M) as a result of the road space reallocation, the reduction in the road capacity may preclude further longer-term future development.

A601(M) short-listed options	Objective 1: Facilitate lower life costs and reduce public sector expenditure	Objective 2: Secure the best solution for the long-term management and safety of the structures along the route	Objective 3: Not prejudice/ preclude future development
Option 5	The removal of Higher North Road bridge and the introduction of the at-grade junction increases the overall capital expenditure of this option when compared to the option to retain Higher North Road bridge (Option 3). However, the maintenance and renewal burden is considerably lower due to the despecialisation, the implementation of an at-grade junction and the road-space reallocation to provide a single carriageway road and footpath/cycleway along the A601(M).	The despecialisation of the A601(M) would reduce the ongoing maintenance burden considerably, along with the bridge repair works – this option delivers on the safety considerations in the short, medium and long-term. The removal of Higher North Road and implementation of an at-grade junction also reduces the ongoing renewal and maintenance burden of an additional bridge.	The removal of the M status of the A601(M) and provision of an at-grade junction with A601(M) and Higher North Road provides opportunities for access to the A601(M) from future development. With the retention of the dual carriageway and associated road capacity, both the current level of future predicted traffic demand and the potential for further longer-term future development is likely to be able to be catered for by the capacity of the A601(M).

8. Summary

8.1 Background

The A601(M) is a 1.3 mile (2.1km) Special Road in Lancashire, linking M6 junction 35 to the A6 north-east of Carnforth. The following structures on the A601 (M) have current maintenance issues - Brewers Barn West, Brewers Barn East, Higher North Road and Elpha bridges.

Highway maintenance budgets are reducing, highway authorities can no longer maintain all their assets to the same standard or carry out cyclic activities at the same frequency as in the past. The reducing budgets require management of aging assets and management of risk, in order to provide a safe and as reliable highway asset network as resources will allow.

If these assets are left to further deteriorate, access along the A601(M) and Nether Beck (over Higher North Road bridge) will have to be constrained through weight and/or lane restrictions, which will impact HGVs particularly along the A601(M) accessing Truck Haven, with a considerable diversion, and could cause non-HGV traffic to divert via Carnforth itself (central area designated as an AQMA). The A601(M) is also currently part of the strategic road network diversionary route for the M6 motorway (between junctions 35 and 36).

Stage 1 of the project consisted of a qualitative long-list sift of six potential options for the future of the A601(M) route, which were agreed between LCC and Jacobs. The six options were qualitatively sifted based on identified objectives and issues/considerations, with the most suitable options taken forward for further assessment in Stage 2.

8.2 Assessment

As part of this Stage 2 assessment, the potential options identified will consider whole life costs and the ongoing maintenance burden and the future maintenance requirements to LCC, along with impacts on traffic and the environment. The OAR process has assessed the short-listed options in order to provide a recommendation on options to be taken forward for Strategic Outline Business Case (SOBC) development and benefit cost ratio (BCR) calculations.

At the request of LCC, the Do Minimum Scenario (Option 1) has been assessed within this OAR. Option 1 involves continued monitoring of bridges, management of permitted traffic loading implemented by introducing permanent weight restrictions and permanent physical measures such as reduction in number of lanes.

Options 3, 4 and 5 were also short-listed to be assessed within this OAR. There is limited significant differences in terms of impacts on traffic or environmental impacts between these options. Slight beneficial differences in potential opportunities to facilitate future development have also been considered. The main differential between the options are up-front capital expenditure and ongoing maintenance burden.

8.2.1 Findings

Option 1 would have the most impact on traffic and the environment, with the reassignment of vehicles following the implementation of weight restrictions and reduction in remaining capacity as a result of lane restrictions. It is also the most expensive of the options, in terms of capital expenditure, due to temporary interventions, ongoing monitoring and the cost increased related to the deferred works, as well as the ongoing maintenance burden due to retention of the special road status.

Option 3 maintains all the current access arrangements, therefore having limited impact on traffic and the environment, including the capacity of the A601(M). The despecialisation reduces the maintenance requirements and therefore ongoing expenditure. However, the retention of Higher North Road bridge does require ongoing maintenance and renewal expenditure when compared to its removal and replacement with an at-grade junction. The retention also has implications on the location of access associated with opportunities for future development.

Option 4 maintains all access arrangements, with an alternative access for Nether Beck, via an at-grade junction. This alternative access will have limited impact on traffic, in terms of reassignment. However, the introduction of the road space reallocation to a single carriageway and a footway/cycleway will change the way the A601(M) currently operates, in terms of capacity, which could have implications on further future development opportunities, as well as the use of the A601(M) as the SRN diversionary route for M6 motorway (between junction 35 and 36). The despecialisation and the removal of Higher North Road bridge reduces the maintenance requirements and therefore ongoing expenditure. The road space reallocation also reduces the maintenance requirements, when compared to a dual-carriageway.

Option 5 maintains all access arrangements, with an alternative access for Nether Beck, via an at-grade junction. This alternative access will have limited impact on traffic, in terms of reassignment and capacity of the A601(M) will be maintained due to the retention of the dual carriageway, which has the potential to benefit further future development opportunities, as well as the use of the A601(M) as the SRN diversionary route for M6 motorway (between junction 35 and 36). The despecialisation and the removal of Higher North Road bridge reduces the maintenance requirements and therefore ongoing expenditure.

8.2.2 Next steps

In collaboration with LCC officers, it was concluded that Options 3 and 5 provide the optimal solutions for the future of the A601(M) route and structures within its extents to be taken forward to SOBC. Both options provide a balance between initial capital expenditure and ongoing maintenance burden, whilst maintaining the capacity of the A601(M).

Appendix A. Capital and maintenance costing spreadsheet