

# A59 Kex Gill Diversion Scheme

## Options Assessment Report

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Prepared for:



Prepared by:



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# 1 Executive Summary

## 1.1 A59 Kex Gill

### 1.1.1 Importance of the A59 Route and Kex Gill Landscape

The A59 provides a key strategic east-west connection in North Yorkshire, linking Harrogate and Skipton, which are the key settlements within their respective authority areas, (see Figure 1-1). Whilst the A59 does not form part of the Strategic Road Network (SRN), it is viewed by residents and businesses as a critical strategic route for east-west connectivity in the north of England, offering an important connection to sections of the SRN, most notably Junction 31 of the M6 and Junction 47 of the A1(M)<sup>1</sup>. In addition to this strategic connectivity, the A59 also provides an important link for smaller settlements and communities in this area, providing accessibility to the wider transport network and key facilities and services.

Figure 1-1 – Route of A59 through North Yorkshire



At Kex Gill, the A59 route passes through a rural and open landscape, designated as the Nidderdale Area of Outstanding Natural Beauty (AONB). The surrounding landscape is considered to be of very attractive quality and highly valued for its recreational resource. In addition, large parts of the area are designated as Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Special Area of Conservation (SAC).

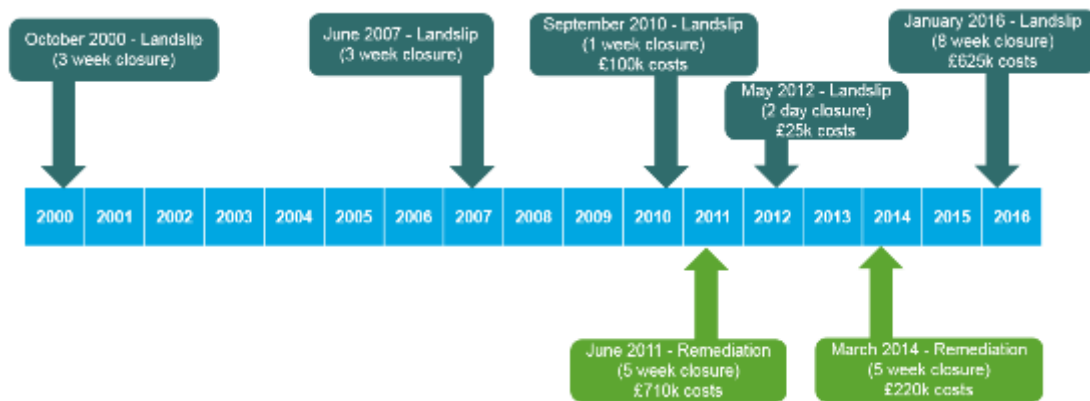
### 1.1.2 A59 Kex Gill Landslips

There is a long history of landslips on the land above the A59 at Kex Gill (see Figure 1-2). These landslips deposit material onto the road leading to unpredictable closures of the A59. Analysis of existing geotechnical information indicates that the primary cause of these landslips is heavy rainfall, coupled with relatively unstable

<sup>1</sup> The route also forms part of Transport for the North's (TfN) plans for a Major Route Network (MRN)

land on the hillside slopes, leading to earthwork failures. The most recent landslide occurred in early 2016 and resulted in a road closure of approximately 8 weeks. In addition, the cost to North Yorkshire County Council (NYCC) for emergency slope stabilisation and associated carriageway work was around £625,000.

Figure 1-2 – Timeline of Road Closures on A59, Kex Gill



Whilst various engineering works have been undertaken, adjacent to the existing A59, to remediate past landslips and to reduce the landslide risk, in view of the extent of the area at risk and the large scale of the existing or potential landslide features, full stabilisation of the area at risk would require extensive and very substantial engineering works and is unlikely to be practicable or environmentally acceptable. It is thus probable that the existing A59 or any online improvement would remain susceptible to landslides and related disruption.

Furthermore, whilst the specific effects on landslide activity are difficult to quantify, landslide events are frequently related to individual extreme rainfall events or years with generally higher winter rainfall. It is therefore probable that, given the projections of future climate change, which indicate increased rainfall in winter months, this will result in some increase in the frequency of individual landslide events and/or the re-activation or increased movement of existing and/or relict landslide features.

### 1.1.3 The Need for Intervention

Fortunately, to date, although a vehicle has been caught by a landslide, there have been no personal injuries as a result of a landslide at Kex Gill. However, without intervention, there continues to be a significant risk that road users could be caught in any future landslide, (potentially resulting in serious injuries or fatalities).

The main effect of historic landslide events has been to deposit debris on the carriageway, but the highway itself has remained substantially intact. However, there is a significant risk that larger scale events may occur in the future extending across and below the road, causing extensive damage to or breach of the highway itself, resulting in an extended closure over several months whilst the highway is reinstated.

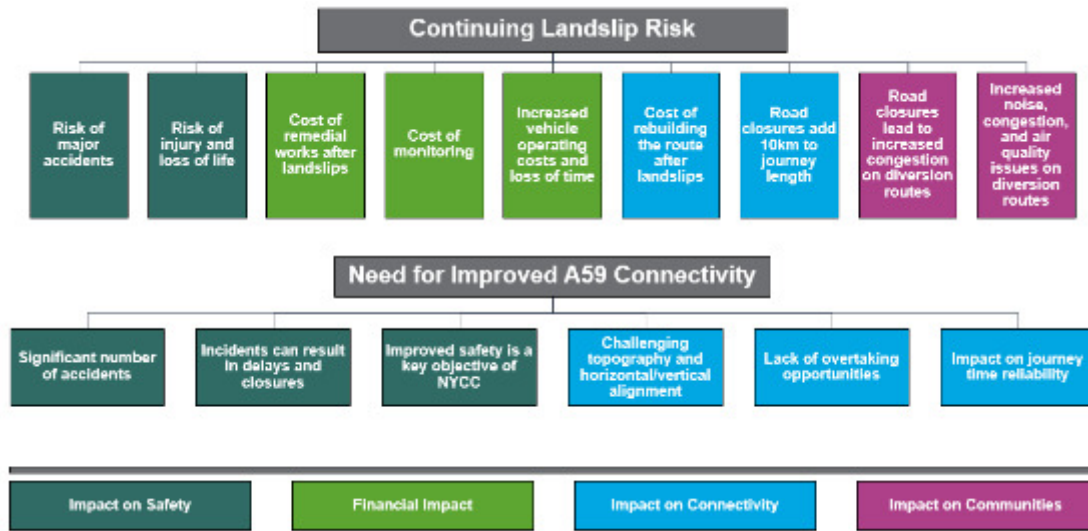
The clear-up costs and continued high level of maintenance and monitoring required at Kex Gill results in a significant cost to NYCC. Further to the costs identified in Figure 1-2, NYCC continues to typically spend around £240,000 per year on maintenance and monitoring. In times of emergency, the cost of implementing a full road closure together with diversion routes for one week can cost around £40k.

In the event of a landslip at Kex Gill, the A59 is closed and users are forced to use the diversion route which adds approximately 10km to the journey distance, resulting in significant impacts on journey times and costs to A59 users and adversely impacts the resilience of the route, journey time reliability and consequently, east-west connectivity. Furthermore, the official diversion route runs through a number of towns in West Yorkshire. The additional traffic and congestion which occurs when the A59 is closed results in adverse impacts to the communities of Ilkley, Burley in Wharfedale and Otley, amongst others. A number of other roads are also used by vehicles as a diversion when the A59 is closed at Kex Gill, creating adverse impacts to the communities along these routes also. These roads are generally either B Road or a lower standard and hence are not necessarily suitable for large volumes of traffic, or significant numbers of HGVs in particular. The routes do not necessarily offer a shorter distance compared to the official diversion route, but may be being used to avoid congestion on the official diversion route.

Further to the issues associated with landslips and closures at Kex Gill, NYCC are keen to improve connectivity on the A59 between Harrogate and Skipton to support sustainable economic growth. Outside of any periods of closure, the main constraint on journey time reliability is the formation of convoys behind slow moving vehicles (usually Heavy Goods Vehicles (HGVs)) on this section of the A59, due to the challenging topography and alignment of the road and the lack of overtaking opportunities. There are also a significant number of accidents occurring along the A59 route, with sections of the A59 in the study area displaying accident rates twice the national average. Again, these factors affect the reliability and resilience of the route.

Figure 1-3 summarises these important issues which affect the A59 at Kex Gill, demonstrating a clear need for intervention.

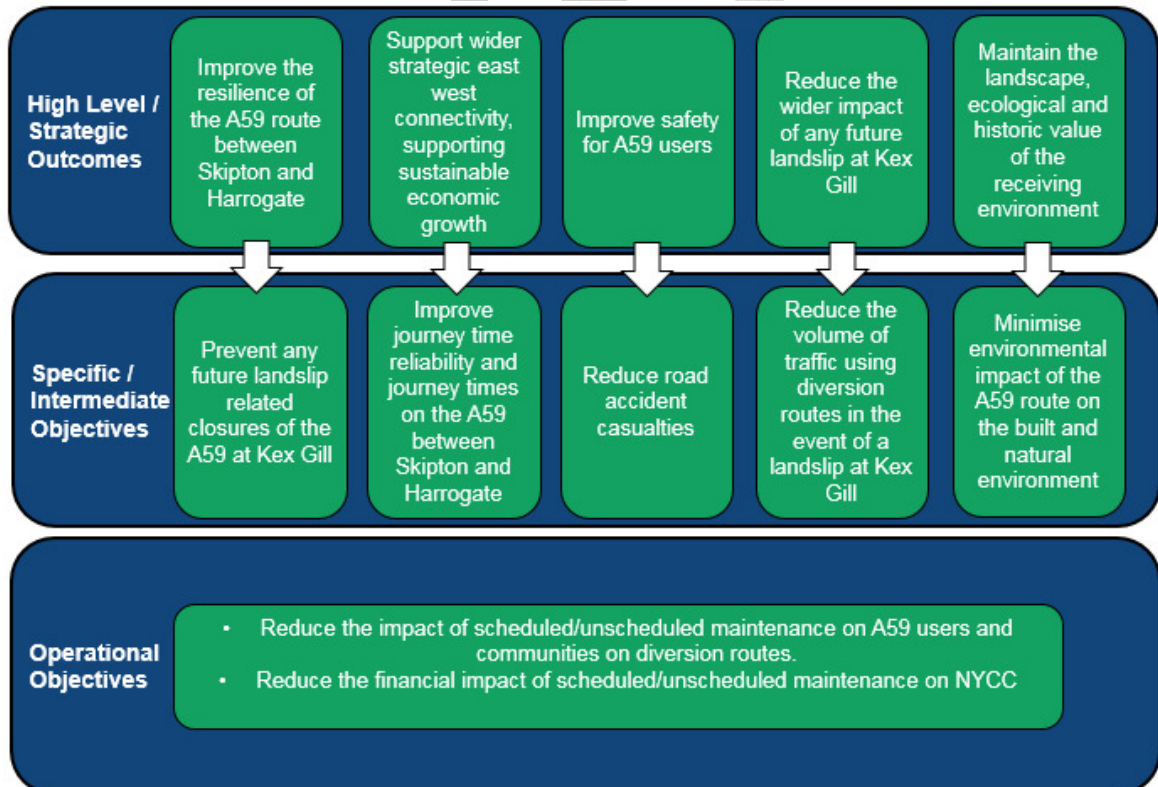
Figure 1-3 – The Need for Intervention



1.1.4 Scheme Objectives and Area of Impact

A hierarchy of objectives have been established, (see Figure 1-4), developed in consultation with the client (NYCC) and representatives of Harrogate Borough Council (HBC) and Craven District Council (CDC).

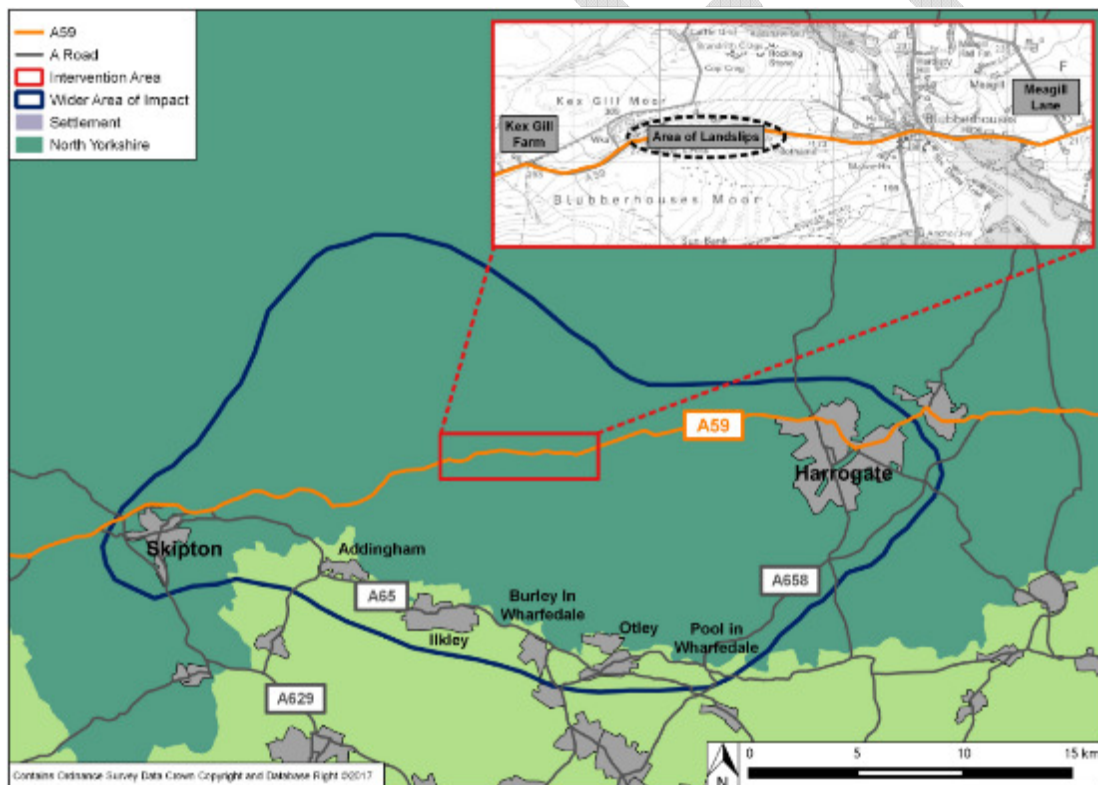
Figure 1-4 – A59 Kex Gill Diversion Scheme Objectives



### 1.1.5 Option/Corridor Development

Given the nature of the problems at Kex Gill, which are primarily related to landslips, it is not appropriate to consider a wider range of measures or interventions to address travel behaviours. However, Public Transport, pedestrian/cycle improvements or smarter measures, whilst potentially reducing the traffic flows along the route, would not tackle the issue of landslip risk. The only way to ensure continued east-west connectivity on the A59 is to divert the Kex Gill section of the route out of the landslip risk area or to develop a slope stabilisation scheme capable of providing near 100% confidence that there would be no further failures. With no other suitable east-west connection in the area, it is imperative that a robust A59 alignment continues to be provided. As a result, the options which have been developed are all highways focussed. These options are focused on the intervention area, see (Figure 1-5), which illustrates the geographical extents for the development of options. The figure also illustrates the wider area of impact – illustrating the anticipated geographic extent of the key travel market anticipated to be impacted by the scheme, including the communities located along the official diversion route.

Figure 1-5 – Intervention Area and Wider Area of Impact

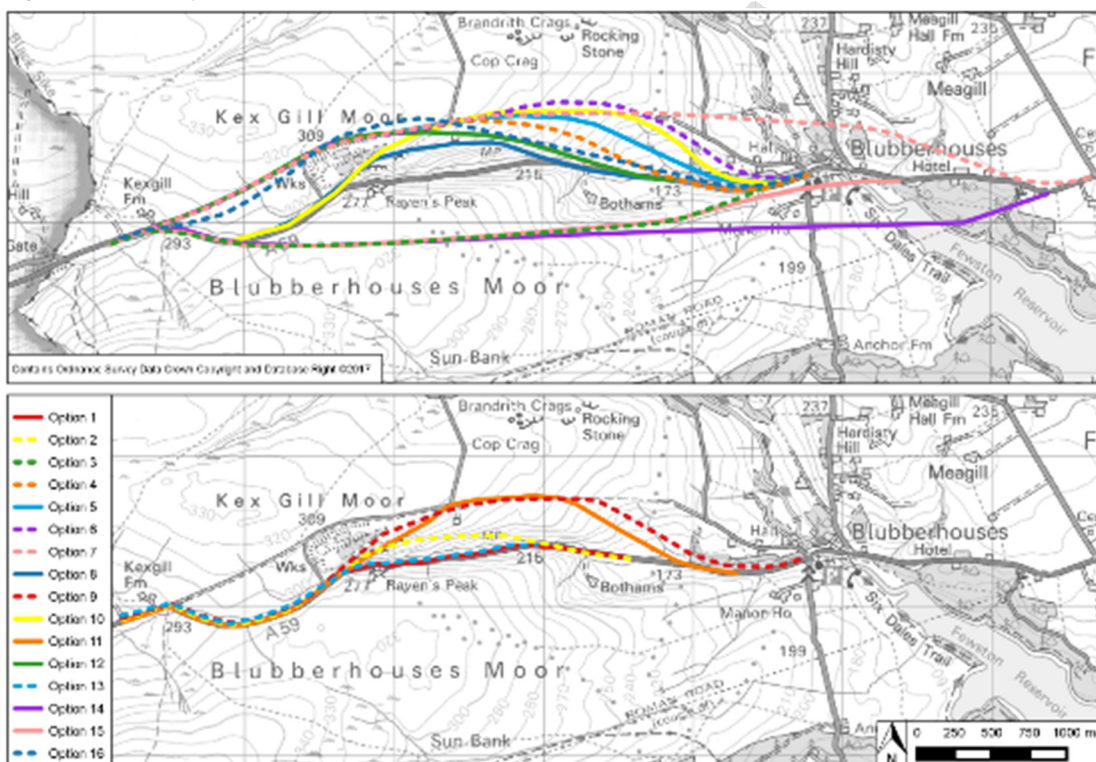


Option development began with an internal 'problems and issues' workshop, attended by the study team technical leads (Environment, Geotechnical, Highways, Quantity Surveying and Transport Planning), thus ensuring consideration of a wide range of factors. Subsequently, the Highways team developed initial designs for



options<sup>2</sup> and a further workshop was held to review these initial options. As a result of the discussions at the workshop, several new option alignments were created. On the 11<sup>th</sup> January, an ‘initial options’ workshop was held at NYCC area offices in Skipton, attended by both the study team technical leads and representatives of NYCC, HBC and CDC. At this workshop, a ‘fly-through’ for each of the 16 options was presented. The development of options has been guided by the known Highway, Environmental and Geological constraints, resulting in the development of 16 individual options, see Figure 1-6.

Figure 1-6 – 16 Options Schematic Plan

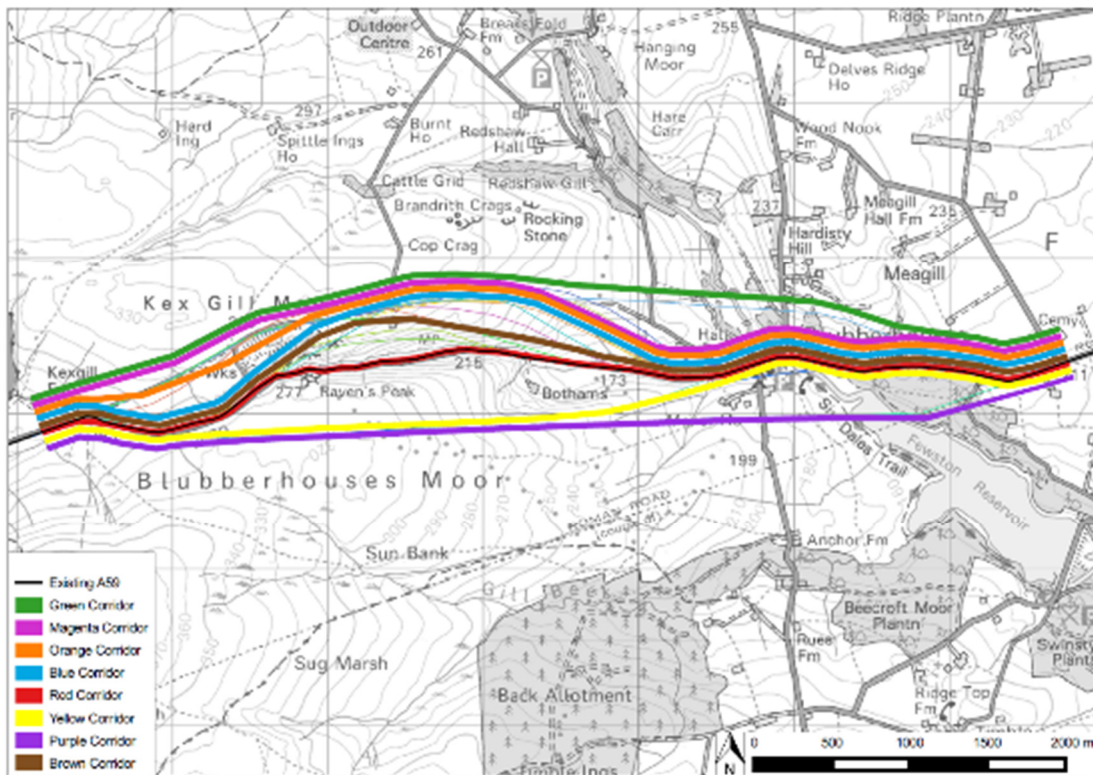


Prior to commencing the assessment and sifting stage of the study, the 16 options were condensed into a series of eight corridors, given that many of the options were similar in alignment, (see Figure 1-7).

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<sup>2</sup> Designs were developed using Autodesk's InRoads 360 'conceptual' design programme. The programme was configured to apply Design Manual for Roads and Bridges (DMRB) standards to each option, ensuring that initial designs complied with 'desirable' minimum horizontal and vertical geometry.

Figure 1-7 – Schematic Plan of the Eight Corridors



### 1.1.6 Option/Corridor Assessment and Sifting

In order to determine the better performing interventions, a structured sifting process has been followed, in line with the Department for Transport (DfT) Transport Analysis Guidance (WebTAG) and using the DfT's Early Assessment and Sifting Tool (EAST). EAST is a tool that has been developed to summarise and present evidence on options in a clear and consistent format, supporting decision making and is designed to be consistent with the DfT's five case transport business case structure:

- Strategic Case;
- Economic Case;
- Managerial Case;
- Financial Case; and,
- Commercial Case.

The results of the EAST assessment demonstrated that the Blue, Magenta and Orange corridors are deemed to be the best performing, scoring positively against many of the EAST metrics. In particular, these corridors fit well with government and wider transport objectives and demonstrates a significant positive impact in terms of economic growth, wellbeing, and Social and Distribution Impacts (SDIs), offering improved resilience, connectivity, reliability and safety and consequently



meeting the specific scheme objectives, in particular, removing the risk of landslip related closures of the A59. These three corridors are considered to be amongst the more affordable corridors, demonstrate some of the shortest implementation timescales and offer a good degree of flexibility, should wider circumstances change. Given that these corridors involve offline construction, they will have significant impacts in environmentally sensitive areas. As such, it will be important to minimise any harm caused to this sensitive environment. This is a key issue which needs further consultation with stakeholders. However, despite this, these corridors are among those anticipated to be most acceptable to the public.

Whilst the Yellow, Green and Purple corridors also score well against many of the metrics, there are several reasons why, overall, they are not considered to be amongst the better performing corridors:

- Costs in excess of £70m (£100m in the case of the Green and Purple corridors) therefore becoming increasingly unaffordable, particularly as they are unlikely to offer a similar level of increase in benefits.
- Implementation timescales are shown to be longer than that of other corridors.
- Significant adverse environmental impact on environmentally sensitive areas resulting from the extensive construction in areas designated as AONB, SSSI, SPA and SAC also resulting in lower public acceptability.
- Finally, the practical feasibility of delivering these corridors is lower, partly due to the need to deal with extensive peat deposits with water courses crossing route causing stability/drainage issues and, in the case of the Green and Purple corridors, the need for substantial structures.

The Brown corridor, whilst being amongst the corridors deemed to be most affordable and having one of the shortest implementation timescales, does not score well in terms of scale of impact, failing to substantively meet many of the scheme objectives, primarily as it is located in an area of continues landslip risk and therefore offer little in the way of increased resilience, reliability, connectivity or safety. In addition, the corridor also requires construction in an environmentally sensitive area, though not on the scale of Yellow, Green and Purple corridors. The fact that this corridor involves construction in the AONB, SSSI, SPA and SAC whilst still being subject to the same landslip risks as the current route, means that this corridor is considered to be one of the worst performing in terms of public acceptability.

The key strength of the Red Corridor (online) is that it avoids extensive construction within the environmentally sensitive areas of the study area. Furthermore, it is amongst the more affordable corridors and has similar implementation timescales to others. However, as the corridor continues to be located in an area of continuing landslip risk it scores poorly against many of the metrics, in particular the overall scale of impact, based on its limited impacts resilience, reliability, connectivity or

safety improvements. These factors, combined with the fact that its construction would see extensive disruption to A59 users, as an extensive diversion would need to be put in place, means that the public acceptability of this corridor is low. The inability to use the existing A59 as a diversion route during construction also means that this corridor scores poorly in terms of flexibility and practical feasibility.

## 1.2 Next Steps

### 1.2.1 *Development of Scheme Design*

The completion of the Option Assessment Report (OAR) has resulted in the identification of three preferred corridors; Blue, Magenta and Orange. These corridors (and therefore the initial options on which they are based) are all broadly similar – being located on the north side of the Kex Gill valley; involving improvement to the Kex Gill Farm corner; a diversion around the key area of landslip risk; and tying back into the existing A59 alignment around Blubberhouses. The only substantive difference between the preferred corridors is whether they diverge from the existing A59 at Kex Gill Farm or further east along the existing A59, (the latter option also incorporating a smoothing of Kex Gill Farm corner) and the actual specific alignment of the section diverting around the key landslip risk area. Both of these areas require further investigation and testing before a decision can be made as to which is the preferred arrangement. Key to enabling this refinement, is the need for further ground condition and topographical surveys in the vicinity of the preferred corridors. This information will be critical in being able to narrow down the exact alignment of a preferred option.

### 1.2.2 *Engagement with Stakeholders and the Public*

Whilst some initial engagement with a limited number of stakeholders has taken place, it will be important to engage with a wider range of key stakeholders in more depth, now that preferred corridor alignments are beginning to emerge and other potential options (particular online options) are being discarded. In particular, the need for consultation with environmental stakeholders is paramount, in order to discuss the need for the scheme and understand the strength of feeling regarding the impacts of construction in environmentally sensitive areas, (as this is likely to be a key area of opposition) versus the benefits of a new alignment outside of an area of substantial landslip risk. Furthermore, it will be important to discuss potential areas of mitigation, such as returning the landscape of the existing section of the A59 to its original state.

Similarly, the next steps need to include for initial public consultation. Given that any offline option is likely to result in the need for a public inquiry, engaging the public from an early point in the study will be important in order to ensure that clear messages are being broadcast and that local communities feel that they are being engaged with early in the study process. Establishing a communications plan will be vital to ensure that stakeholders and the public are kept up to date throughout the subsequent stages of the study, limiting the risk of objections during the anticipated public inquiry.

### 1.2.3 *Development of Outline Business Case*

Alongside both the development of the scheme design and the stakeholder/public consultation, there is a need to develop a robust business case, both to secure potential DfT funding and to clearly illustrate to stakeholders (and the public) the benefits of implementing a Kex Gill Diversion scheme. Aligned with the development of a business case is the need to refine the cost estimating work done to date, in particular, developing a more detailed risk register and quantification of risks, and developing greater cost certainty over both the capital and revenue cost estimates. Clearly, the additional ground investigation and topographical surveys that are recommended will enable increased confidence in the development of scheme cost estimates, which currently include a substantial allowance for contingency and optimism bias.

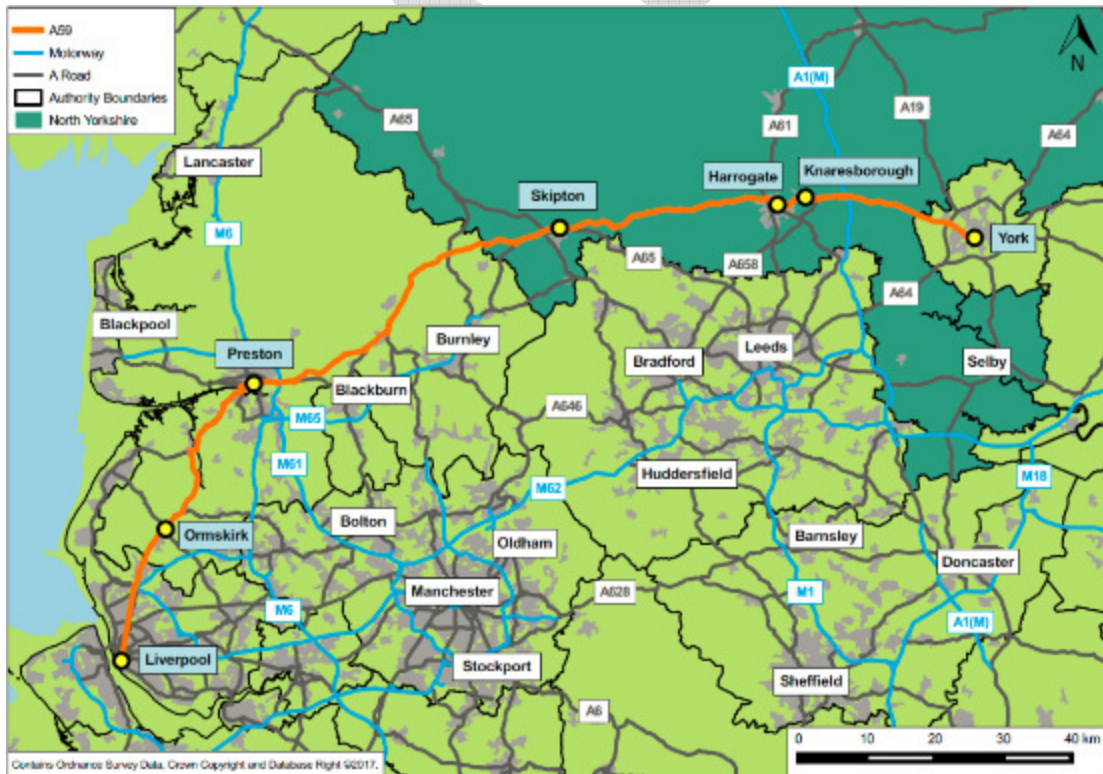
Finally, in order to develop a robust business case which includes an accurate representation of the quantification of benefits associated with a Kex Gill Diversion Scheme and the corresponding Benefit Cost Ratio (BCR) and Value for Money (VfM), (which again will be imperative for both securing funding and demonstrating the benefits of intervention to stakeholders and the public), consideration needs to be given to the need for some form of appraisal tool (e.g. transport model) to enable this quantification. Early discussion have taken place between NYCC, Mouchel and the DfT in relation to modelling requirements and these will continue over the coming months.

## 2 Introduction

### 2.1 Study Area Overview

The A59 is a key strategic route, approximately 170km in length, which runs from Wallasey in Merseyside to York in North Yorkshire, passing through a number of towns and cities including Liverpool, Ormskirk, Preston, Clitheroe, Skipton, Harrogate and Knaresborough (see Figure 2-1). Whilst the A59 does not form part of the Strategic Road Network (SRN), it is seen as a key strategic route for east-west connectivity in the north of England, (it is part of the MRN – Major Route Network – being developed by Transport for the North (TfN)) and provides connection to sections of the SRN, most notably Junction 31 of the M6, to the east of Preston, and Junction 47 of the A1(M) to the east of Harrogate. The A59 also provides key links to other important sections of the road network, including the A61 which connects to Leeds and the A65 connecting to Cumbria in the northwest of England. As can be seen in Figure 2-1, to the immediate north of the A59, there are no other east-west routes that are viable for strategic travel in this region. Consequently it is a very important route in this area.

Figure 2-1 – A59 Extents



The focus of this study is the section of the A59 at Kex Gill, between Skipton and Harrogate, see Figure 2-2. The A59 provides a key strategic east-west connection in this part of the country, linking Harrogate and Skipton which are the key settlements within their respective authority areas. Furthermore, the section of the A59, linking the A1 and Harrogate to Skipton and Craven District is identified in the York, North



Yorkshire and East Riding (YNER) Local Enterprise Partnership's (LEP) Strategic Economic Plan<sup>3</sup> (SEP) as a priority route.

The A59 also provides an important link for smaller settlements and communities in this area, providing accessibility to the wider transport network and key facilities and services. The route is a particularly important link for the local communities and businesses in Skipton and Harrogate, given that travel by alternative modes is not necessarily viable; there are no direct bus or rail links between the two towns<sup>4</sup>.

Figure 2-2 – A59 Kex Gill Location Plan



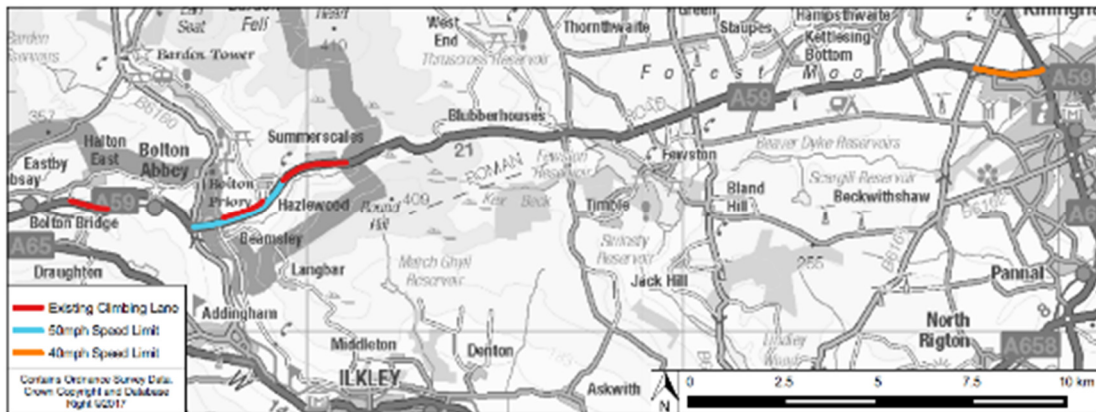
The route between the two towns is a predominantly a rural single carriageway, subject to the national speed limit. There are, however, two short sections with lower speed limits, including a 1.5km section with a 50mph speed limit, to the east of Bolton Bridge and a 1.7km section with a 40mph speed limit, immediately to the west of the A61 junction at Harrogate (see Figure 2-3). In addition, this section of the route

<sup>3</sup> Strategic Economic Plan, York, North Yorkshire & East Riding Local Enterprise Partnership, (2016)

<sup>4</sup> A journey by bus requires travelling via Leeds or Addingham and changing services; this journey would take around two hours. Similarly, a journey by rail requires changing trains at Leeds City Station, with a journey time ranging between 1.5-2 hours. A car journey along the A59 under normal conditions would be expected to take around 40 minutes.

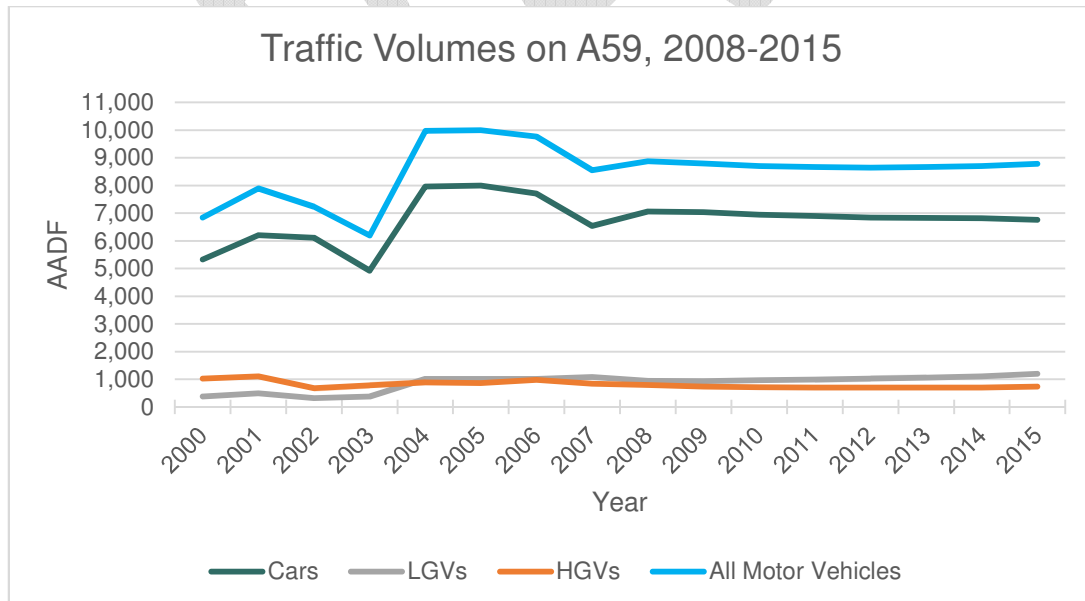
is undulating, with some steep sections of carriageway, including at Kex Gill. As a result, there are three sections of climbing lane, including two sections eastbound near Beamsley, and to the east of Bolton Bridge and, a westbound section near Halton East; to the west of the Bolton Bridge junction.

Figure 2-3 - A59, Location of Climbing Lanes and Speed Limit Changes



The A59 has an Average Annual Daily Traffic Flow (AADF) of approximately 8,800<sup>5</sup>. As illustrated by Figure 2-4, the traffic level has remained relatively constant over the time period analysed. Cars make up approximately 80% of the traffic flow, but there is also a significant number of Lights Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs) using the route (approximately 1,200 and 750 respectively).

Figure 2-4 – A59 Average Annual Daily Flow 2008-2015



Source: Department for Transport (DfT)

<sup>5</sup> 2015, based on DfT traffic count site on A59, east of Blubberhouses: <http://www.dft.gov.uk/traffic-counts/>

## 2.2 Kex Gill Landslips

Kex Gill is a narrow and steep sided valley located on the A59 in North Yorkshire, situated approximately 16km west of Harrogate and 15km east of Skipton, see Figure 2-5 and Figure 2-6. The A59 at Kex Gill passes through a rural and open landscape, designated as the Nidderdale Area of Outstanding Natural Beauty (AONB). The landscape of the area within the Nidderdale AONB is considered to be of very attractive quality and highly valued for its recreational resource, with numerous footpaths and bridleways. In addition, large parts of the area are designated as a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Special Area of Conservation (SAC).

There is a long history of landslips on the land above the A59 at Kex Gill. These landslips deposit material onto the road leading to unpredictable closures. The primary cause of the landslips is heavy rainfall coupled with relatively unstable land on the hillside slopes in the area leading to earthwork failure. The most recent landslide occurred in early 2016 and resulted in a road closure of approximately 8 weeks duration. In addition, the cost to North Yorkshire County Council (NYCC) for emergency slope stabilisation and associated carriageway work was around £625,000. Fortunately, to date, although a vehicle has been caught by a landslide, there have been no personal injuries as a result of a landslide at Kex Gill. However, without intervention, there continues to be a risk that road users could be caught in any future landslide or of larger landslips leading to much longer road closures and an associated significant maintenance cost liability to NYCC.

Figure 2-5 – Schematic Location Plan





Figure 2-6 – Kex Gill Photographs



**Kex Gill landslide area**

**Westward view of A59 at Kex Gill**

In addition to the risk to the safety of road users, there are a number of other associated impacts of landslips at Kex Gill. In the event of a landslide at Kex Gill, the A59 is closed and users are forced to use the diversion route which adds approximately 10km to the journey distance, resulting in significant impacts on journey times and costs to A59 users. Furthermore, the official diversion route runs through a number of towns in West Yorkshire, resulting in adverse impacts to the communities of Ilkley, Burley in Wharfedale and Otley, amongst others.

Besides the issues associated with landslips and closures at Kex Gill, NYCC are keen to improve connectivity on the A59 between Harrogate and Skipton to support sustainable economic growth. Outside of any periods of closure, the main constraint on journey time reliability is the formation of convoys behind slow moving vehicles (usually HGVs) on this section of the A59. Due to the alignment of the road and the topography, there are few overtaking opportunities between Harrogate and Skipton. There are also a significant number of accidents occurring along the A59 route.

### 2.3 Previous Studies

NYCC have identified the need for an improvement to the A59 at Kex Gill as a high priority, in order to improve the resilience of the network between Harrogate and Skipton. The need for a solution to the problems of landslips at Kex Gill is highlighted in a number of existing documents, including both the North Yorkshire Local Transport Plan 4<sup>6</sup> (LTP4) and the Strategic Transport Prospectus for North Yorkshire<sup>7</sup>.

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<sup>6</sup> North Yorkshire Local Transport Plan 4, North Yorkshire County Council, 2013

<sup>7</sup> A Strategic Transport Prospectus for North Yorkshire, North Yorkshire County Council (2015)



NYCC has previously commissioned a number of geotechnical investigations of the land in the Kex Gill area, in order to try to develop their understanding of the geotechnical issues resulting in landslips, the include:

- **Report on Ground Investigation at A59, Kex Gill, Norwest Holst Soil Engineering, 2008.** This report summarised that the ground investigation broadly concurred with published geology reports. Including presence of very weak to medium strong carboniferous strata and groundwater in the exploratory boreholes.
- **A59 Kex Gill Geotechnical Interpretative Report, Jacobs, 2009.** The report concluded that ground failures appeared to be due to a planar slide of superficial deposits. The risk of a massive rotational failure above the road was considered to be low, however, a risk of continued shallow planar failures in the slope above the road was identified. Recommendation for re-grading of the slope face and provision of a rock berm was provided.
- **A59 Bypass Preparatory works – Geotechnical Walkover and High Level Geotechnical Risk Register, Jacobs, 2015.** In summary, the site walkover concluded that there was a possibility of embankment bearing failure and settlement issues and potential for landslides. It also noted that quarrying in the area has altered the general landscape and there may be cut and fill in unexpected places. Other key risk hazards noted included, soft weak soils, level of groundwater and stability of slopes and excavation of rock to create cuttings.
- **Landslip A59 Kex Gill, Blubberhouses – Preliminary Sources (Desk) Study, Capita, 2015.** Three options were investigated. Option 1, to stabilise the existing slope – this was perceived to be beneficial for reducing impacts to the AONB. However, further detailed ground investigation was recommended to assess feasibility. Option 2 referred to realignment of the road along Old Kex Gill Turnpike. This option was considered to have many potential benefits. Option 3 included realigning the road into the valley bottom, this option however was discounted due to the potential for an increase in fluvial flooding downstream of the option.
- **Kex Gill Preliminary Environmental Appraisal (Draft), Capita, 2016.** The report, which is currently still being finalised, will set out findings relating to the likely environmental effects of construction of a new road alignment on a range of environmental topics.
- **Kex Gill Options Summary Report, Capita, 2016.** This report was commissioned to provide a high level options assessment for relocation of the A59. Five options were considered and they were all considered to offer high Value for Money (VfM). It was noted however, that there is potential for adverse environmental impacts. It was recommended that the options are

examined in greater detail in a full options assessment, followed by formal consultation.

A further geotechnical study of the Kex Gill area is currently being undertaken by Capita. It is anticipated that a report of the findings will be available by April 2017.

NYCC also previously commissioned a study into the economic and environmental feasibility of a potential diversion scheme at Kex Gill<sup>8</sup>. This study informed the Yorkshire Dales Landslips Package Local Highways Maintenance Challenge Fund bid, submitted by NYCC to the Department for Transport (DfT) in 2015. The bid was for a landslip prevention scheme comprising slope stabilisation and support, and drainage enhancement. The estimated cost was approximately £10m for a package of works covering Kex Gill and Swaledale (west of Richmond). The bid demonstrated high VfM with a Benefit Cost Ratio (BCR) of 2.9. Whilst, the bid was unsuccessful on this occasion, it instigated a dialogue between the DfT and NYCC over the need for a solution to the issues affecting the A59 at Kex Gill, a dialogue which has continued alongside the development of this Option Assessment Report (OAR).

## 2.4 Structure of Report

This OAR documents the process of identifying the need for intervention (based on the current and future issues) and the process of option development and sifting. The remainder of the document is structured as follows:

- **Chapter 3** outlines the current situation in the study area in terms of current transport (and other) policy, travel demands and opportunities and constraints;
- **Chapter 4** sets out the future transport situation, taking into account future land-use policies, changes to the transport system and travel demands;
- **Chapter 5** establishes the need for intervention, based on the current and future transport-related problems in the area and the underlying causes of these problems;
- **Chapter 6** presents a clear set of intervention-specific objectives;
- **Chapter 7** establishes the geographical area of impact to be addressed by an intervention, based on an understanding of the scope of the travel market, key origins and destinations and the extent of current and future transport problems;
- **Chapter 8** outlines the option generation process;

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<sup>8</sup> A59 Harrogate to Skipton Preparatory Works Package: Kex Gill Diversion Economic & Environmental Feasibility Study, Jacobs, 2015

- **Chapter 9** discusses the process of how the options were appraised and sifted to identify preferred options;
- **Chapter** Error! Reference source not found. summaries the findings of the OAR and outlines the next steps for the Kex Gill Diversion Scheme.

DRAFT

## 3 Understanding the Current Situation

### 3.1 Overview

This section of the report provides a summary of the current situation and problems affecting the A59 at Kex Gill, including a commentary on current transport and other relevant policies, current travel demand and level of service, and current opportunities and constraints.

The key issue is the occurrence of landslips at Kex Gill which result in closures of the A59, and associated adverse impacts on A59 users and the communities and businesses which rely on the route. However, even outside of periods of closure, there are issues associated with the route which have a detrimental impact on east-west connectivity. The remainder of this section discusses these two key issues in more detail.

### 3.2 Landslips at Kex Gill

#### 3.2.1 History of Landslips

There is a long history of landslips on the valley slopes above the A59 at Kex Gill. These landslips result in material being deposited onto the road, leading to the closure of the road. Table 3-1 summarises the main landslip events and periods of maintenance/remedial work that have occurred over the last 16 years. The last full closure of the A59 was an 8 week closure in January 2016. The direct cost to NYCC relating to the management of the closures and implementation of repairs (including removal of debris, repair of damaged infrastructure, traffic management and stabilisation of embankments) has been approximately £1.7m over the most recent 6 year timeframe<sup>9</sup>.

Table 3-1 – Road Closure History at Kex Gill

Date	Event	Action	Works Duration	Costs
Oct 2000	Landslips in two locations during heavy rainfall. 1. Minor slip west of Raven's Peak, small amount of material slumped onto carriageway. 2. Significant landslip west of Paradise, depositing a large amount of saturated material onto the carriageway, blocking the road.	Road Closed. Removal of saturated material from the carriageway and from the adjacent slope. Construction of stabilisation works involving large rock retaining wall against the carriageway, backfilled with free draining crushed rock.	3 weeks	Not known

<sup>9</sup> Where costs are known. Costs associated with some of the earlier landslips are unknown.

Date	Event	Action	Works Duration	Costs
Jun 2007	Significant landslip west of Paradise occurring during heavy rainfall (approx. 30m east of 2000 landslip), depositing a large amount of saturated material onto the carriageway, blocking the road. Passing vehicle trapped by landslip.	Road Closed. Removal of saturated material from the carriageway and from the adjacent slope. Construction of stabilisation works involving large rock retaining wall against the carriageway, backfilled with free draining crushed rock.	3 weeks	Not known
Sep 2010	Significant landslip west access to Botham's Farm, depositing a large amount of weathered mudstone, soil and trees onto the carriageway, partially blocking the road. A different failure mechanism to the slips of 2000 and 2007; this time involving the uprooting of trees during high winds.	Road Closed. Removal of slipped material from the carriageway and from the adjacent slope. Trimmed back weathered rock face to approx. 60 degrees angle, formed rock trap behind large rock retaining wall alongside the carriageway.	1 week	£100k
Jun 2011	Planned Stabilisation Works.	Road Closed. Main works were west of Paradise encompassing the landslips of 2000 and 2007. Other works included repairs to blocked watercourses at Myers Wood and east of Black Dyke; repairs to retaining walls north of A59 and carriageway resurfacing.	5 weeks	£410k (Slope) £300k (c/way works)
May 2012	Landslip within the area of previous stabilisation works undertaken in 2011, during heavy rainfall. Large amounts of water coming out of the slope face washing out substantial amounts of material over the rock retaining wall and onto the carriageway. Also a second area of slippage occurred at the eastern limit of the remediated slope.	Temporary traffic lights installed initially, then road closure to carry out excavation works. Removal of washed out material from the carriageway and from the slope above the retaining wall.	3 days (A59 closed for 2 days)	£25k
Mar 2014	Planned slope drainage works.	Road remained open under temporary traffic lights. Construction of herringbone drains on the slope face. Difficult construction methods involving cable climbing plant on the slope anchored to heavy plant at top of slope.	6 weeks (A59 kept open)	£220k
Jan 2016	Significant movement observed in the slope above and within the area of previous	Road Closed. Construction of combined drainage and access track	8 weeks	£550k (Slope)

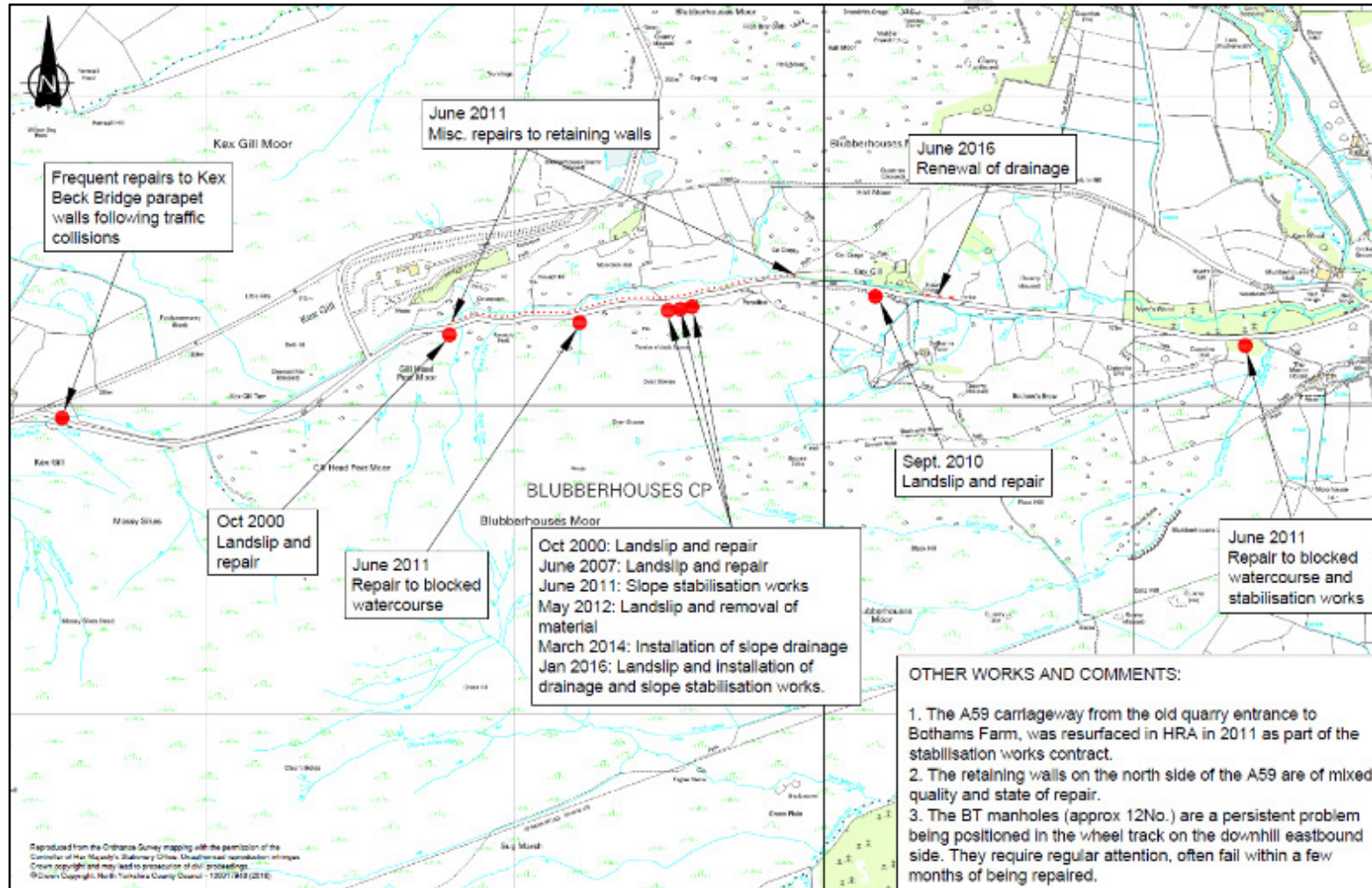
Date	Event	Action	Works Duration	Costs
	stabilisation works undertaken in 2011. Large tension cracks observed in the area, with vertical movements up to 800mm occurring after a prolonged period of rain with intense rainfall just after Christmas 2015.	from near the buildings at Paradise to the waterfall at the top of the slope. Construction of additional rock retaining walls above the existing walls adjacent to the A59, and backfilling with free draining crushed rock		£75k (c/way works)

Figure 3-1 illustrates the locations of the landslips and remedial works that have been undertaken since 2000.





Figure 3-1 – Location of Road Closures



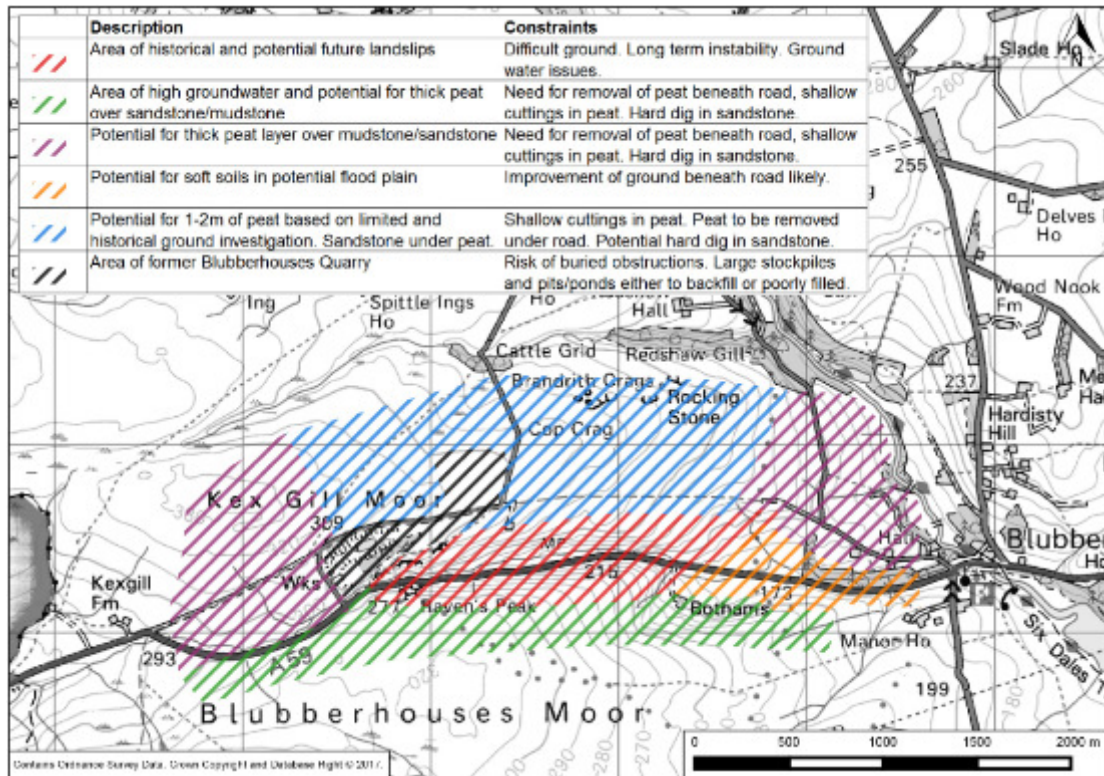
Source: North Yorkshire County Council (NYCC)

### 3.2.2 Existing Ground Conditions

Road closures at Kex Gill are primarily as a result of landslips depositing large amounts of material on to the carriageway. The principal cause of the landslips at Kex Gill is heavy rainfall on the relatively unstable natural hillside slopes in the area leading to earthwork failure.

The general ground conditions in the Kex Gill area comprise two major beds of competent sandstone within more general weaker mudstone and shale strata. Kex Gill itself is a steep sided valley where natural erosion processes have created over-steepened slopes. Together with a probable high water table, this creates conditions which are inherently susceptible to natural landslide activity including possible large deep seated landslides. In addition to the reported landslide activity affecting the existing A59 highway on the southern side of the valley, the northern slopes of the valley also show visible evidence of large historic and relict landslide features and some evidence of recent smaller scale landslide activity. Much of the Kex Gill valley is thus potentially at risk from landslides, as indicated on the plan below, either from new landslide events or re-activation of existing historic landslide features.

Figure 3-2 – Geotechnical Constraints Plan



Various engineering works have been undertaken adjacent to the existing A59 to remediate past landslips and to reduce the landslide risk, including the provision of rock fill support and provision of drainage works. However, in view of the extent of the area at risk and the large scale of the existing or potential landslide features, full stabilisation of the area at risk would require extensive and very substantial engineering works and is unlikely to be practicable or environmentally acceptable. It



is thus probable that the existing A59 or any online improvement would remain susceptible to landslides and related disruption.

It is difficult to predict the changes in future weather events with any certainty, but the global scientific consensus is that the world's climate is changing. The United Kingdom (UK) Climate Projections 09 (UKCP09)<sup>10</sup> report sets out key projections of future climate change in the UK. This report notes that, overall, there will be relatively little change in the total amount of precipitation that falls annually. However, there is expected to be an increase in rainfall in the winter (offset by a decrease in rainfall in the summer) for much of the UK. The report illustrates that, over the past 45 years, in winter, all regions of the UK have experienced an increase in heavy precipitation events.

Significant changes that have been observed in the UK climate include an increase in the relative importance of heavy precipitation events in winter. Precipitation, in the winter is expected to increase in the range of +10 to +30% over the majority of the country. In broad terms, climate models suggest that we should expect to see a continuation of the changes that have been observed in the UK, albeit at an increased rate.

It is noted that assets deteriorate more quickly due to changes in average climatic conditions with transport assets being more badly damaged as a result of more extreme climatic events. The possible effects of climate change will be an increase in the demands placed on existing assets, such as their ability to perform under higher temperature and greater rainfall intensity, also an increase in their rate of deterioration. This will exacerbate the issues at Kex Gill due to the instability of the embankments.

The UKCP09 report sets out projected changes for the 2080s for a medium emissions scenario include increased winter rainfall, rising sea levels and more frequent storm surges which may increase flood risk. These changes are likely to exceed current natural variability and consequently, services that are demonstrably sensitive to current weather events are likely to become increasingly vulnerable in the future. The specific effects on landslide activity are difficult to quantify, but as landslide events are frequently related to individual extreme rainfall events or years with generally higher winter rainfall, it is probable that the projections of future climate change will result in some increase in the frequency of individual landslide events and/or the re-activation or increased movement of existing and/or relict landslide features.

It is expected landslips will continue but current investigations are underway to better understand the reasons for the ground failures and instability of the slopes which

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<sup>10</sup> *UK Climate Projections is a climate analysis tool, funded by Defra, providing information on future climate projections*

results in the landslips. This will inform the optioneering process so appropriate measures can be considered.

### 3.2.3 *Maintenance Challenges*

In addition to the landslips that have taken place (and sustained risk of future landslips), there are a number of significant factors associated with the condition of the A59 carriageway at Kex Gill.

A large proportion of the A59 carriageway through the Kex Gill valley is lined by stone walls, a large proportion of which is in need of extensive maintenance. NYCC confirm that they have several reports of loose stones becoming dislodged from the wall and being struck by vehicles in the carriageway.

NYCC geotechnical engineers outlined that the retaining wall supporting the A59 at Kex Gill has been repaired on a number of occasions over the years. As a result, the quality of the retaining at different locations is variable. Recent highway surveys have indicated that there is cracking evident which will again require extensive maintenance.

In addition, NYCC note that there are other issues associated with the A59 carriageway at Kex Gill which require addressing in the near future, including sinking man hole covers, drainage failures and failures of the carriageway surface itself.

### 3.2.4 *Impact of Landslips*

#### **Direct Impacts**

To date, the main effect of landslide events has been to deposit debris on the carriageway, but the highway itself has remained substantially intact. However, there is a significant risk that larger scale events may occur in the future extending across and below the road, causing extensive damage to or breach of the highway itself, resulting in an extended closure over several months whilst the highway is reinstated.

Fortunately, although a vehicle has been caught by a landslip, there have been no personal injuries as a result of a landslip at Kex Gill to date. However, landslips at Kex Gill can occur without warning. Given the significant traffic flows along the A59, there is a significant risk of a serious accident occurring, with the potential for multiple vehicles to be involved.

The clear-up costs and continued high level of maintenance and monitoring required at Kex Gill results in a significant cost to NYCC. Further to the costs identified in Table 3-1, NYCC continues to typically spend around £240,000 per year on maintenance and monitoring. In times of emergency, the cost of implementing a full road closure together with diversion routes for one week would cost around £40k.

#### **Indirect Impacts**

In the event of landslip at Kex Gill, the A59 needs to be closed, sometimes for an extended period (as demonstrated in Section 3.2.1). This closure results in a number of further impacts, summarised below and explained in further detail in Section 3.3:

- **Impacts on journey times/distance** – the diversion route adds approximately 10km to journey distances, resulting in significant impacts on journey times, vehicle operating costs and east-west connectivity. A59 users are directed to use the official diversion route, which runs through a number of towns and villages in West Yorkshire which are already experiencing congestion. This results in a further detrimental impact on journey time reliability for both diverting A59 users and existing users of the routes which make up the official diversion route.
- **Severance** – closure of the A59 creates a major severance issue for east-west journeys, resulting in poor connectivity. Furthermore, increased traffic volumes passing through the towns and villages on diversion routes exacerbates issues of local severance, adversely impacting local communities and businesses.

### 3.3 Impacts of A59 Kex Gill Closure

#### 3.3.1 A59 Closure and Diversion Route

In the event of a landslip at Kex Gill (or another incident requiring a road closure), a significant stretch of the A59 must be closed, see Figure 3-3. The cost of implementing a full road closure, together with implementation of diversion route, for one week, costs around £40k. Significant signage is deployed to alert drivers to the road closure. In addition to barriers physically preventing access to the road that is closed, diversion and road closure signage is provided at all major junctions and in the main settlements including Harrogate, Skipton, Addingham, Ilkely, Otley and Pool-in-Wharfedale.

*Figure 3-3 – A59 Closure Extents and Diversion Routes*

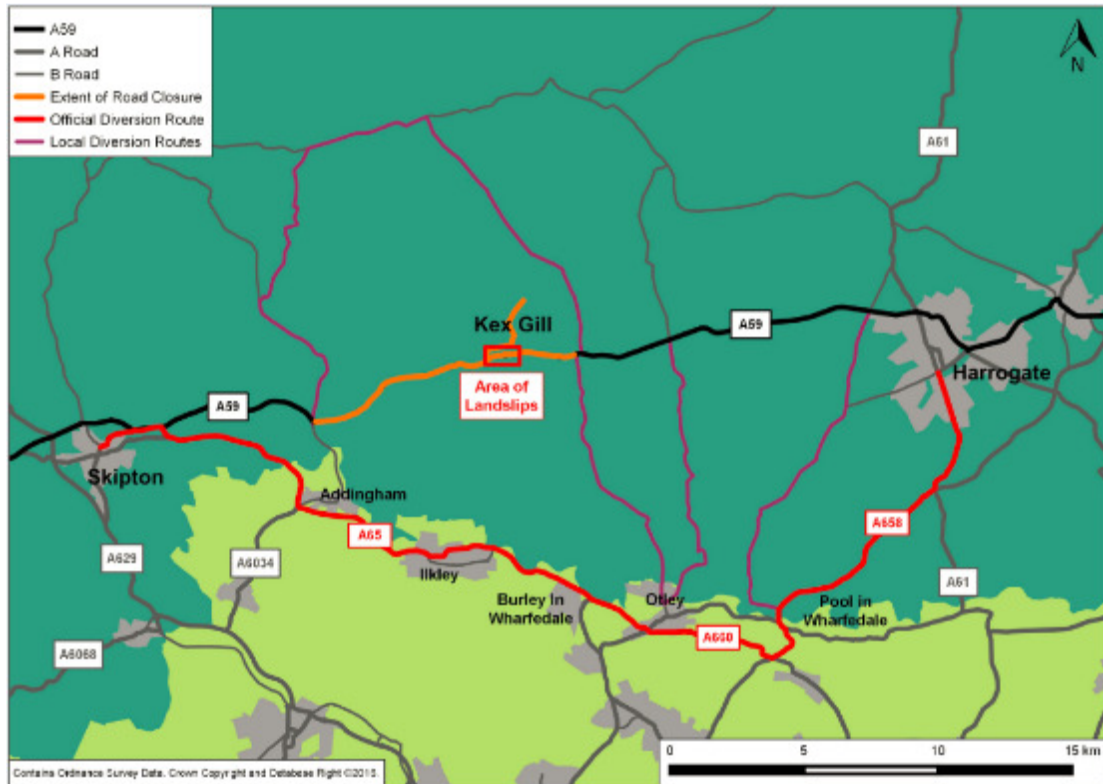


Figure 3-3 also illustrates the official diversion route which A59 users are directed to follow in the event of a closure at Kex Gill. A journey between Skipton and Harrogate is approximately 10km further using the official diversion route, compared to using the A59. This leads to longer journey times for travellers, not just because of the extra distance, but also because the diversion routes passes through several towns where 30mph speed limits are in place and congestion is already evident, particularly at peak times. The additional traffic from the A59 exacerbates the congestion issues, adversely effecting both existing users of these routes and the communities and businesses along them.

Figure 3-3 highlights that a number of other roads are used by vehicles as a diversion when the A59 is closed at Kex Gill<sup>11</sup>. These roads are generally either B Road or a lower standard and hence are not necessarily suitable for large volumes of traffic, or significant numbers of HGV's in particular. The routes do not offer a shorter distance compared to the official diversion route, but may be being used to avoid congestion on the official diversion route.

### 3.3.2 Traffic Flow Impacts

Given the relatively long diversion route, traffic flows vary on the surrounding roads when a road closure is in place compared to normal conditions. Figure 3-4 below illustrates a summary of traffic data at various locations on the road network,

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<sup>11</sup> This is based on an examination of traffic flow data for periods where the A59 is closed which demonstrated a notable increase in flow on these routes during periods of closure.

illustrating how the Annual Average Daily Traffic (AADT) movements vary when a road closure is in place.

Figure 3-4 – Traffic Flow Changes AADT – A59 Open/Closed

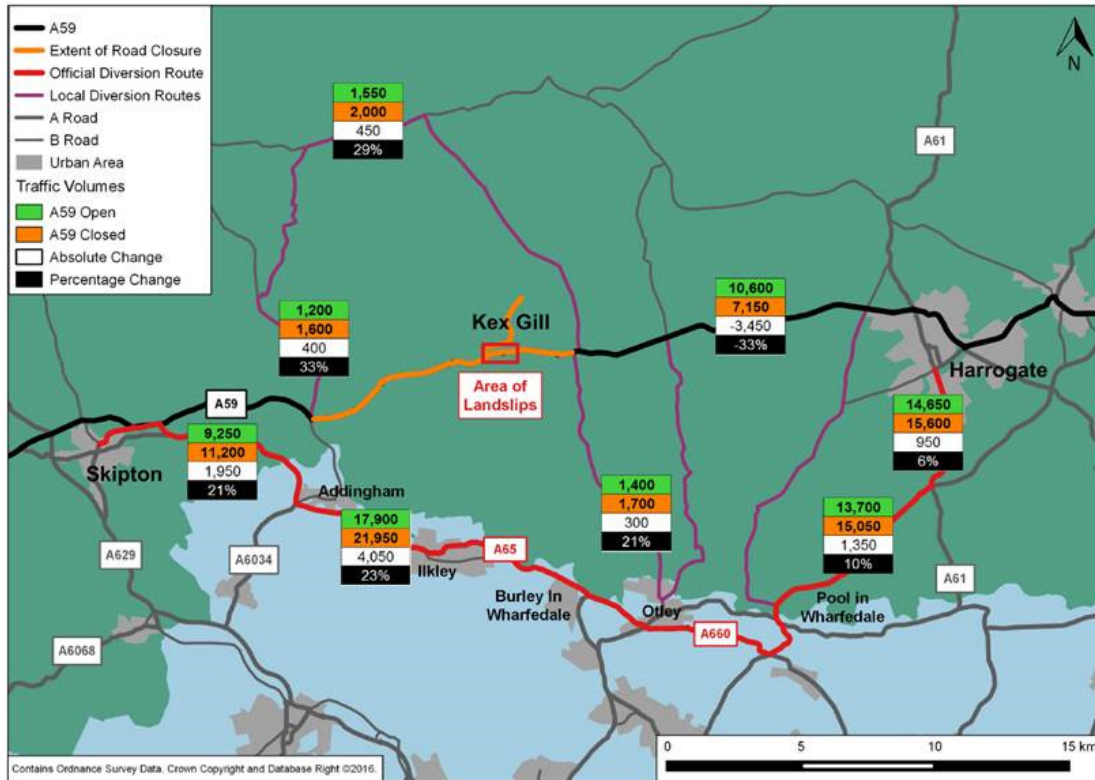


Figure 3-4 summarises the average daily traffic flows at locations on roads in the vicinity of Kex Gill during times when the A59 is open and during times when it is closed due to a landslide. In summary, this illustrates that:

- Traffic flows on the official diversion route increase when the A59 is closed; proportional increases ranging from 6% to 23%.
- Traffic on local roads, not forming part of the official diversion, show a relatively higher proportional traffic increase ranging from 21%-33%. Indicating that roads unsuitable for large traffic volumes and vehicles are being used as a diversion route.

### 3.3.3 Journey Time/Reliability Impacts of A59 Closure

The closure of the A59 at Kex Gill has a significant impact on journey times for users of the A59. In addition, the increase in traffic on the official diversion route has an adverse impacts on the journeys of those already using the route. Trafficmaster<sup>12</sup> journey time data has been analysed in order to interpret the impact on journey times

<sup>12</sup> Trafficmaster data is collected from in-vehicle GPS (Global Positioning System) tracking devices which can be used to derive average speed, journey time, journey time variability and other statistics.

for both A59 users and those already using routes which become diversion routes in the event of a closure of the A59 at Kex Gill. Figure 3-5 highlights the five routes which have been considered. Note that the impact on both a local (Skipton to Harrogate) journey and strategic (Skipton to east of Harrogate) journey has been analysed – as illustrated by the solid / dashed line on Figure 3-5). The exact extents of each of these types of journey are:

- **Local Journey:** A6131 The Bailey/A59 junction, Skipton to B6162 Otley Road/A61 York Place junction, Harrogate.
- **Strategic Journey:** A6131 The Bailey/A59 junction, Skipton to A59/A658 junction, east of Knaresborough.

Figure 3-5 – Diversion Routes between Skipton and Harrogate

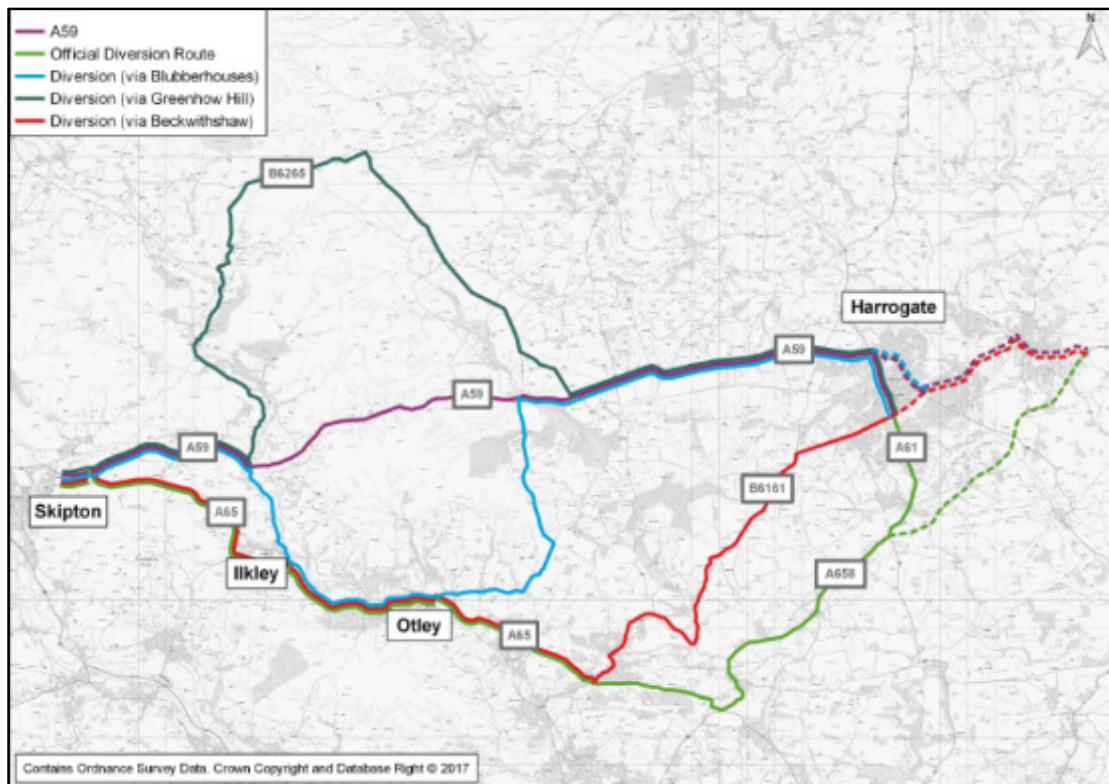


Table 3-2 summarises the results of the Trafficmaster analysis for Skipton to Harrogate journey, demonstrating that all of the diversion routes involved users travelling a significantly longer distance. Whilst a journey on the A59 route is approximately 34km, a similar journey using the official diversion routes is approximately 43km, some 9km longer. Other diversion routes result in a journey which is approximately 7-17km longer.

Clearly, such an increase in distance for local and strategic trips will have a profound impact on journey times. Table 3-2 highlights that, in the AM Peak, average journey times on the A59 are approximately 35 minutes for eastbound trips and 34 mins for westbound trips. However, when the A59 is closed, users of the official diversion

routes experience average journey times of approximately 69 and 56 minutes for eastbound and westbound journeys respectively, some 34 and 23 minutes longer than comparable journeys using the A59. Users of some of the other, unofficial, diversion routes would see average journey times of 60-63 minutes for eastbound journeys and 51-56 minutes for westbound journeys, again, significantly longer than a corresponding trip using the A59. In terms of average speeds, users of the official diversion route are subject to drop in average speed of 20kph for eastbound journeys and 14kph for westbound journeys.

A similar picture is evident in the PM Peak. Table 3-2 highlights that average journey times on the A59 are 32 minutes for eastbound and westbound trips. However, when the A59 is closed, users of the official diversion routes experience average journey times of 58 and 62 minutes for eastbound and westbound journeys respectively, some 26 and 30 minutes longer than a comparable journey using the A59. Users of some of the other, unofficial, diversion routes would see average journey times of 55-59 minutes for eastbound journeys and 55-58 minutes for westbound journeys, again, significantly longer than a corresponding trip using the A59. In terms of average speeds, users of the official diversion route are subject to drop in average speed of 19kph for eastbound journeys and 21kph for westbound journeys.

In terms of the impact of an A59 closure on existing users of the routes which make up the official diversion route (A65, A660 and A658), Table 3-2 demonstrates that there is a significant impact. In the AM Peak, users experience an increase in average journey time of 18 minutes eastbound and 7 minutes westbound. In the PM, the increase in average journey time is 10 minutes eastbound and 13 minutes westbound. With the exception of westbound movements on the Blubberhouses and Greenhow Hill diversions in the AM Peak, users of the other diversion routes also experience substantial increase in average journey times.



Table 3-2 – AM, Inter and PM Peak Journey Times and Average Speeds between Skipton and Harrogate (Local journey)

Route Option		A59		Official Diversion		Diversion via Blubberhouses		Diversion via Greenhow Hill		Diversion via Beckwithshaw		
Route Direction		EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	
Distance (km)		34.0		43.1		45.1		51.2		41.1		
AM Peak (08:00-09:00)	Average Journey Time (mins)	A59 Open	35.1	33.8	51.1	49.8	54.9	52.4	49.5	56.6	49.9	48.8
		A59 Closed	-	-	68.8	56.4	60.3	51.4	61.6	53.2	62.9	56.5
		Change	-	-	17.8	6.6	5.4	-1.0	12.1	-3.4	12.9	7.7
		A59 Comparison	-	-	33.7	22.5	25.2	17.5	25.5	19.4	27.7	22.6
	Average Speed (kph)	A59 Open	58.1	59.4	50.7	51.9	49.2	51.0	62.1	53.8	49.4	50.6
		A59 Closed	-	-	37.6	45.9	44.8	52.0	49.9	57.2	39.2	43.7
		Change	-	-	-13.1	-6.0	-4.4	1.0	-12.2	3.4	-10.2	-6.9
		A59 Comparison	-	-	-20.5	-13.5	-13.2	-7.4	-8.2	-2.2	-18.8	-15.7
PM Peak (17:00-18:00)	Average Journey Time (mins)	A59 Open	31.9	31.9	47.7	48.7	49.2	49.1	41.7	48.8	45.5	47.5
		A59 Closed	-	-	57.9	61.6	55.4	55.0	54.9	55.6	59.3	57.9
		Change	-	-	10.2	12.9	6.2	5.8	13.2	6.8	13.8	10.4
		A59 Comparison	-	-	26.1	29.7	23.5	23.1	23.0	23.8	27.5	26.0
	Average Speed (kph)	A59 Open	64.0	63.1	54.2	53.1	54.9	54.4	73.7	62.4	54.2	52.0
		A59 Closed	-	-	44.6	42.0	48.8	48.6	56.0	54.8	41.6	42.7
		Change	-	-	-9.6	-11.1	-6.1	-5.8	-17.7	-7.7	-12.6	-9.4
		A59 Comparison	-	-	-19.4	-21.1	-15.2	-14.5	-8.0	-8.3	-22.4	-20.4

EB = Eastbound; WB = Westbound



Table 3-3 summarises the results for journeys between Skipton and east of Harrogate, replicating a strategic journey along the A59. The table demonstrates that a strategic journey via one of the diversion routes, would be 8-17km further compared to a journey using the A59. Again, this has a substantial impact on journey times. Table 3-3 highlights that, in the AM Peak, average journey times on the A59 are approximately 50 minutes for eastbound and westbound trips. However, when the A59 is closed, users of the official diversion routes experience average journey times of approximately 68 and 60 minutes for eastbound and westbound journeys respectively, some 18 and 11 minutes longer than comparable journeys using the A59. Users of some of the other, unofficial, diversion routes would see average journey times of 79-83 minutes for eastbound journeys and 72-80 minutes for westbound journeys, again, significantly longer than a corresponding trip using the A59. In terms of average speeds, users of the official diversion route are subject to drop in average speed of 6kph for eastbound journeys and 1kph for westbound journeys.

A similar picture is evident in the PM Peak. Table 3-3 highlights that average journey times on the A59 are 46 minutes for eastbound trips and 45 minutes for westbound trips. However, when the A59 is closed, users of the official diversion routes experience average journey times of 59 and 62 minutes for eastbound and westbound journeys respectively, some 11 and 12 minutes longer than a comparable journey using the A59. Users of some of the other, unofficial, diversion routes would see average journey times of 69-78 minutes for eastbound journeys and 70-76 minutes for westbound journeys, again, significantly longer than a corresponding trip using the A59. In terms of average speeds, users of the official diversion route are subject to drop in average speed of 4kph for eastbound journeys and 5kph for westbound journeys.

In terms of the impact of an A59 closure on existing users of the routes which make up the official diversion route (A65, A660 and A658), Table 3-3 demonstrates that there is a significant impact. In the AM Peak, users experience an increase in average journey time of 16 minutes eastbound and 9 minutes westbound. In the PM, the increase in average journey time is 11 minutes eastbound and 12 minutes westbound. Users of the other diversion routes also experience a substantial increase in average journey times.

Table 3-3 – AM, Inter and PM Peak Journey Times and Average Speeds between Skipton and east of Knaresborough (Strategic journey)

Route Option		A59		Official Diversion		Diversion via Blubberhouses		Diversion via Greenhow Hill		Diversion via Beckwithshaw		
Route Direction		EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	
Distance (km)		40.6		48.6		51.6		57.8		49.4		
AM Peak (08:00-09:00)	Average Journey Time (mins)	A59 Open	49.8	49.8	52.0	51.7	69.5	68.3	64.1	72.6	68.7	67.3
		A59 Closed	-	-	68.2	60.4	78.6	72.0	79.8	73.9	82.7	79.7
		Change	-	-	16.2	8.7	9.0	3.7	15.7	1.3	14.0	12.4
		A59 Comparison	-	-	18.4	10.6	28.8	22.2	30.1	24.1	32.9	29.9
	Average Speed (kph)	A59 Open	48.9	48.9	56.1	56.3	44.5	45.3	54.1	47.8	43.2	44.1
		A59 Closed	-	-	42.7	48.2	39.4	43.0	43.4	47.0	35.9	37.2
		Change	-	-	-13.3	-8.1	-5.1	-2.3	-10.6	-0.8	-7.3	-6.9
		A59 Comparison	-	-	-6.2	-0.7	-9.5	-5.9	-5.5	-1.9	-13.0	-11.7
PM Peak (17:00-18:00)	Average Journey Time (mins)	A59 Open	45.7	46.5	48.4	49.2	63.0	63.7	55.5	63.4	63.9	64.3
		A59 Closed	-	-	59.2	61.6	69.1	70.3	68.6	71.0	78.3	75.7
		Change	-	-	10.8	12.3	6.1	6.6	13.0	7.6	14.4	11.4
		A59 Comparison	-	-	13.6	15.1	23.4	23.8	22.9	24.5	32.7	29.2
	Average Speed (kph)	A59 Open	53.3	52.4	60.2	59.1	49.1	48.6	62.4	54.8	46.4	46.2
		A59 Closed	-	-	49.2	47.3	44.8	44.1	50.6	48.9	37.9	39.2
		Change	-	-	-11.0	-11.8	-4.3	-4.5	-11.9	-5.9	-8.6	-7.0
		A59 Comparison	-	-	-4.1	-5.2	-8.4	-8.4	-2.7	-3.5	-15.4	-13.2

EB = Eastbound; WB = Westbound

### 3.3.4 *Severance Impacts*

The road closures resulting from landslips can impact people's lives in a number of ways. The closure of the A59 creates a physical issue of severance with poor connectivity resulting between the areas to the east and west of the closure. This impacts on people traveling east-west along this route, as the diversion route involves a significant increase in journey distance, meaning journey time, costs and reliability are all adversely affected. The increased traffic volumes passing through the various towns and villages along the diversion route also presents problems and can exacerbate issues of severance in these communities. Figure 3-4 illustrates that traffic flow can increase by over 20% when a road closure is in place, highlighting that significant increased flows are evident. The increased flows can create a 'barrier' effect and can essentially divide communities through perceived difficulties in crossing the 'barrier', which in this case is a heavily trafficked road, which can impact all users in particular pedestrians and cyclists. This severance impact can change the journeys of people going to work, to shop, to school, to local amenities and for leisure uses.

The increased traffic, particularly HGV's, through the communities along the alternative routes will also exacerbate issues of adverse noise and air quality impacts. This will be detrimental to the people working and living in these communities as well as deterring visitors and business. Furthermore the increased traffic flows, particularly during peak periods could represent a safety issue with increased risk of conflict between vulnerable road users and vehicles.

## 3.4 **A59 Constraints Outside Periods of Closure**

The previous section has outlined the impacts and issues associated with closures of the A59 resulting from landslips. However, even when the route is fully open, there are a number of existing issues effecting the section of the A59 through Kex Gill that impact on users. These are primarily associated with:

- **Journey time reliability.**
- **Accidents.**

### 3.4.1 *Journey Time Reliability*

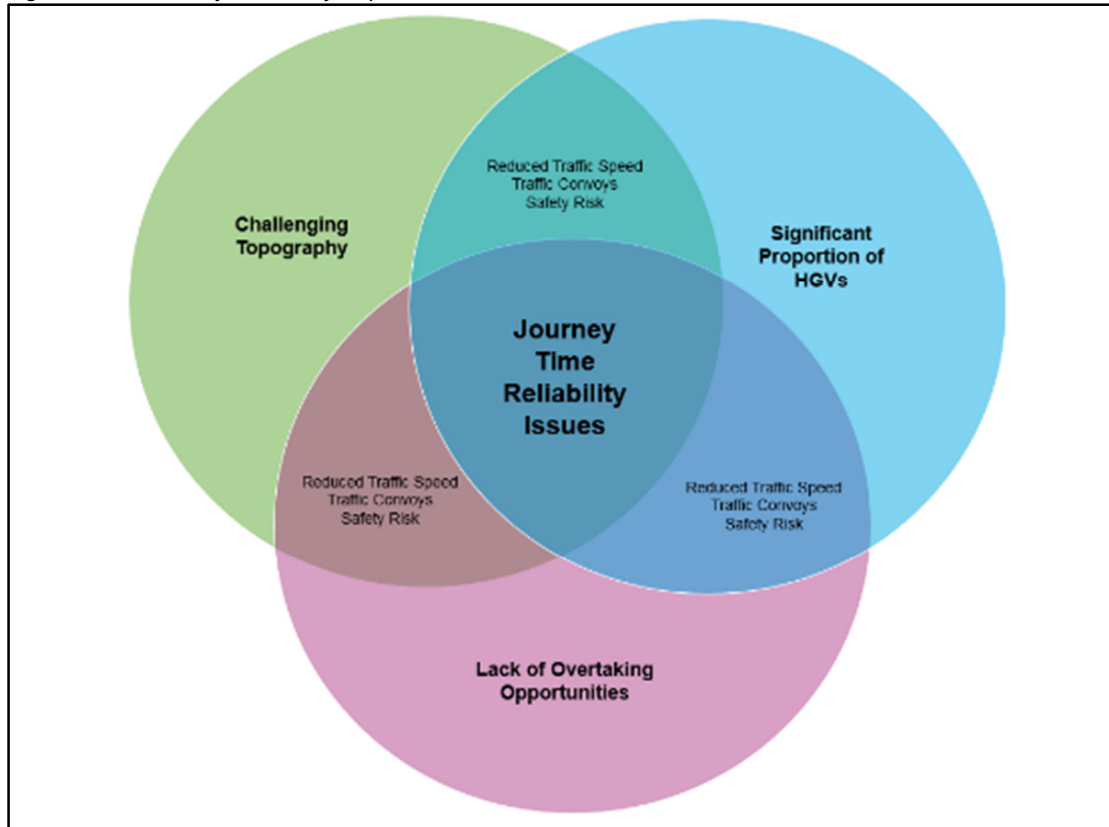
Journey time reliability is a key issue affecting the A59 at Kex Gill when the route is open and can be explained by three key issues:

- **Topography of route** – the topography at Kex Gill is particularly undulating which results in a challenging horizontal and vertical alignment for users. This in turn impacts on vehicle speeds across the route, particularly for HGVs.
- **Significant proportion of HGVs** – the A59 carries a relatively high number of HGVs and this coupled with the undulating terrain can result in convoys of slow moving traffic regularly forming behind HGVs or other slow moving vehicles.

- **Lack of overtaking opportunities** – the challenging horizontal and vertical alignment of the route combined with a lack of formal overtaking opportunities (i.e. dual carriageway or climbing lanes) exacerbates issues of poor journey time reliability. It can also create a safety related issue (see Section 3.4.2).

Figure 3-6 summarises the above issues in the form of a Venn diagram.

Figure 3-6 – Journey Reliability Impacts



Analysis of Trafficmaster journey time data for the A59 route between Skipton and Harrogate indicates that there are notable journey time differences between cars and HGVs. During the inter-peak period, for eastbound journeys, average journey times for HGVs are approximately 3 minutes longer than those of cars. Similarly, for westbound journeys, the difference is approximately 2 minutes. This is equivalent to a 4-7kph difference in average speed over this section of the route. This gives some indication of the possible impact on vehicles which find themselves in a convoy of slower moving vehicles behind a HGV.

### 3.4.2 A59 Accident History

#### **A59 between Harrogate and Skipton**

A desktop based analysis of Personal Injury Accident (PIA) collisions data has been undertaken, in order to determine whether there are any particular sections of the route with potential road safety issues. The analysis also seeks to determine whether there are any specific causes or re-occurring factors associated with the collisions.

The desktop based research has analysed collisions for the latest available five year period; 2011- 2015<sup>13</sup>. Table 3-4 summarises the accidents that have occurred along the A59, between its junction with the A61 at Harrogate and the A59/A65 junction near Skipton, over this 5 year period, split by severity. In addition, Figure 3-7 provides an illustration of the same data.

Table 3-4 – Summary of Accident Severity

		Year					Total
		2011	2012	2013	2014	2015	
Severity	Fatal	1	1	1	1	0	4
	Serious	4	3	5	6	4	22
	Slight	16	23	25	19	20	103
<b>Total</b>		<b>21</b>	<b>27</b>	<b>31</b>	<b>26</b>	<b>24</b>	<b>129</b>
<b>KSI severity rate</b>		<b>0.238</b>	<b>0.148</b>	<b>0.194</b>	<b>0.269</b>	<b>0.167</b>	<b>0.202</b>

Figure 3-7 – Location of Collisions (2011-2015) on A59 between Skipton and Harrogate

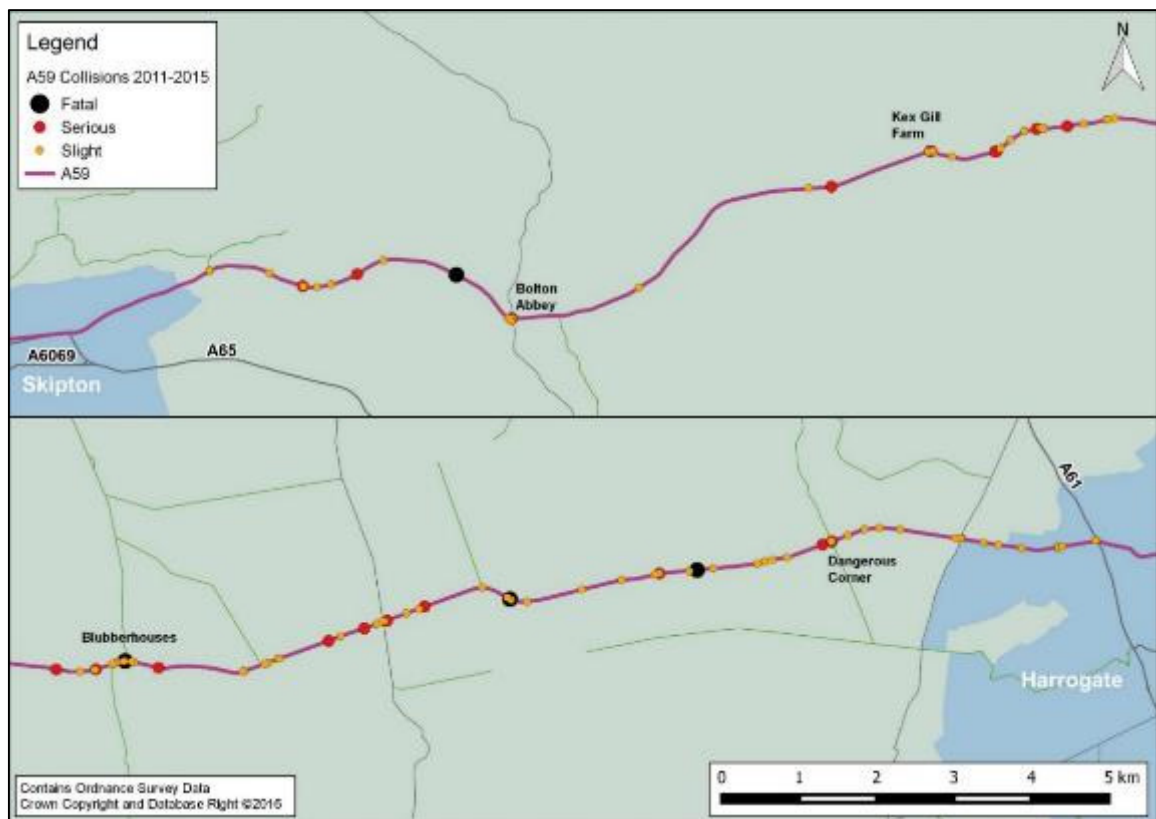


Table 3-4 demonstrates that there has been a total of 129 accidents on this stretch

<sup>13</sup> Whilst data for the first 6 months of 2016 was provided, the analysis has focused on full years' worth of collisions data only.

of the A59, 103 of which were categorised as 'slight'<sup>14</sup>, 22 as 'serious'<sup>15</sup> and 4 as 'fatal'. The KSI<sup>16</sup> rate (the ratio of fatal or serious injury accidents/all accidents) for this stretch of the A59 was 0.202, marginally higher than the national average KSI rate for a rural A-Road (0.196<sup>17</sup>).

Whilst, it is clear that there are a number of accidents along the A59 route, the focus of this study is the Kex Gill area. NYCC are investigating safety across the A59 corridor as part of a separate ongoing study. The following analysis, focuses on the accidents that have occurred in the Kex Gill study area.

### **A59 at Kex Gill**

An accident rate analysis has been undertaken, in order to allow comparison of the accident rates on the A59 with national averages for similar road types. Accident rates are calculated based on the number of accidents per billion vehicle miles. The accident rate analysis requires the A59 study area to be split into a series of separate links, where there is a change in the characteristics of the route. Characteristics considered included:

- Speed limit.
- Urban/rural setting.
- Straight/winding stretch of road.
- Changes in topography (e.g. undulating or flat).
- Open/enclosed (e.g. open moorland or enclosed by woodland).

Figure 3-8 illustrates the four different links identified for the Kex Gill study area section of the A59.

*Figure 3-8 – Accident Rate Analysis Links*

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<sup>14</sup> *Slight accident: One in which at least one person is slightly injured (an injury of a minor character such as a sprain (including neck whiplash), bruise or cut which are not judged severe, or slight shock requiring roadside attention, Includes injuries not requiring medical treatment) but no person is killed or seriously injured.*

<sup>15</sup> *Serious accident: One in which at least one person is seriously injured (An injury for which a person is detained in hospital, or any of the following injuries whether or not they are detained in hospital: fractures, concussion, internal injuries, crushing's, burns, severe cuts, severe general shock requiring medical treatment and injuries causing death 30 or more days after the accident.) but no person (other than a confirmed suicide) is killed.*

<sup>16</sup> *Killed or Seriously Injured*

<sup>17</sup> *Department for Transport Statistics Table RAS10002 "Reported accidents and accident rates by road class and severity, Great Britain, 2010-14 average, 2008 – 2015"*

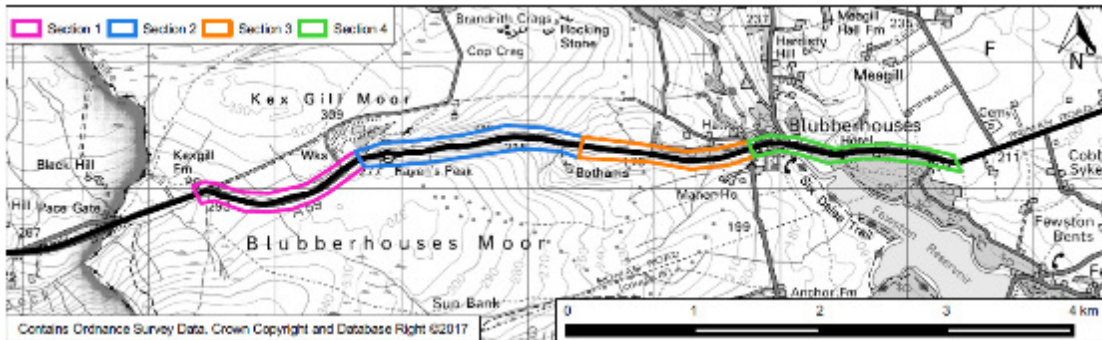


Table 3-5 summarises the accident rates calculated for each separate link illustrated in Figure 3-8. As it can be seen, all four of the links have accident rates higher than the relevant national average rate. Of particular note is that links 1, 2, and 4 all have an accident rate of more than double the national average, potentially highlighting a specific road safety concern on those sections of the A59.

Table 3-5 – Accident Rate Comparison – All Injury

Link	Description	Slight	Serious	Fatal	Accident Rate (per 1 billion vehicle miles)	National Average Accident Rate <sup>18,19</sup>	Difference from National Average (%)
1	A59 (Summerscales/ Kex Gill Farm to New Moor Rd)	6	5	0	627.8	280	224%
2	A59 (New Moor Rd to Bothams Farm)	10	2	0	579.5	280	207%
3	A59 (Bothams Farm to Blubberhouses)	3	2	0	313.9	280	112%
4	A59 (Blubberhouses to near Busky Dike Lane)	6	1	1	623.7	280	223%

An analysis of the causality associated with the accidents on the four links has also been undertaken. Figure 3-9 illustrates that 30% of accidents were weather related, for example vehicles skidding in wet/icy conditions. However, a large proportion of

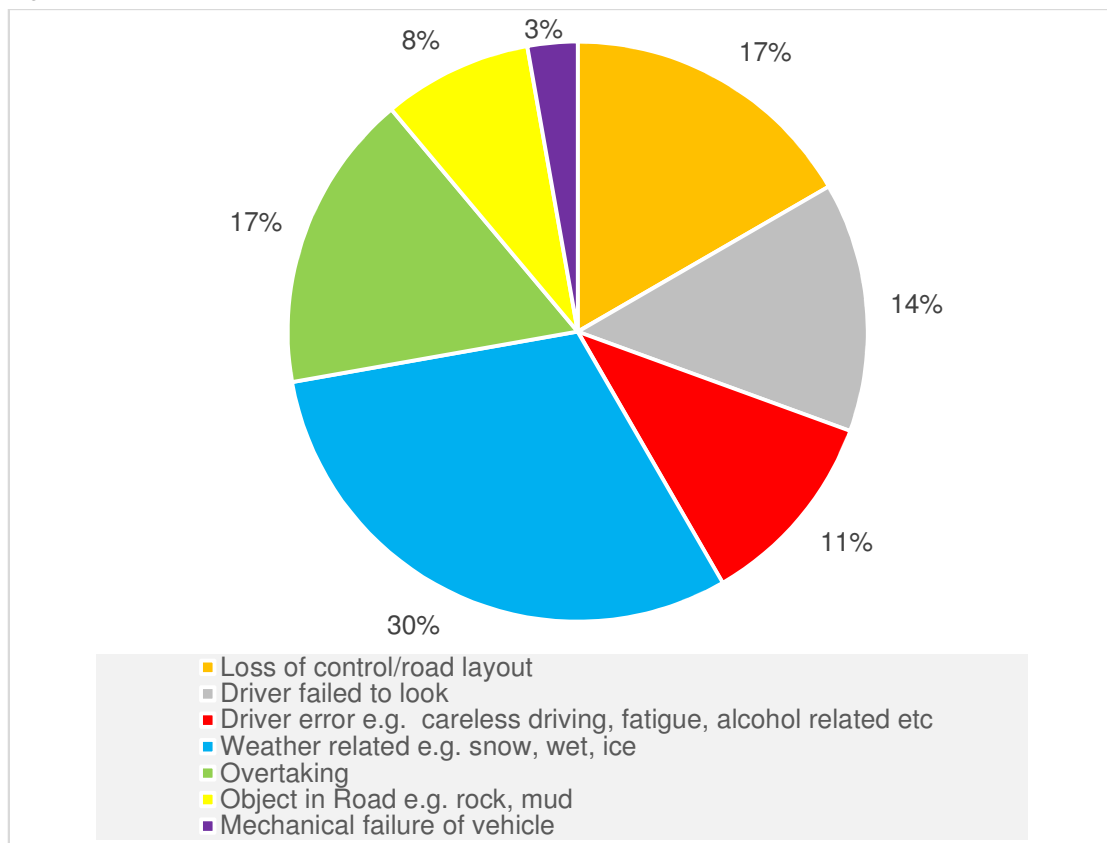
<sup>18</sup> Department for Transport Statistics Table RAS10002 “Reported accidents and accident rates by road class and severity, Great Britain, 2010-14 average, 2008 – 2015”

<sup>19</sup> Note that links 1-10 are compared against the rural A-Road national average and link 11 is compared against the urban A-Road national average

the accidents relate to issues associated with the road alignment and general location within the Kex Gill valley, including:

- 17% of accidents were due to loss of control/road layout; mainly attributed to the winding nature of the road.
- 17% of accidents were associated with overtaking, possibly resulting from drivers frustration of being caught behind slow moving vehicles and a lack of opportunities to overtake;
- 8% of accidents were associated with objects in the road (potentially associated with debris falling from the Kex Gill slopes).

Figure 3-9 – Road Traffic Accident Causation, A59 Kex Gill



An accident cluster analysis has also been undertaken in order to identify any specific locations of accident clusters and to attempt to identify if there is a prevailing cause associated with them. This analysis identified three accident cluster sites as illustrated in Figure 3-10 and Table 3-6. Further details are provided in Appendix 1.



Figure 3-10 – Accident Cluster Locations

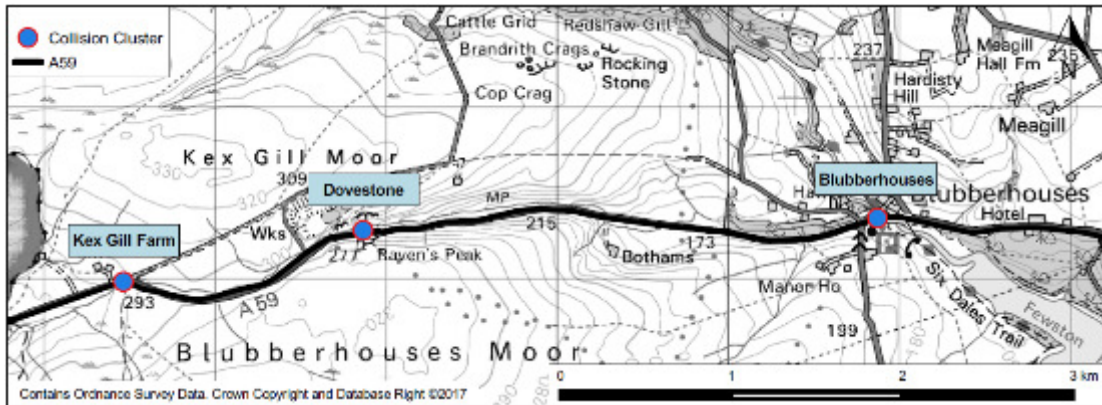


Table 3-6 – Accident Cluster Collisions and Fatal Accident Sites

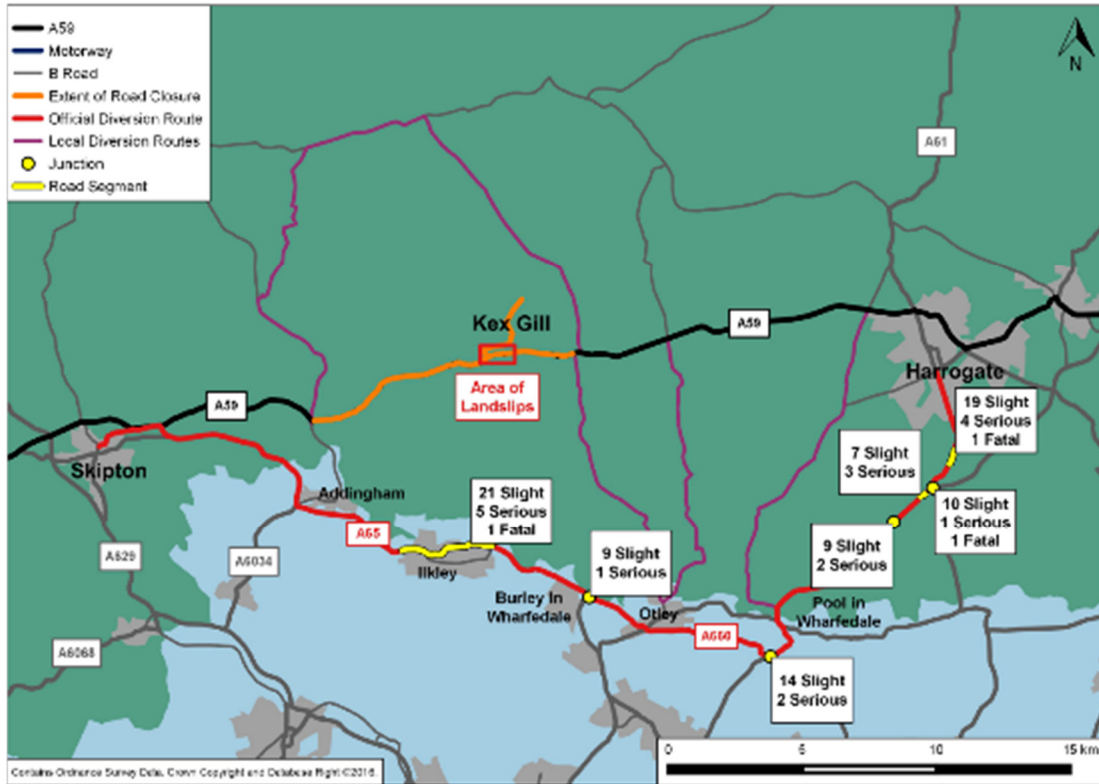
Cluster Site	Slight	Serious	Fatal	Total
Kex Gill Farm	3	3	0	6
Dovestone	3	1	0	4
Blubberhouses	6	0	1	7
<b>Total</b>	<b>12</b>	<b>4</b>	<b>1</b>	<b>17</b>

**Official Diversion Route Accident History**

A high level review of the accidents along the official diversion route has also been undertaken using collision data available on CrashMap<sup>20</sup>. This analysis has demonstrated that there are several locations along the route which have a significant number of accidents. Figure 3-11 illustrates sections with particularly poor accident records.

Figure 3-11 – Official Diversion Route Accidents

<sup>20</sup> Crashmap is an online tool making road casualty data publicly available



Adding further traffic volumes to these routes, when a road closure at Kex Gill is in place could exacerbate the already poor safety records at these locations. Therefore providing a scheme that removes the need for A59 closures and subsequent diversion of traffic onto the official diversion route is important.

### 3.5 Environmental Sensitivities

#### 3.5.1 Existing Environmental Sensitivities in Study Area

The Kex Gill area is within a particularly environmentally sensitive area. The following sections summarise the environmental sensitivities including:

- **Landscape Character.**
- **Visual Context.**
- **Biodiversity.**
- **Water Environment.**
- **Historic Environment.**
- **Air Quality.**
- **Noise.**

#### ***Landscape Character***

The A59 through Kex Gill goes through a rural and open landscape, designated as an AONB – Nidderdale AONB. The landscape of the area within the Nidderdale AONB is of very attractive quality and highly valued for its recreational resource, with numerous footpaths and bridleways, such as along the River Withan on the Five Dales Trail, over remote moorlands and through green picturesque river valleys on lower ground. This national designation covers a large area stretching from the high moorland of Great Whernside to the south with the edge of the Vale of York to the east. To the east of the study area, is the Yorkshire Dales, National Park, an area of great scenic beauty.

The study area lies within two of Natural England's National Character Areas (NCA): the western extents falls within NCA 21: Yorkshire Dales and the eastern extents falls within NCA 22: Pennine Dales Fringe. These character areas are characterised by large-scale upland landscapes of high, exposed moorland, with blanket bog and heath, dissected by dales which are often deep and have their own distinctive character. There are also remnants of semi-natural broadleaved woodland on valley sides and in gills, contrasting with large, rectangular blocks of conifers in some dales. The field boundaries are formed by drystone walls on higher ground and hedges in lower areas.

*Figure 3-12 – View west from bridleway along stone walled field boundaries*

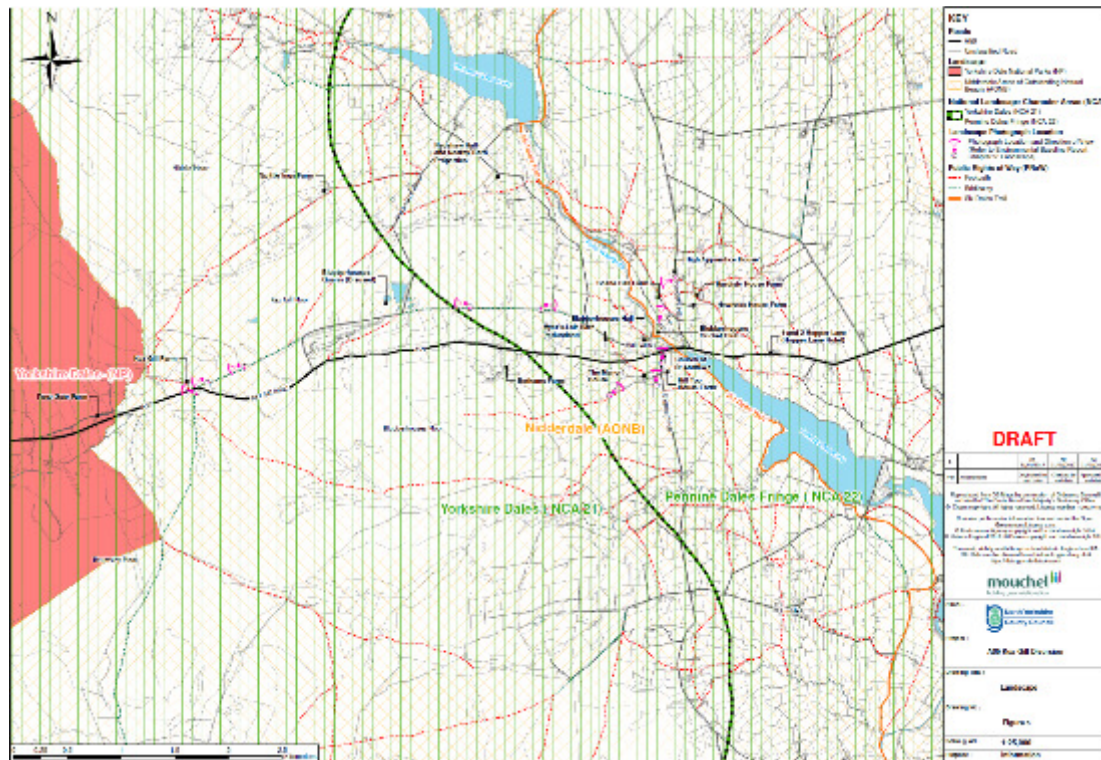


See Figure 3-13<sup>21</sup> for the extent of the Yorkshire Dale National Park, the National Landscape Character Area boundaries and network of footpaths, bridleways and trails around the scheme area.

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<sup>21</sup> See Appendix 2 for A3 sized high resolution version of the image.

Figure 3-13 – Landscape Character Areas



### Visual Context

The visual context of the study area and the existing A59 corridor is characterised by the gently rolling upland hills between Harrogate and Skipton, immediately east of the Yorkshire Dales National Park and lying within Nidderdale AONB. Blubberhouses Moor and Kex Gill Moor flank the A59 to the south and north respectively as the existing road travels through a local valley leading to Blubberhouses and Fewston reservoir. Views from the bridleway to the north of the A59 are broad and open and although the road can be heard, there is a degree of wildness and tranquillity, until re-connecting with the main road to the west or dropping down into the village of Blubberhouses to the east.

Figure 3-14 – View west from bridleway looking back towards Kex Gill Farm



### Biodiversity

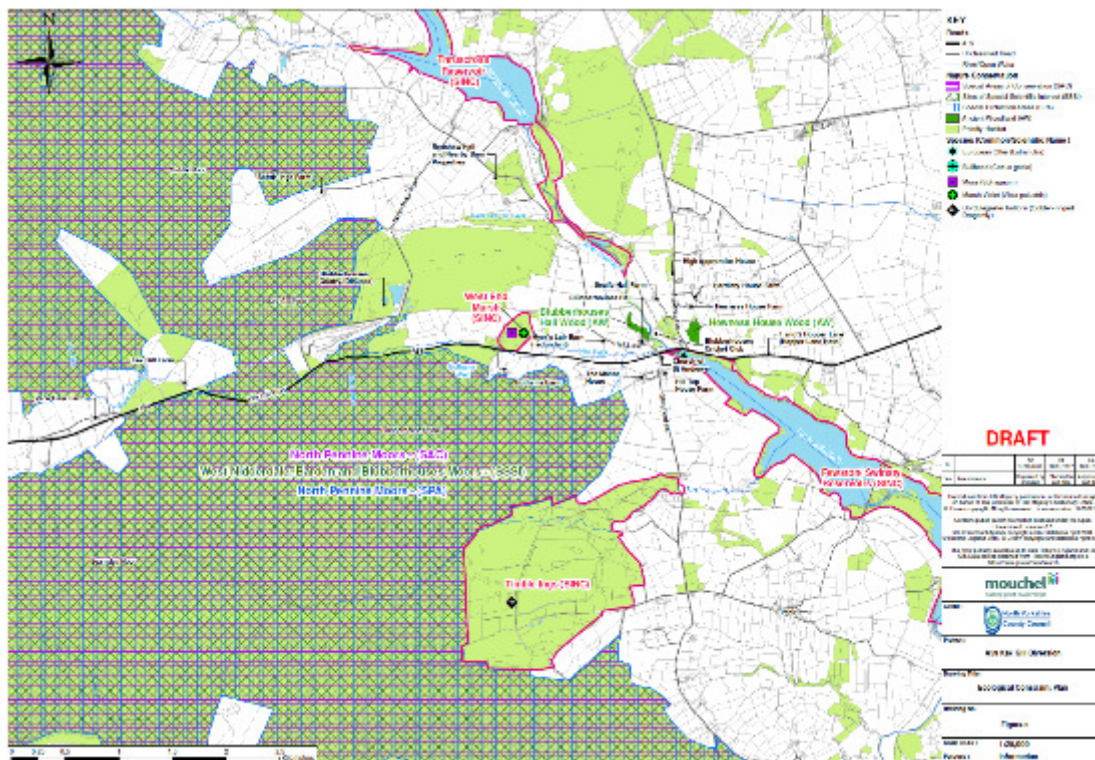
Land around the A59 at Kex Gill supports a number of protected habitats and species and is designated as a nature conservation site at an international, national



and local level. A significant amount of land to the south and north of the study area section of the A59 fall within North Pennine Moors SAC and SPA; both international nature conservation designations. The North Pennine Moors is designated a SAC because it contains much of the upland heathland of northern England and is the major area of blanket bog in England. It is also designated as a SPA because it encompasses extensive tracts of semi-natural moorland habitats with blanket bog and upland and supports populations of European species of importance listed on Annex I of the Birds Directive.

The area making up the SPA and SAC is also designated at a national level as a SSSI – West Nidderdale, Barden and Blubberhouses Moors. A number of Sites of Importance for Nature Conservation (SINCs) have also been designated by the Local Authority to the north and south of the A59. One of these SINCs, West End Marsh, is adjacent to the A59 and occupies land outside the SPA, SAC and SSSI designations. Two ancient woodlands, Blubberhouses Hall Wood and Hewness House Wood, are found at the eastern end of the study area; either side of the village of Blubberhouses. See Figure 3-15<sup>22</sup> for the location of the afore-mentioned nature conservation sites.

Figure 3-15 – Ecological Constraints Plan



The habitats within the study area may support protected and notable plant and animal species. Using aerial photographs and following a desk top study, habitats

<sup>22</sup> See Appendix 2 for A3 sized high resolution version of the image.

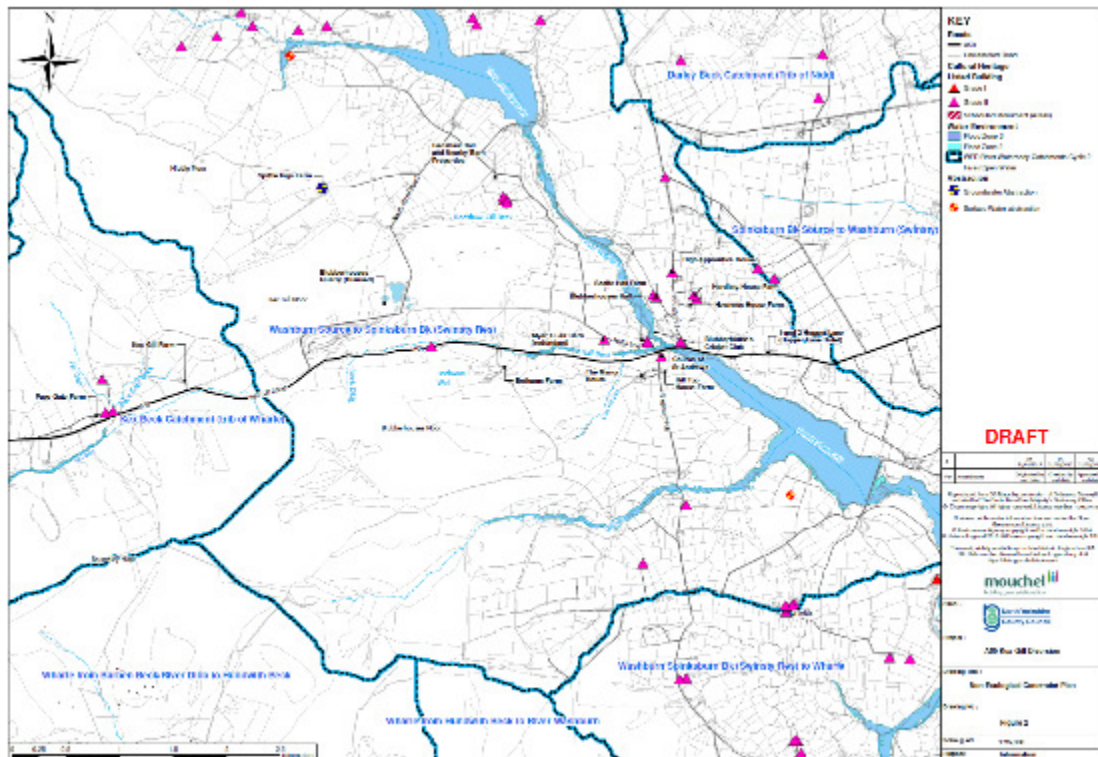
suitable to breeding birds, bats, badgers, reptiles and otters, water voles, fish and invertebrates can be found around the scheme length.

### **Water Environment**

The study section of the A59 crosses River Washburn at Blubberhouses. River Washburn feeds into the Fewston Reservoir. Kex Beck, a tributary of River Wharfe, flows from east to west crossing the existing A59 approximately 50m east of the junction with Kex Gill Road/North Moor Road. There are a number of drains and dikes that flow off the moorland, to the north and south; some of these have associated small bodies of standing water. The wet peaty surface of the moorland means that it is boggy in places and provides the source for these watercourses.

According to the Environment Agency's flood mapping, the majority of the study area is not at risk of flooding. However, some of the area around Blubberhouses, in the immediate vicinity of the River Washburn and Fewston Reservoir, lies within Flood Zone 3 meaning that the probability of flooding is high (1 in 100 or greater annual probability of river flooding). See Figure 3-16<sup>23</sup> for the location of these waterbodies and Flood Zone.

Figure 3-16 – Non-Ecological Constraints Plan



### **Historic Environment**

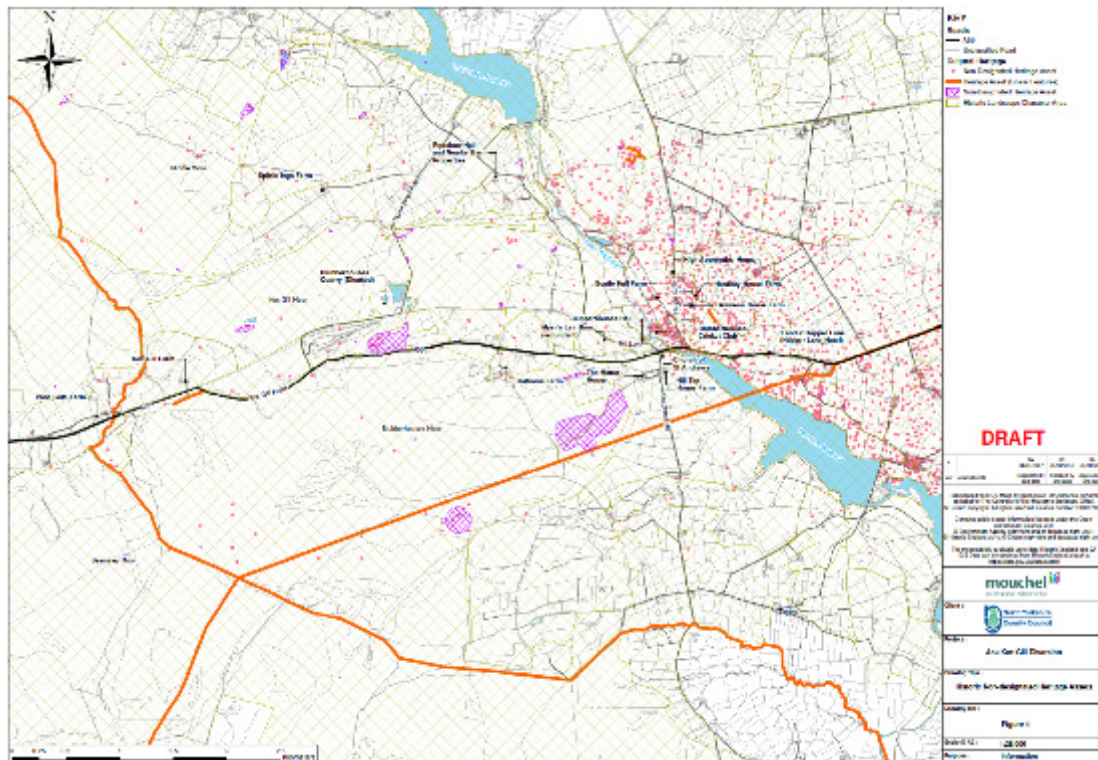
The historic environment of the study area is characterised by post medieval roads, enclosures, hamlets, farms and barns, fields, quarries, trackways and hollow ways,

<sup>23</sup> See Appendix 2 for A3 sized high resolution version of the image.



building platforms, wells and boundaries and boundary stones. There are a number of Listed Buildings within the study area, but these are primarily found close to the A59 at Blubberhouses. Other characteristic non-designated cultural heritage assets include 18th-19th century milestones and boundary stones, bridges, churches, mileposts, mills and a public house. See Figure 3-16 for the location of the Listed Buildings. The local Historic Environment Records (HER) contains finds of numerous antenna arrays within the study area, and one aircraft crash site. There are also several find spots of prehistoric axes, flint scatters and roman or medieval coins. There is a concentration of HER sites to the east of the study area consisting largely of fields, quarries, track ways and find spots. This is most likely indicative of a concentration of research in this area and a high potential of unknown archaeological assets across the intervention area. See Figure 3-17<sup>24</sup> for the location of Historic Non-Designated Heritage Assets around the study area.

Figure 3-17 – Non Designated Heritage Assets



### **Air Quality**

Harrogate Borough Council (HBC) does not have any NO<sub>2</sub> monitoring sites within 2km of the scheme area. A review of Defra's background pollutant concentrations mapping for transport related pollutants of concern (NO<sub>2</sub> and PM<sub>10</sub>) within the study area between 2015 and 2017 revealed that these were all well under the European Union (EU) set limit of 40µg/m<sup>3</sup>.

<sup>24</sup> See Appendix 2 for A3 sized high resolution version of the image.



Air Quality Management Areas (AQMAs) are mainly declared for areas where the EU limits and Government standards adopted for NO<sub>2</sub> and PM<sub>10</sub> are not being achieved or are unlikely to be achieved. The A59 at Kex Gill is not situated in an AQMA and there are none within 2km of the study area. In the absence of any evidence to suggest otherwise, and given the open and rural area of the location, the existing baseline conditions are assumed to be good quality.

### **Noise**

Defra Noise Important Areas (NIA) are locations where the 1% of the population are affected by the highest noise levels from major roads according to the results of Defra's strategic noise maps. There are no NIAs within 1km of the scheme area. The study area is sparsely populated area with limited number of high value sensitive receptors, including residential dwellings and Listed Buildings, particularly towards the eastern and western extent of the area. There are a few scattered farm houses along the route of the existing A59 and these are set back from the road.

### **Environmental Sensitivities – Summary**

**Landscape Character** – The A59 passes through the Nidderdale AONB and the wider study area also lies within two of Natural England’s NCAs.

**Visual Context** – the area is characterised by gently rolling hills with broad and open views to the north of the A59 from the bridleway.

**Biodiversity** – there are a number of protected habitats and species in the vicinity of the A59. This includes the North Pennine Moors SAC and SPA. This is also nationally designated as a SSSI and SIN.

**Water Environment** – the majority of the study area is not in a flood risk area. However, some of the options cross an area designated as Flood Zone 3 at the River Washburn and Kex Beck.

**Historic Environment** - There are a number of Listed Buildings within the study area, primarily near to the A59 at Blubberhouses as well as non-designated cultural heritage assets including 18th-19th century milestones and boundary stones, bridges, churches, mileposts, mills and a public house .

**Air Quality** - The A59 at Kex Gill is not situated in an AQMA and there are none within 2km of the study area. The existing baseline conditions are assumed to be good quality.

**Noise** - There are no NIAs within 1km of the scheme area. The study area is sparsely populated area with limited number of high value sensitive receptors,

### **3.6 Support for Intervention**

A review of the existing key transport, economic and planning policies and strategies for the study area has been undertaken. Many of these documents support the case for intervention, outlining the problems that affect the A59 at Kex Gill and demonstrating the need for a scheme to address the issues. Kex Gill is situated within an area administered by a two-tiered structure of local government; falling within the administrative boundaries of HBC and NYCC. These authorities are the main stakeholders relating to improvements at Kex Gill, with NYCC being the principal stakeholder as Highway Authority for this stretch of the A59. At a more

strategic level, North Yorkshire falls within the YNYER LEP area, as such proposals will need to accord with the LEP's strategic goals. Neighbouring authorities' aims and objectives will also need to be considered in the context of a road improvement on the A59 at Kex Gill. The A59 connects westwards from Kex Gill towards Skipton, which falls within Craven District Council's (CDC) administrative area. The official diversion route, used when the A59 is closed, passes through the administrative areas of Leeds City Council (LCC) and City of Bradford Metropolitan District Council (DBMDC), so impacts within the boundaries of those authorities also need to be considered. The following documents have been reviewed:

- North Yorkshire Local Transport Plan 4 (2015).
- A Strategic Transport Prospectus for North Yorkshire (2015).
- West Yorkshire Local Transport Plan 2011 – 2026 (2015).
- Transport for the North - The Northern Transport Strategy: One Agenda. One Economy. One North.
- York, North Yorkshire & East Riding Local Enterprise Partnership - Strategic Economic Plan.
- York, North Yorkshire & East Riding Local Enterprise Partnership - Local Growth Deal 3.
- Harrogate Borough Council Corporate Plan 2014-2017 (April 2016).
- Harrogate Borough Council – Local Plan.
- Harrogate Borough Council – Core Strategy.
- Nidderdale Area of Outstanding Natural Beauty Management Plan 2014-2019.
- Craven District Council 'Council Plan 2016 -2019.
- Craven District Council Local Plan (adopted July 1999).
- Leeds City Council – Core Strategy.
- City of Bradford Metropolitan District Council - Unitary Development Plan.

A number of key themes come out of the policy documents referred to above, including:

- **Economic Growth** – Contributing to economic growth by delivering reliable and efficient transport networks and services, facilitating provision of housing and employment opportunities.

- **Quality of life/road safety** – Improving road and transport safety and the quality of life of communities.
- **Accessibility** – Improving equality of opportunity by facilitating access to services for all.

### 3.6.1 *Economic Growth*

It is recognised that transport is essential to the health of the economy across all of the relevant policy documents reviewed. In accordance with this, NYCC needs to make sure that its transport network and services are as reliable and efficient as possible to support the existing economy as well as helping facilitate future economic growth. This is emphasised in NYCC's LTP4 which highlights that "the highway is the main network for travel in North Yorkshire and since it affects everyone, maintaining the highway network is the County Council's highest transport priority". As such improvements to underperforming sections of road in the county is essential to aid movement of people and goods in the region. Improvement of the A59 at Kex Gill will facilitate this.

Addressing the impacts of peripherality are also identified within the LTP as being important for economic growth in the region. North Yorkshire is part of the Northern Powerhouse and sits adjacent to two City Regions (Tees Valley City Region and Leeds City Region). Improving road and rail connections into these City Regions remains an important element of LTP4 to encourage economic growth in 'The North'. Furthermore there are a number of areas in North Yorkshire with underperforming economies, because of their distance from the central transport corridor. Due to the distances involved (e.g. Skipton being 50km from the A1(M)) major improvements in journey times to these areas are difficult to achieve. The road and rail networks to the peripheral areas are also often of a poor standard which has a major impact on journey time reliability; this impacts on the wider economy of the area. Improvements of the A59 at Kex Gill will help address this issue of peripherality through provision of a more resilient route providing a viable route for connection in the area, in particular east-west connectivity, forming part of a greater strategic route.

The strategies and policy plans for this area of North Yorkshire also outline aspirations for economic growth through the provision of new homes, businesses and employment opportunities. The creation of over 3,000 jobs and 500 new homes in the wider area around Kex Gill (in Skipton, Harrogate, Northallerton and Pickering) forms part of the Growth Deal proposals set out in the YNYER LEP's SEP. This growth will increase demand for travel along the A59 exacerbating the issues currently being experienced; provision of a more resilient route will better cater for this planned growth.

The YNYER LEP also cites constraints to the economic performance in the region being as a result of poor connectivity. Journey time reliability on east-west routes is highlighted as a particular issue and is often raised by businesses as a problem in terms of the predictability of deliveries and staff punctuality. One of the LEP's main priorities is for a well-connected economy. Improving road connectivity along the

A59, in the form of a road realignment, is specifically highlighted as a key project for the LEP area. The strategic importance of east-west connectivity for economic growth in the north is also echoed in TfNs Northern Transport Strategy which sets out an aim of transforming economic growth in the North. Through provision of a more resilient road route along the A59 through Kex Gill will help achieve these aims.

Improving the resilience of the A59 route through Kex Gill will also be beneficial to neighbouring authorities in West Yorkshire, as it will minimise the rerouting of traffic through the area during times of road closure. The West Yorkshire LTP 2011 – 2026 sets out a vision for West Yorkshire’s transport system “to connect people and places in ways that support the economy, the environment and quality of life and enhancing the quality of life of people living in, working in and visiting West Yorkshire”. It is recognised that one of the biggest challenges in the area is potential future road traffic growth related to housing and economic growth and the dominance of the car as the main mode of travel. Reducing the need for traffic from the A59 rerouting onto West Yorkshires roads will help improve accessibility and economic growth in that region. The CBMDC and LCC’s planning policy documents also highlight that there is a need to reduce the impact of travel by managing growth of traffic and minimising its impact on communities and the environment. Provision of a more resilient route on the A59 can indirectly help reduce congestion on roads within the Bradford and Leeds areas by reducing rerouting traffic when the A59 is closed.

#### **Support for Intervention – Economic Growth**

It is recognised that good transport links are vital for economic growth and vitality across a wide range of policy documentation. As such the provision of a resilient and reliable A59 will help achieve the policy objectives for economic growth in this region by improving connectivity, accessibility and help facilitate additional demands on the highway network.

#### **3.6.2 Quality of Life/Road Safety**

Improvements to quality of life and road safety are key objectives throughout the policy documents relevant to the Kex Gill area. In particular NYCC’s LTP4 and West Yorkshire’s LTP highlight that there is a higher than average road casualty rate in the region. Any new road option will seek to address the issue of accidents along its route through the provision of a smoother alignment in terms of gradient and horizontal alignment.

NYCC states that it is committed to providing efficient and sympathetic highway management, maintenance and improvement works within its environmentally sensitive areas. It also seeks to reduce some of the negative effects of transport, such as air pollution. The HBC Local Plan reiterates these aspirations by seeking “to



encourage the development of a safe and efficient transport system which minimises environmental harm and serves existing and future development”. Objectives include taking measures to reduce congestion, promotion of a safe and attractive traffic environment, and promotion of transportation that will lead to improvements in air quality due to a reduction in traffic emissions. Improvements to the A59 at Kex Gill can assist the flow of traffic and reduce re-routing of traffic through neighbouring towns and villages when road closures are in place, thereby reducing adverse impacts that result. Smoother road alignments, vertically and horizontally, will support more reliable travel speeds and times helping reduce accidents resulting from winding, undulating routes and lack of overtaking opportunities.

The high quality environment in this area of North Yorkshire is identified within policy and strategies covering the area. HBC’s Core Strategy notes that the Nidderdale AONB is internationally and nationally recognised for its geological and ornithological interest. As such policies are in place to protect the integrity of internationally important biodiversity sites. In particular HBC’s Core Strategy Policies EQ1 “Reducing Risks to the Environment” and EQ2 “The Natural and Built Environment and Green Belt” highlight the importance of the area, environmentally, and how the landscape should be protected. This is further emphasised in the Nidderdale AONB Management Plan which seeks to maintain and enhance the special qualities of the AONB’s landscape including priority wildlife habitats and restore damaged or degraded feature. Provision of a new road through this area will undoubtedly impact on the AONB, however the design of the road will aim to limit the impacts as much as possible and it is envisaged the existing road alignment will be ‘greened’ to reincorporate it back into the natural landscape, where possible.

#### **Support for Intervention –Quality of Life/Road Safety**

Improvements to the quality of life and overall road traffic safety is recognised as being important in local policy strategy documents. Improvements to the A59 at Kex Gill can assist the flow of traffic and reduce the adverse impacts of re-routing of traffic through neighbouring towns and villages when road closures are in place. A smoother alignment can also reduce the accident risks along the route.

#### **3.6.3 Accessibility/Connectivity**

A well-connected economy and improved road connectivity along the A59 have previously been highlighted as aspirations for the area. Improved east-west connectivity is an aspiration of TfN who are developing a MRN, which will identify the most important local highway authority roads that are considered to perform a 'strategic' role. This will allow for better targeting of investment and improvements to achieve greater connectivity in the region and support economic growth across local authority boundaries. NYCC has also identified a number of priority east–west routes for potential improvement in the LTP4, including the A59 route, to enhance connectivity between the A1(M), Skipton and onwards to East Lancashire. The A59

at Kex Gill forms part of this route and improvement of that specific stretch of the A59, in order to address the issues of landslip related road closures, is referenced in a number of NYCC's strategy/policy documents. A new road alignment to avoid the areas at risk of landslips is the suggested intervention required to improve the situation.

NYCC's Strategic Transport Prospectus highlights issues of connectivity, in particular it notes that the Craven district has been disadvantaged for many years by poor transport links and action is needed urgently to address the variable journey times on the A59. The proposed scheme identified to address this is provision of three additional climbing lanes between Harrogate and Skipton including a major re-alignment at Kex Gill in order to address the major landslip risk. The provision of a road diversion scheme is therefore recognised as being an important piece of infrastructure within the area to enhance accessibility and connectivity.

The improvement proposed at Kex Gill is not a standalone piece of infrastructure enhancement, it forms part of wider plans for improved east-west connectivity across the county. Improvement at Kex Gill is seen as being an important element to build resilience into the highway network in the region; this is identified in NYCC's LTP4 and Strategic Transport Prospectus as well as the LEP's SEP. The LEP also has aims for a transformational change to east-west transport links across its area, this will involve significant improvements to road, including the A59, and rail networks over the next 20 years.

At a more local level HBC notes that transport connectivity and traffic congestion are a longstanding issue in the district. One of its priorities, directly relevant to proposed improvements at Kex Gill, is for the area to have a strong local economy with excellent travel and transport connectivity. HBC also identifies that improving accessibility is an important factor to be addressed in order to achieve the Core Strategy Plan's vision of sustainable living, prosperity and access for all. This is echoed in CDC's Local Plan which highlights an objective of provision and maintenance of a safe and efficient transport network to achieve social, economic and environmental wellbeing. It is considered this can be achieved by protecting routes, as required, for new roads and road improvements where construction would lead to significant environmental benefits and would assist the free flow of traffic. A road diversion at Kex Gill would be in accordance with this aspiration as it will reduce the need for road closures maintaining access at all times.

An intervention on the A59 at Kex Gill is not specifically trying to address any congestion issues between Harrogate and Skipton. However, the frequent road closures involve diversions along more congested routes in West Yorkshire. The West Yorkshire LTP identifies that the road network, particularly in Leeds, is currently operating at or close to its practical capacity and congestion on the roads impacts a range of transport modes, in particular it causes the bus network to run inefficiently. Improvements on the A59 can indirectly help reduce impacts on West Yorkshire's roads by reducing the volume of re-routing traffic during times of road closure at Kex Gill on to its roads.

### **Support for Intervention –Accessibility/Connectivity**

The A59 is recognised as a key east-west link in a number of policy documents. Improvements to the resilience of the A59 at Kex Gill will enhance accessibility and connectivity due to reduced risk of closures as well as improved journey times/reliability.

### **3.7 Summary**

This section of the OAR has presented information from a range of policy, strategy and data sources to provide the evidence base for the current situation and identification of challenges at Kex Gill.

## Understanding the Current Situation – Summary

### *Landslips at Kex Gill*

- The valley slopes above the A59 at Kex Gill have a long history of landslips leading to closure of the A59.
- The principal cause of the landslips at Kex Gill is heavy rainfall on the relatively unstable embankments leading to earthwork failure.
- In the past five years the A59 at Kex Gill has been closed on average around 2.5 weeks per year due to landslips and associated remedial work.

### *Impacts of A59 Kex Gill Closure*

- A major severance issue for east-west journeys;
- Poor connectivity and poor journey time reliability;
- Increased traffic volumes passing through towns and villages adversely impacts on local communities and businesses.

### *Other A59 Constraints*

The main constraint on the A59 is journey time reliability mainly due to:

- the formation of convoys behind slow moving vehicles (usually HGVs);
- the alignment of the road and the undulating topography;
- there being few overtaking opportunities between Harrogate and Skipton

This also creates a safety issue with drivers attempting overtaking manoeuvres when it is not safe to do so; this section of the A59 has a relatively poor safety record.

### *Environmental Constraints*

- Kex Gill is located within an environmentally sensitive area (with European, national and local designations).
- Any new road alignment would result in loss and/or fragmentation of habitats and heritage features.

### *Support for Intervention*

- Many of the relevant policy and strategy documents covering this area of North Yorkshire support the case for intervention at Kex Gill,
- Improvements at Kex Gill will help policy objectives for supporting economic growth, road safety/quality of life and accessibility/connectivity.

## 4 Understanding the Future Situation

### 4.1 Overview

The DfT's Transport Analysis Guidance (WebTAG) guidance states that an understanding should be developed of the future transport situation, taking into account

- Future land-uses and policies;
- Future changes to the transport system; and
- Future travel demands and levels of service.

This section of the OAR sets out the way in which the areas surrounding Kex Gill are expected to grow over the coming years, highlighting the locations for significant development. Whilst the area in the immediate vicinity of Kex Gill and Blubberhouses is not expected to experience any significant growth, given that it is within the Nidderdale AONB, there are significant housing and employment development plans for Skipton, Harrogate and other towns and communities in both North Yorkshire and West Yorkshire. The planned (committed and uncommitted) transport network improvements have also been summarised.

### 4.2 Future Land-Uses and Policies

#### 4.2.1 *Craven District Council (CDC) Emerging Local Plan*

CDC is currently preparing its new Local Plan. The latest draft Local Plan<sup>25</sup>, published for consultation in April/May 2016, sets out its vision for Craven in 2032, which is for Craven to have experienced a period of steady, sustainable growth and change and for it to be an attractive place to live, work and visit, offering a fulfilling and vibrant community life. In terms of transport and growth, the vision is for new homes to have good access, by all transport modes, to local facilities, employment areas, town centres and the countryside, as well as there being new well connected employment locations enabling residents to work locally.

The draft Local Plan for consultation, highlights an objective to provide sufficient and suitable employment land to enable business to grow, as well as to accommodate new businesses. The document highlights employment needs across the district, based on a 2013 evidence base, identifying the need for around 28 hectares of additional employment land during the plan period. It is noted that a separate consultation regarding preferred site allocations/options is required. This will inform the total amount of employment land to be provided. An earlier draft Local Plan<sup>26</sup>,

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<sup>25</sup> *Draft Craven Local Plan, Craven District Council (2016)*

<sup>26</sup> *Draft Craven Local Plan, Craven District Council (2014)*



consulted on in 2014, indicated nearly 15 hectares of employment provision would be provided in Skipton.

In July 2016, CDC published a draft Local Plan Sites for Housing consultation document<sup>27</sup>, setting out housing provision for the area. The draft policy in this document sets out that, to meet the housing needs of Craven, provision needs to be made for a minimum of 5,120 net additional dwellings across the district during the plan period (April 2012 to March 2032); 50% of these are to be provided in Skipton.

<b>Craven District</b>	<b>Skipton</b>
28ha of employment land	15ha of employment land
5,120 dwellings	2,560 dwellings

#### 4.2.2 *Harrogate Borough Council (HBC) Emerging Local Plan*

The draft Harrogate District Local Plan<sup>28</sup>, published for consultation in October 2016, sets out in draft policy GS1: Providing new homes and jobs, that provision will be made for 11,700 new homes as a minimum, and 20-25 hectares of new employment land over the period 2014-2035 across the district. This is based on the objectively assessed need for 557 dwellings per annum and the Council's Employment Land Review, which forecast 7,930 additional jobs across all sectors in the borough.

Updates of the housing and employment evidence requirements are scheduled to take place prior to submission of the plan due to regular updating of population and economic forecasts and to ensure that they are both aligned.

The Strategic Housing and Economic Land Availability Assessment<sup>29</sup>, undertaken in 2016, which forms part of the evidence base for the draft Local Plan, outlines that approximately 5,500 dwellings and 7.8 hectares of employment land is expected to be delivered in the town of Harrogate.

It is important to note that, development proposals that would have an adverse impact on the natural beauty and special qualities of the Nidderdale AONB will be resisted, unless it can be demonstrated that the benefits of the proposal clearly outweighs any adverse impact and that the proposal cannot be located elsewhere, in a less damaging location.

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<sup>27</sup> *Draft Craven Local Plan – Preferred Sites for Housing, Craven District Council (2016)*

<sup>28</sup> *Harrogate District Draft Local Plan, Harrogate Borough Council (2016)*

<sup>29</sup> *Strategic Housing and Economic Land Availability Assessment, Harrogate Borough Council (2016)*

<b>Harrogate District</b> 25ha of employment land 11,700 dwellings	<b>Harrogate</b> 8ha of employment land 5,500 dwellings
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#### 4.2.3 *Leeds City Council (LCC) – Local Development Framework*

LCC's Core Strategy<sup>30</sup>, adopted in November 2014, is the main document within the districts Local Development Framework (LDF). The strategy sets out the overall vision and strategic level policies to guide the delivery of development and investment decisions and the overall future for the Leeds District up to 2028.

The strategy outlines that 70,000 (net) new dwellings will be accommodated between 2012 and 2028 in the Leeds District, 2,000 of which are planned to be delivered in the Outer North West area, which includes the Otley and Pool-in-Wharfedale, communities located on the official diversion route.

To ensure that the potential for future job growth is supported, the strategy outlines a requirement for a further 706,250 square metres of office space and 493 hectares of industrial and warehousing land, to be provided by 2028. This type of land use will be targeted for delivery in the city and town centres within the Leeds District.

<b>Leeds District</b> 493ha of employment land 700,000 sqm of office space 70,000 dwellings	<b>Outer North West Area</b> employment land and office space target in town centres 2,000 dwellings
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#### 4.2.4 *City of Bradford Metropolitan District Council (CBMDC) – Local Plan*

The CBMDC is currently preparing a new Local Plan for the district. The Core Strategy<sup>31</sup> is the main document which sets out the broad aims and objectives for sustainable development within the Bradford District, up to 2030. Overall, sufficient land is to be identified to provide over 42,100 new homes. In addition, 135 hectares of employment land is required to allow businesses and industry to grow.

The Allocations Development Plan<sup>32</sup> is currently being developed and highlights that the Wharfedale area, which is located along the official diversion route, is expected to provide 2,500 new homes:

- Ilkley - 1,000.

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<sup>30</sup> *Leeds Core Strategy, Leeds City Council (2014)*

<sup>31</sup> *Core Strategy Development Plan Document, City of Bradford Metropolitan District Council (2014)*

<sup>32</sup> *Allocations Development Plan Document, City of Bradford Metropolitan District Council (2016)*

- Burley-in-Wharfedale – 700.
- Menston – 600.
- Addingham – 200.

In terms of employment land, the Council's Employment Land Review<sup>33</sup> recognised that there was a market for small to medium business enterprises in the Wharfedale area. The Core Strategy highlights the requirement for an allocation of 5 hectares of new employment land in Wharfedale, to accommodate future employment needs.

<b>Bradford District</b> 135ha of employment land 42,000 dwellings	<b>Wharfedale</b> 5ha of employment land 2,500 dwellings
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#### 4.2.5 *Developments at Kex Gill*

In terms of specific developments in close proximity to Kex Gill, a planning application has been submitted seeking to extend the period of time for the extraction of silica sand at Blubberhouses Quarry. Mineral extraction at the quarry (of silica sand) commenced in 1987 and the site was operational until 1991. There are currently no buildings at the site, as the original processing plant was demolished in 2007. However, it is understood that there are significant mineral reserves that remain un-worked (4 million tonnes). The planning application seeks a 25 year extension to the permission for mineral extraction. In terms of the impact to the A59, the planning application supporting documents state that the quarry would be expected to generate (on an average day) 80 loaded vehicle movements to/from the site. The planning application is currently undetermined.

It should be noted that NYCC, the City of York Council and the North York Moors National Park Authority, as minerals and waste planning authorities, are currently preparing a joint minerals and waste plan. The current timetable programmes adoption in November 2017. Once finalised the plan will set out new planning policies for minerals and waste developments across all three areas which will guide decisions on planning applications up to 2030.

A consultation on the publication draft<sup>34</sup> was undertaken in November/December 2016, this document makes reference to Blubberhouses Quarry. It is noted that silica sand is a scarce and nationally significant mineral which was formerly worked at Blubberhouses Quarry, where reserves still remain. The reserves at Blubberhouses are considered to contain sand suitable for high-quality glass manufacture and

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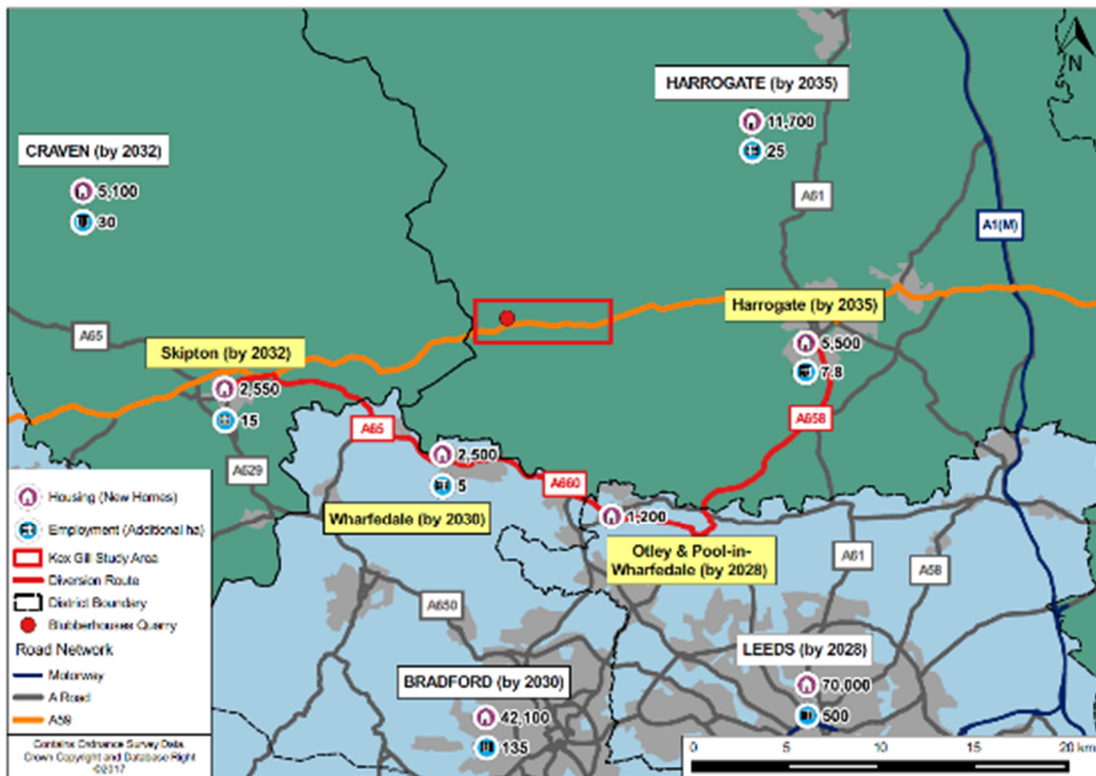
<sup>33</sup> *Employment Land Review Update, City of Bradford Metropolitan District Council (2011)*

<sup>34</sup> *Minerals and Waste Joint Plan, North Yorkshire County Council, City of York Council and the North York Moors National Park Authority (2016)*

proposals for development of the resources, as such there are proposals to safeguard the resource and proposals to develop the silica sand at Blubberhouses will be supported in principle subject to mitigation of the environmental impacts and compliance with the relevant regulations.

Figure 4-1 summarises the housing and employment growth plans for the study area.

Figure 4-1 – Summary of Strategic Growth Proposals in the Vicinity of Kex Gill



#### 4.2.6 Air Quality Management Area (AQMA)

Pool-in-Wharfedale, to the north of Leeds, is situated along the route of the official diversion route to be used when the A59 is closed at Kex Gill. This village currently suffers from traffic congestion and ‘canyoning’ effects meaning traffic pollutants of concern, including Nitrogen Dioxide (NO<sub>2</sub>) and particulate matter with an aerodynamic diameter of less than 10µm (PM<sub>10</sub>), do not disperse rapidly creating adverse air quality conditions in the village. Main Street in Pool has been identified as having levels of pollution consistently above the EU set limit of 40µg/m<sup>3</sup>. Consequently, an AQMA is being proposed at this location. Increased traffic flow, particularly HGVs resulting from further closure and diversion of traffic from the A59 towards this area will exacerbate this issue.

#### 4.3 Future Changes to the Transport System

Proposed changes to the wider transport system need to be considered as part of the development of transport proposals, in order to understand the potential effects

on demand and travel patterns and also in order to understand the cumulative impact of transport interventions on the study area.

This section sets out proposed changes to the transport system that could influence connectivity and accessibility across the A59 corridor between Skipton and Harrogate, impacting on proposals for a Kex Gill Diversion scheme.

#### 4.3.1 *North Yorkshire County Council (NYCC) – Local Transport Plan Four (LTP4)*

The NYCC LTP4<sup>35</sup> sets out a range of strategic transport priorities for the period 2016 to 2045. These priorities include the need to improve east-west connectivity and enhancing the reliability of the transport network.

The plan stresses that improvements to east-west links are considered necessary in order to help to boost the economic performance of North Yorkshire, by improving access to businesses, unlocking housing growth and enabling the area to be accessed more easily from other areas of the country and the strategic transport network (e.g. A1(M) and East Coast Mainline).

The LTP4 highlights that the A59 is a primary east-west corridor which currently experiences poor journey times and reliability. The provision of a road improvement scheme at Kex Gill is regarded as a high priority, forming part of wider, strategic plans for improved east-west connectivity across the county. In addition, the LTP4 outlines plans for the introduction of three additional climbing lanes (providing overtaking opportunities). On the A59 between Skipton and Harrogate.

#### 4.3.2 *A Strategic Transport Prospectus for North Yorkshire (2015)*

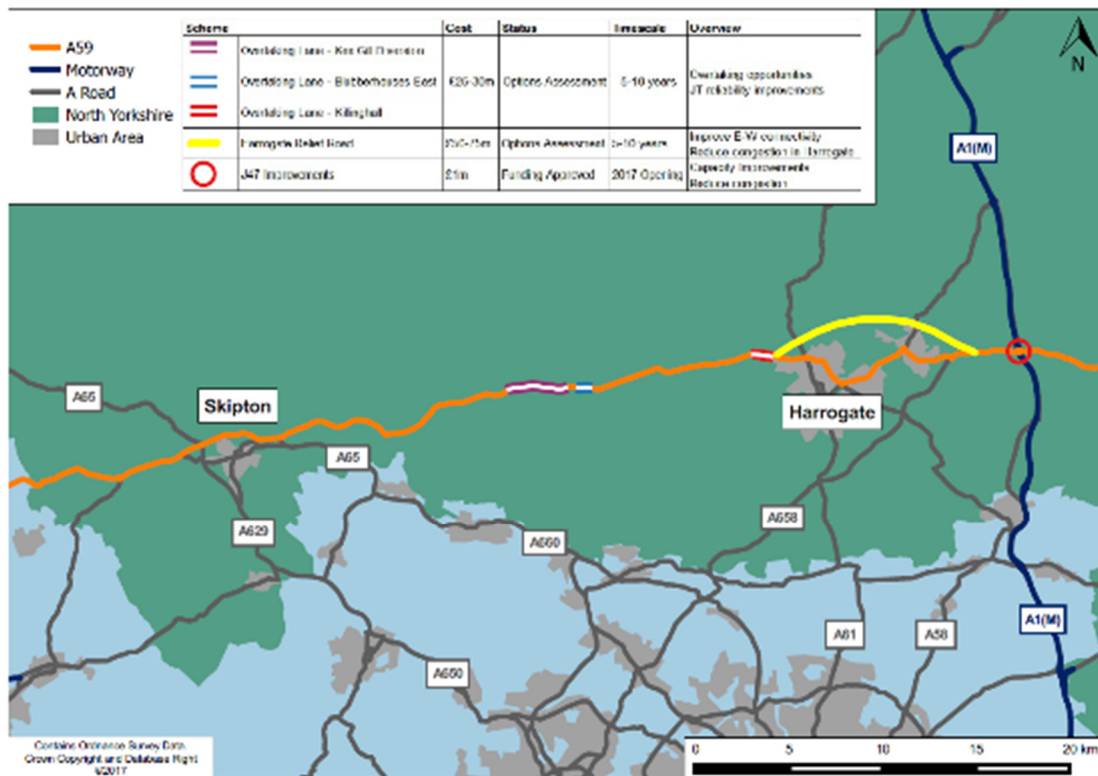
In 2015, NYCC published a Transport Prospectus for North Yorkshire<sup>36</sup>, outlining how NYCC would like to work with the government, TfN and the Northern City Regions to ensure that improved transport connections allow North Yorkshire to both contribute to and share in the economic benefits of the Northern Powerhouse. The prospectus sets out a number of initiatives for improvements to the transport network in the county by 2030. Figure 4-2 illustrates the initiatives which are likely to have direct a direct impact on the A59 between Skipton and Harrogate and therefore are an important consideration in terms of the development of the Kex Gill Diversion scheme.

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<sup>35</sup> *Local Transport Plan 4, North Yorkshire County Council (2016)*

<sup>36</sup> *A Strategic Transport Prospectus, North Yorkshire County Council (2015)*

Figure 4-2 – Strategic Transport Prospectus Initiatives on A59 Corridor



The following bullet points provide additional details regarding each of these key initiatives:

- **A1(M)/A59 Junction 47 Upgrade** – Proposals to improve the capacity at the A1(M)/A59 Junction 47 including the provision of wider slip roads and the introduction of traffic signal control to the existing motorway roundabout junction to reduce the effects of congestion, minimising queues and delays. The scheme is anticipated to cost approximately £1 million and is scheduled to be delivered during 2017. NYCC is also investigating further options to increase the capacity of the junction to accommodate planned future growth.
- **Harrogate Relief Road** – Proposals for a scheme to address east-west connectivity and traffic congestion issues in the town which currently result in delays and unreliable journey times. A study is currently underway to consider the need for and alignment of a relief road. Expectations are that any scheme would cost in the region of £75 - £100 million and take 10-15 years to deliver.
- **A59 Harrogate to Skipton Overtaking Opportunities Package (including a Kex Gill Diversion Scheme)** – A package including three additional climbing lanes on the A59 between Harrogate and Skipton at Killinghall, Blubberhouses and Kex Gill (potentially, as part of the main landslip related diversion scheme). Previous forecasts for the package are in the region of £30 million with an estimated delivery period of 5-10 years.



Whilst all these improvements seek to improve east-west connectivity, their impact will be limited if there continues to be a risk of closures of the A59 at Kex Gill.

A review of the West Yorkshire LTP<sup>37</sup> and West Yorkshire Combined Authority (WYCA) Transport Strategy<sup>38</sup> did not identify any major schemes either impacting the on the A59 or the official diversion route.

#### 4.4 Future Travel Demands and Levels of Service

In addition to the issue of landslips impacting on connectivity, accessibility and creating severance issues, journey time reliability is also a significant constraint on the A59. The existing alignment, landscape topography and volume of traffic together with few overtaking opportunities results in the formation of convoys of traffic behind slow moving vehicles (typically HGVs). This coupled with the relatively high landslip risk means that journey times are unreliable between Skipton and Harrogate. Future travel demand for the A59 as a result of planned growth in the region may exacerbate this.

The potential future travel demand for the A59 has been assessed principally by looking at the level of growth expected in the region, using the DfT's National Transport Model. A high level assessment of highway capacity has been undertaken, the results of which are set out below. Traffic flows for the base year (2015) were obtained from the DfT traffic counts website and NYCC traffic data website. Future year<sup>39</sup> traffic flows (for 2030) have been forecast by applying a growth factor to the base year (2015) counts. The growth factor is produced by the Transport Analysis and Strategic Modelling (TASM) Division of the DfT using the National Transport Model (NTM). The output is presented as a percentage increase in car miles for Yorkshire and Humberside. In accordance with the guidance a 17.4% growth factor has been applied to observed 2015 traffic counts (see Table 4-1). The Congestion Reference Flow (CRF) for this section of the carriageway has also been calculated. The CRF is an estimate of the AADF at which the carriageway is likely to be 'congested' in the peak periods on an average day. The CRF<sup>40</sup> measures the performance of a road between junctions (therefore the effect of junctions would need to be considered separately). Finally, the 'Route Stress' ratio has been calculated. Route Stress is the ratio of the annual average daily flow to the CRF. The output is presented as a percentage and is an estimation as to the level of congestion on the link.

Stress levels are considered to be as follows:

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<sup>37</sup> 'My Journey' Third West Yorkshire Local Transport Plan, Metro (2011)

<sup>38</sup> West Yorkshire Transport Strategy 2016-2036 Consultation Draft, WYCA (2016)

<sup>39</sup> Future year flows are based on a do minimum scenario without future improvements included.

<sup>40</sup> The equation for calculating CRF is found in the DMRB TA 46/97, Annex D

- 0 – 84% – not congested.
- 85 – 99% – congested.
- 100% and over – severely congested.

*Table 4-1 – Existing Highway Provision: Base Year 2015*

Location	Year	2015		
		AADF (2 way)	CRF	Route Stress (%)
A59 Kex Gill	2015	8,800	29,300	30
	2030	10,300	29,300	35

The results in Table 4-1 demonstrate that currently, the A59 at Kex Gill is not generally operating under stress. In addition, despite predicted future growth in traffic, the Kex Gill section of the A59 is still expected to be in an uncongested state by 2030. Clearly, future traffic growth is not anticipated to be an issue for the Kex Gill section of the A59.

## Understanding the Future Situation – Summary

### *Land-uses and Policies*

- A new road alignment at Kex Gill is in accordance with a range of policies at national, regional and local level and is a key transport proposal in North Yorkshire.
- Growth of the economy is a key aim in many relevant policy documents. Improvements at Kex Gill will enhance accessibility and east-west connectivity helping businesses develop and grow through improved access to their markets, customers and other relevant services, ultimately aiding economic growth.
- Safety improvements are a key policy aspiration and improvements at Kex Gill will help meet this policy objective.

### *Changes to the Transport System*

- Improvements to east-west links are considered necessary to boost the economic performance of North Yorkshire.
- Improving access to businesses, unlocking housing growth and enabling the area to be accessed more easily from the strategic transport network are also key aspirations.
- Three key improvements are planned for the A59 between Skipton and Harrogate:
  - A1(M)/A59 Junction 47 Upgrade
  - Harrogate Relief Road
  - A59 Harrogate to Skipton Overtaking Opportunities Package

### *Future Travel Demand*

- Travel demand on the A59 is set to increase as a result of the planned growth in the vicinity of Kex Gill; principally in Skipton and Harrogate but also in the major urban areas of Leeds and Bradford.
- The impacts of landslips will be exacerbated if there's greater demand for travel occurs on A59.
- Removal of the risk of road closures from landslips will reduce the level of adverse impacts resulting from the landslips and facilitate more reliable journeys for a greater number of road users.

## 5 Establishing the Need for Intervention

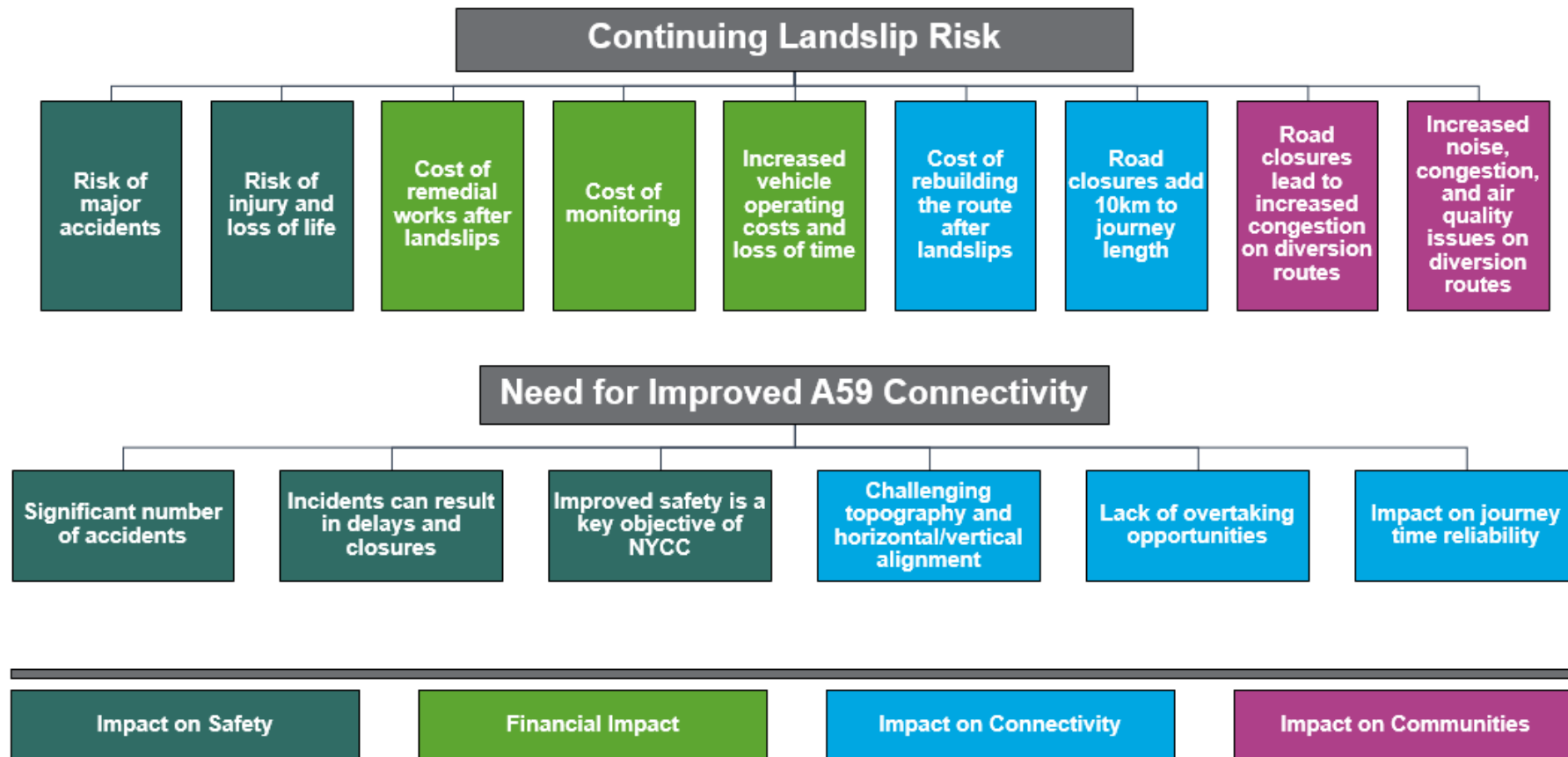
### 5.1 Overview

The purpose of this chapter is to set out the need for intervention; taking into account current and future transport-related problems in the Kex Gill area and examining the underlying causes of these problems. The previous sections of the report have identified that there are a number of problems, issues and constraints affecting the A59 at Kex Gill. These principal issues can be grouped into two key themes:

- **Continuing Landslip Risk.**
- **Need for Improved A59 Connectivity.**

Figure 5-1 illustrates the key issues associated with these two key areas whilst the subsequent text provides further justification for the need for intervention.

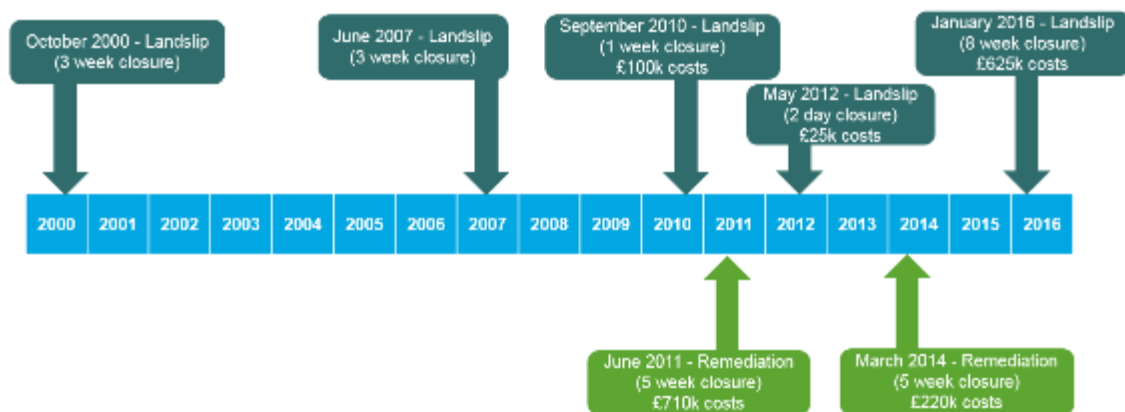
Figure 5-1 – The Need for Intervention



## 5.2 Continuing Landslip Risk

The evidence has demonstrated that there is a history of landslips at Kex Gill. The peat and clay ground conditions on the steep slopes in the Kex Gill valley become unstable after periods of intense rainfall which can lead to landslips. Figure 5-2 summarises the recent landslip history, illustrating the increasing frequency of landslip and maintenance events. Whilst work is ongoing to investigate the ground conditions that lead to these landslip events, it is widely agreed that there is no solution that will completely remove the risk of the valley slopes at Kex Gill failing again in the future. Furthermore, given the predictions for climate change, which show a propensity for increased heavy rainfall events through winter months, there could be an increasing risk of future landslips at Kex Gill.

Figure 5-2 – Timeline of Road Closures on A59, Kex Gill



The previous sections of the report have demonstrated that there are a number of major impacts associated with landslip events at Kex Gill. These are summarised below.

### 5.2.1 Safety Impact

Fortunately, to date, there have been no personal injuries recorded as a result of the landslips that have occurred at Kex Gill, although a vehicle has been caught by a landslip. However, there remains a very real risk that any future landslip could result in a major accident involving vehicles using the A59. It is not possible to predict with any certainty when a landslip may occur. The potential for a large landslip at Kex Gill exists, given the significant volume of traffic using the A59 throughout the day, there is a significant risk of injury or loss of life and this is one of the key factors behind the need for intervention.

### 5.2.2 Financial Impact

The remedial works necessary to maintain the route also represent a significant financial burden to NYCC, with costs associated with traffic management and repair and remedial works being approximately £1.7m over the last 6 years. In addition, the high level of monitoring also has a significant cost associated with it. Without intervention, NYCC will continue to be burdened with a significant maintenance liability and risk of significant costs associated with further remedial works. In addition, the potential for a much larger landslip exists, this could destroy a large



section of the A59 and result in a significant cost to rebuild the route. This is another key reason why intervention is needed.

### 5.2.3 *Impact on A59 Users*

In the event of a landslip at Kex Gill (or other major incident) a large section of the A59 is closed and users are directed to follow the official diversion route (although evidence indicates that other routes are also used as a diversion route to) which passes through a number of towns and villages in West Yorkshire. This closure has a major impact on A59 users, adding approximately 10km to the journey length, effecting both strategic east-west trips and more localised journeys. Analysis of the available Trafficmaster data has demonstrated substantial increases in average journey times during periods when the A59 is closed:

- **AM Peak:**
  - Eastbound – 34 minute increase.
  - Westbound – 23 minute increase.
- **PM Peak:**
  - Eastbound – 26 minute increase.
  - Westbound – 30 minute increase.

Users of other diversion routes, via Blubberhouses, Greenhow Hill or Beckwithshaw also experience similar increase in average journey times.

In addition, journey time reliability is impacted, as the increase in traffic on the official diversion route due to the closure of the A59, leads to increased congestion. The increase in journey length/time and reduction in journey time reliability also has an economic cost to A59 users, both in terms of increased vehicle operating costs and loss of time. Safeguarding the A59 route and removing the impact on A59 users of any future landslip at Kex Gill is a major factor supporting the need for intervention.

The forecast future housing and employment development in the study area is likely to result in a higher number of trips in the area, resulting in a greater number of people being adversely impacted by future landslip events at Kex Gill.

### 5.2.4 *Impact on Communities*

The severance impact associated with a closure of the A59 has a major impact on the local communities and businesses across the study area. Given the strategic importance of this east-west link, the wider impacts of a prolonged closure of the A59 are significant. In addition, the additional traffic which occurs on the official diversion route adversely impacts on the communities along this route, including:

- Ilkley.

- Burley-in-Wharfedale.
- Otley.
- Pool-in-Wharfedale.
- Pannal.

The communities can experience increased noise, severance congestion and air quality issues. Reducing the impact of any future landslip on the local communities is a key aim for any intervention.

### **5.3 Need for Improved A59 Connectivity**

The evidence has demonstrated that, even when the A59 route is fully open, there are a number of issues effecting users journeys.

#### *5.3.1 Journey Time Reliability Issues*

The analysis of journey time data indicates that, as a result of the topography and the corresponding horizontal/vertical alignment of the A59 route through Kex Gill, HGV's journey times are impacted on this section of the route, with journey times between Skipton and Harrogate shown to be 2-3 minutes slower than for a car. Given the lack of overtaking opportunities across the route, convoys of cars can develop behind slower moving vehicles, thus impacting on the journey time reliability for users of the A59. Improving journey time reliability and east-west connectivity is a key objective for NYCC and is supported in a number of existing policies and strategies.

#### *5.3.2 Safety Issue*

The evidence outlined in Section 3 clearly demonstrated that there were a significant number of accidents on the Kex Gill section of the A59 over the five year period analysed. The analysis identified three accident cluster sites as well as indicating that some section of the route had an accident rate double the national average. As well as the safety risk for users, incidents along the route can result in delays and closures, further impacting on the journey time reliability of the route. Improving the safety of the A59 is a clear objective for NYCC and developing interventions that can seek to reduce the number of accidents at Kex Gill is an important consideration.

## 6 Identifying Objectives

### 6.1 Overview

The definition of objectives plays a key role in steering the development of transport schemes and assessing whether they have been successful once delivered. Essentially, objectives set out what a scheme, or indeed transport strategy, is designed to achieve. The development of objectives for this project has been informed by Transport Appraisal Process guidance from DfT's WebTAG.

What a scheme should achieve can be expressed at a very high level, in terms of an aim and strategic objectives, or in much more detail including very specific objectives associated with detailed problems and issues. At this stage of the scheme development process, objectives should be higher level, avoiding indications of preferred solutions but enabling more specific objectives to be developed as the project proceeds and options are identified.

Objectives at this stage should also be consistent with specific challenges, identified in the preceding sections of this report, and should be based on a realistic understanding of the issues and context of a project, reflecting the specific opportunities and constraints identified. Whilst objectives should be consistent with wider local, regional and national objectives, they should focus on addressing identified need, rather than seeking to contribute to all policy objectives.

### 6.2 Objective Setting

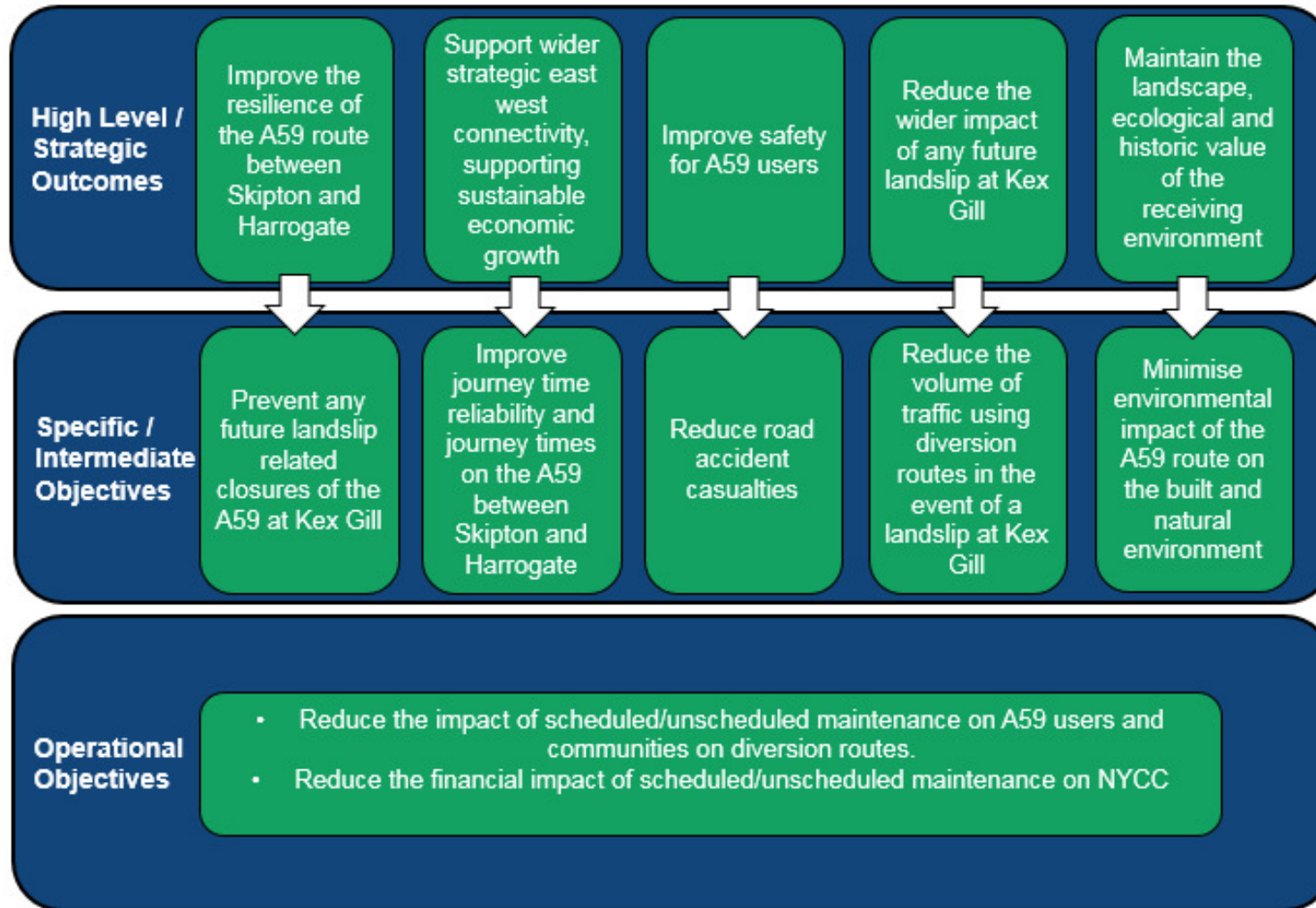
As stated in DfT's WebTAG, consideration should be given to developing a hierarchy of objectives, which provides a framework for future appraisal and evaluation:

- **High level or strategic outcomes** – These would typically express the desired end state, and reflect the aims and ambitions for the area or population (e.g. prevention of A59 landslip related closures). These are generally objectives to which transport contributes, but not always in a direct manner.
- **Specific or intermediate objectives** – These would typically represent the intermediate effects of the transport intervention, including the direct and short term objectives which need to be achieved for the high level or strategic outcomes to be realised.
- **Operational objectives** – These normally represent the desirable outputs which are necessary for the intermediate objectives to be achieved.

Figure 6-1 summarises the hierarchy of objectives for the A59 Kex Gill Diversion Scheme. These objectives have been developed in consultation with the client (NYCC) and representatives of HBC and CDC.



Figure 6-1 – A59 Kex Gill Diversion Scheme Objectives



The following bullet points outline the justification for the specific/intermediate and operational objective's outlined above:

- **Prevent any future landslip related closures of the A59 at Kex Gill** – The evidence has demonstrated that the closure of the A59 at Kex Gill results in significant impacts on A59 users due to increased journey times whilst using the diversion route, both in terms of the increase in journey time when using diversion routes and the uncertainty over journey time reliability. There is also an adverse impact on communities and existing users of the diversion routes during closure periods. Finally, whilst no road users have been caught in previous landslips events, there remains a very real risk of injury or death to A59 users due to future landslips. A key focus of any intervention is that it allows the A59 route to remain open, should there be another landslip at Kex Gill, resulting in increased resilience of the route.
- **Improve journey time reliability and journey times on the A59 between Skipton and Harrogate** – Improving journey time reliability is a key focus. Currently, there are few overtaking opportunities along the route. As such, convoys form behind slow moving vehicles (such as HGVs), due to the alignment of the route and the topography, which impact on user journey time reliability. The significant number of accidents along the route can also effect reliability. The high level of maintenance and monitoring of the route can also result in periods of road works, whilst inspections/remedial works are conducted, again effecting journey time reliability. In the event of a complete closure of the A59 due to a landslip (or other incident) the diversion route creates a much longer journey for users. It is therefore important that intervention look to address journey time reliability issues.
- **Reduce road accident casualties** – the analysis of accident data has demonstrated that there are a number of accident clusters along the A59 and sections of the route that have accident rates above the national average. A key factor of any option will be to aim to address these accident problems and provide a safer route.
- **Reduce the volume of traffic using diversion routes in the event of a landslip at Kex Gill** – currently, in the event of a landslip at Kex Gill, the route is closed and users are required to follow a lengthy diversion route. This increase in traffic volumes on the diversion route can lead to increased congestion and adverse impacts associated with noise, air quality and severance for communities along these routes. It is a key aim of any intervention to reduce this impact.
- **Minimise environmental impact of the A59 route on the built and natural environment** – land around the A59 at Kex Gill is of high nature conservation and landscape value, as a result it is designated a SAC, SPA, SSSI and AONB. Any diversion route in this area could adversely affect the conservation



objectives of these sites. To address this, the design and assessment of any options should seek to avoid/minimise these impacts as reasonably as possible.

- **Reduce the impact of scheduled/unscheduled maintenance on the A59 users and communities on diversion routes** – maintenance works on the A59 at Kex Gill, requiring either a full closure or contra-flow working, result in significant delays to users. Furthermore, when a full closure is in place, the resulting increase in traffic on diversion routes result in adverse impacts to existing users of these routes and the communities along them. Reducing the impact of scheduled/unscheduled maintenance is a key objective.
- **Reduce the financial impact of scheduled/unscheduled maintenance on NYCC** – the continued monitoring and maintenance of the A59 at Kex Gill results in a significant cost to NYCC. In addition, the remedial works needed following a landslip at Kex Gill present a significant cost risk to NYCC. It is therefore important that any intervention reduces the maintenance/monitoring cost to NYCC.

## 7 Geographical Area of Impact

### 7.1 Overview

This section of the report defines the geographical area of impact to be addressed by the intervention, i.e. the area it should be bounded by. DfT WebTAG guidance sets out that the geographic area of impact for a study should be based on:

- Understanding of the geographical scope of the travel market and key origins and destinations; and
- Analysis of the geographical extent of current and future transport problems and underlying drivers.

In the case of the Kex Gill Diversion Scheme, two areas of impact have been developed:

- **Intervention Area** – determining the geographical extents for the development of options, focussed on the key current and future transport problems.
- **Wider Area of Impact** – illustrating the anticipated geographic extent of the key travel market anticipated to be impacted by the scheme, including the communities located along the official diversion route.

### 7.2 Intervention Area

The geographic extents for the development of options are illustrated in Figure 7-1. Clearly, the key focus of the intervention area is in allowing for the development of options which seeks to tackle the problem of landslips at the A59 Kex Gill. However, the intervention area stretches wider than the known area of landslips. At the western extent, the intervention area includes Kex Gill Farm corner, which has been shown to suffer from a high number of accidents. At the eastern extent, the intervention area stretches as far as the A59/Meagill Lane junction, allowing for options which may include elements targeted at addressing the identified journey time reliability problems, associated with a lack of overtaking opportunities.

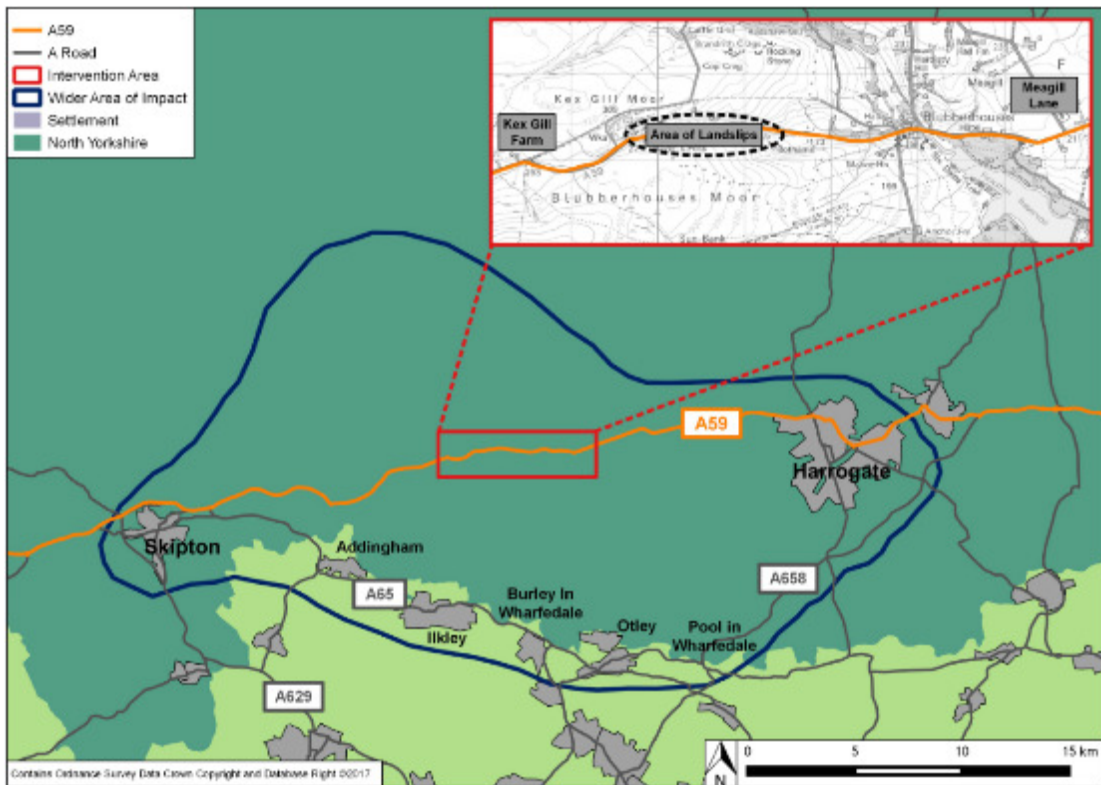
### 7.3 Wider Area of Impact

As previously outlined, whilst the intervention area determines the area in which the development of options should be focussed, it is also important to understand the wider area over which options are likely to have an impact. In addition to the intervention area, Figure 7-1 illustrates the wider area of impact which, primarily, includes the A59 route corridor between its junction with the A65 near Skipton and its junction with A61 in Harrogate). This reflects that options in the intervention area which address the issues of landslips (and also safety and journey time reliability issues) will provide connectivity benefits to journeys on this section of the A59.

Furthermore, Section 2 of this report illustrated that during a landslip event at Kex Gill, a significant length of the A59 must be closed and a lengthy diversion put in place. This official diversion route (A65, A660, A658 and A61) passes through a

number of communities including Ilkley, Burley in Wharfedale and Otley, amongst others, leading to adverse impacts associated with increased traffic flows on these communities. Other roads are also used as diversion routes, some of which are not suitable for large vehicles due to the topography and relatively narrow and winding alignment. Clearly, any option in the intervention area which removes the need for closures of the A59 will be providing a positive impact on the communities along these diversion routes. Therefore, the wider area of impact includes these extents.

Figure 7-1 – Intervention Area and Wider Area of Impact



## 8 Generating Options/Corridors

### 8.1 Overview

This section of the OAR sets out the range of options considered to address the problems and meet the objectives set out in the previous sections of the report. The purpose of option generation is to develop a range of alternative measures or interventions focussed on addressing the identified problem and meeting the identified objectives.

In many circumstances, it would be appropriate to consider a wider range of measures or interventions, including all modes, infrastructure, regulation, pricing and other ways of influencing travel behaviour. Options could include measures that reduce or influence the need to travel, as well as those that involve capital spend.

However, in the case of Kex Gill, the primary problem is not related to the volume of traffic, or congestion, but to the very real risk of future landslips and the associated adverse impacts this has been shown to result in. With no other suitable east-west connection in the area, it is imperative that a robust A59 east-west road link continues to be provided. Public Transport options alone, including increase bus or rail services/frequencies, whilst potentially reducing the traffic flows along the route, would not tackle the issue of landslip risk. In addition, pedestrian/cycle improvements or smarter measures would not address the key issues that have been identified. The only way to ensure continued east-west connectivity on the A59 is to divert the Kex Gill section of the route out of the landslip risk area or to develop a slope stabilisation scheme capable of giving near 100% confidence that there would be no further failures. As a result, the options which have been developed are all highways focussed.

The following sections outline the process adopted for the generation of these highway focussed options as well as summarising the resulting 16 options.

### 8.2 Approach and Key Considerations

#### 8.2.1 *Option Development Approach*

At the outset, an internal 'problems and issues' workshop was arranged and attended by the study team technical leads from the five disciplines (Environment, Geotechnical, Highways, Quantity Surveying and Transport Planning), in order to ensure that all aspects affecting the development of options would be considered. At this workshop, each technical lead presented a summary of the key issues and constraints impacting on option development, based on the desktop analysis and investigation they had conducted.

Following the internal 'problems and issues' workshop, the Highways team began to produce initial designs for options, using Autodesk's InRoads 360 'conceptual' design programme. InRoads 360 provides the ability to combine readily available digital terrain information with aerial photography to produce a three dimensional

virtual world, within which, conceptual designs for the various options can be provided, as illustrated in Figure 8-1.

Figure 8-1 – Example of Infracore 3-D Layout Plan – Illustrative Purposes Only



The programme was configured to apply Design Manual for Road and Bridges (DMRB) standards to each option, ensuring that initial designs complied with ‘desirable’ minimum horizontal and vertical geometry. All horizontal and vertical alignments, and therefore quantities, have a relative degree of accuracy as they were derived using a 5m Grid Digital Terrain with a horizontal accuracy of  $\pm 1$  m RMSE (Root Mean Squared Error) and a vertical Accuracy  $\pm 1.5$  m RMSE. Similarly, the aerial photography had a pixel resolution of 25cm with an overall accuracy  $\pm 1.5$  m RMSE.

A second internal ‘initial options review’ workshop was then held to review the initial options generated by the highways team. Again, all discipline team leads attended. As a result of the discussions at the workshop, several new option alignments were created.

On the 11<sup>th</sup> January, an ‘initial options’ workshop was held at NYCC area offices in Skipton, attended by both the study team technical leads and representatives of NYCC, HBC and CDC. At this workshop, a ‘fly-through’ for each of the 16 options was presented.

### 8.2.2 Key Option Development Considerations

The development of options has been guided by a number of key issues and constraints, summarised below:

#### **Geological Constraints**

The key geological and geotechnical constraints are as follows (see also Figure 3-2 in Section 3:

- Relict, historic and potential future landslides in the Kex Gill valley.

- High ground water and thick peat over sandstone in the area to the south of the Kex Gill valley.
- Peat 1-2m thick in the area north of the Kex Gill valley, increasing in thickness towards the western and eastern ends of the scheme.
- Potential soft soils in the valley floor to the east of Blubberhouses village.
- Quarry workings, plant areas and spoil tips of the disused Blubberhouses Quarry north of A59.

### ***Environmental Constraints***

The key environmental constraints are as follows (see also Section 3.5 and Figure 3-13 to Figure 3-17):

- Potential significant adverse effects on the setting of and views within the Nidderdale AONB as well as recreation users experience of the immediate landscape.
- Potential significant adverse effects on local character.
- Potential severance of existing well-used footpaths and bridleways.
- Potential significant adverse visual effects for Kex Gill Farm.
- Potential significant visual effects for receptors in and around Blubberhouses, including Blubberhouses Hall, Manor House and Scaife Hall Farm.
- Potential significant adverse effects on the nature conservation objectives of North Pennine Moors SAC and SPA and West Nidderdale, Barden and Blubberhouses Moors SSSI.
- Potential loss of ancient woodland.
- Potential effects on the settings of Listed Buildings around Blubberhouses.
- Potential flood risk and water quality impacts.

### ***Highway Design Constraints***

The key constraints that guided the development of highway option were restricted to the topographic nature of the landscape and were as follows:

- The alignment of the existing A59.
- The Kex Gill valley and the locations of known landslips.
- Existing residential buildings.



- Quarry workings, plant areas and spoil tips of the disused Blubberhouses Quarry north of A59.
- Fewston Reservoir.

### 8.3 Options

Following the process outlined in Section 8.2, 16 individual options were developed. Figure 8-2 illustrates the 16 options that have been developed. The following paragraphs provide a brief description of each option.

#### 8.3.1 *Online Options*

##### **Option 1**

Option 1 is an on-line scheme and follows the route of the existing A59 from Kex Gill Farm east, passing along the south side of the Kex Gill valley, before following the existing road through Blubberhouses and along to Meagill Lane. Any on-line solution would require the construction, should they be feasible, of new retaining structures on the south side of the existing road within the Kex Gill valley to prevent future landslips.

##### **Option 13**

Option 13 follows the route of the existing A59 from Kex Gill Farm, past North Moor Road, and follows the route along the south side of the valley, with improved geometry and retaining structures on the south side of the road. The option then follows the route of the existing A59 through Blubberhouses to Meagill Lane.

#### 8.3.2 *Options to North of Kex Gill Valley*

##### **Option 2**

Option 2 follows the existing A59 from Kex Gill Farm, to a point just east of the junction with North Moor Road, where the option leaves the existing A59 to travel centrally down the Kex Gill valley, bypassing the area of existing landslips before tying back in to the A59 approximately 1.2km later. From here the option continues along the existing A59 route through Blubberhouses to Meagill Lane.

##### **Option 4**

Option 4 begins at Kex Gill Farm following the existing A59 leaving the road after 100m to utilise the line of an existing bridleway that runs north easterly towards North Moor Road. The option then follows this road for approximately 900m, to a point, where the existing North Moor Road turns sharply north. At this point the option turns south easterly to begin a long 2.5km descent across the north face of the valley to re-join the A59 immediately east of Blubberhouses, from where it follows the route of the existing road through Blubberhouses onto Meagill Lane.

##### **Option 5**

Option 5 begins at Kex Gill Farm following the existing A59 leaving the road after 100m to utilise the line of an existing bridleway that runs north easterly towards North Moor Road. At this point the option continues in an easterly direction following an existing farm track that runs along the northern edge of Kex Gill valley. It

maintains this route for approximately 1km before turning south east to descend across the north slopes of the valley re-joining the A59 immediately east of Blubberhouses. The option then follows the route of the existing road through Blubberhouses onto Meagill Lane.

### **Option 6**

Option 6 begins at Kex Gill Farm following the existing A59 leaving the road after 100m to utilise the line of an existing bridleway that runs north easterly towards North Moor Road. At this point the option continues in an easterly direction following an existing farm track that runs along the northern edge of Kex Gill valley. It maintains this easterly route for 1.4km above the north face of Kex Gill valley. It then turns south easterly to begin a slightly quicker 1km descent of the valley face down to the existing A59 at the Blubberhouses junction. The option then follows route of the existing road up to Meagill lane.

### **Option 7**

Option 7 follows the route of the existing bridleway from Kex Gill farm to North Moor Road. The option then follows the route of North Moor Road until that turns north, where the option continues travelling east for about 1.7km, where it meets West End Lane. After the junction, the option continues to travel east for around 400m before crossing a new viaduct spanning 350m over the River Washburn, prior to a junction with Hardisty Hill. Around 200m after the junction, the option curves south-east, crossing another new viaduct, spanning about 170m. After the second viaduct, the option continues south-east for another 500m, before curving north-east to Meagill Lane.

### **Option 8**

Option 8 follows the route of the existing A59 from Kex Gill, to the junction with North Moor Lane, where the option continues north-east, and then travels east for 900m, about 120m south of North Moor Road. The option then curves south east, and joins the route of the existing A59 around 1km west of the Blubberhouses junction. The option then follows the existing route of the A59 through Blubberhouses to Meagill Lane.

### **Option 9**

Option 9 follows the route of the existing A59 from Kex Gill Farm beyond the junction with North Moor Road, where the option continues north-east for around 1km, and then travels east just after the route of North Moor Road turns north. The option then runs east for about 700m, before turning south-east, and travelling down to meet the existing A59 at the junction at Blubberhouses. The option then follows the route of the existing A59 to Meagill Lane.

### **Option 10**

Option 10 follows the route of the existing A59 from Kex Gill Farm beyond the junction with North Moor Road, where the option continues travelling north-east for about 1km. From just after the point where North Moor Road curves north, the option travels east for around another 1km, before curving south-east down the side of the

valley to meet the existing A59 at the Blubberhouses junction. The option then follows the route of the existing A59 to Meagill Lane.

#### **Option 11**

Option 11 follows the existing A59 from Kex Gill Farm beyond the junction with North Moor Road, where the existing route travels along the south side of the valley. The option continues north-east for about 1km, before continuing east for about 500m, before turning south-east quite sharply and travelling down the side of the valley to meet the route of the existing A59 about 900m west of the Blubberhouses junction. The option then follows the existing route of the A59 through Blubberhouses to Meagill Lane.

#### **Option 12**

Option 12 follows the route of the existing bridleway from Kex Gil Farm to North Moor Road. The option then joins the route of North Moor Road for about 500m, before gradually turning south-east and descending down the valley to meet the existing A59 around 1km west of the junction at Blubberhouses. The option then follows the route of the existing A59 through Blubberhouses and on to Meagill Lane.

#### **Option 16**

Option 16 travels from Kex Gill Farm around 80m south of the existing bridleway, but following the same direction for around 1km, when the option turns north-east and crosses North Moor Road as it turns east. The option travels around 80m north of North Moor Road for another 900m, before turning south-east and descending down the side of the valley, about 250m North of the existing A59 for around 1.5km, before crossing Hall Lane and joining the existing A59 around 200m east of the Blubberhouses junction. The option then follows the route of the existing A59.

### *8.3.3 Options to South of Kex Gill Valley*

#### **Option 3**

Option 3 follows the route of the existing road heading south-east for about 500m past from Kex Gill Farm. Where the exiting road curves to travel north-east, Option 3 continues south-east until it is around 400m south of the existing road, and then travels east for about 2.5km, before curving north east, and joining the route of the existing road around 300m south west of the Blubberhouses junction. The option then follows the route of the existing road to Meagill Lane.

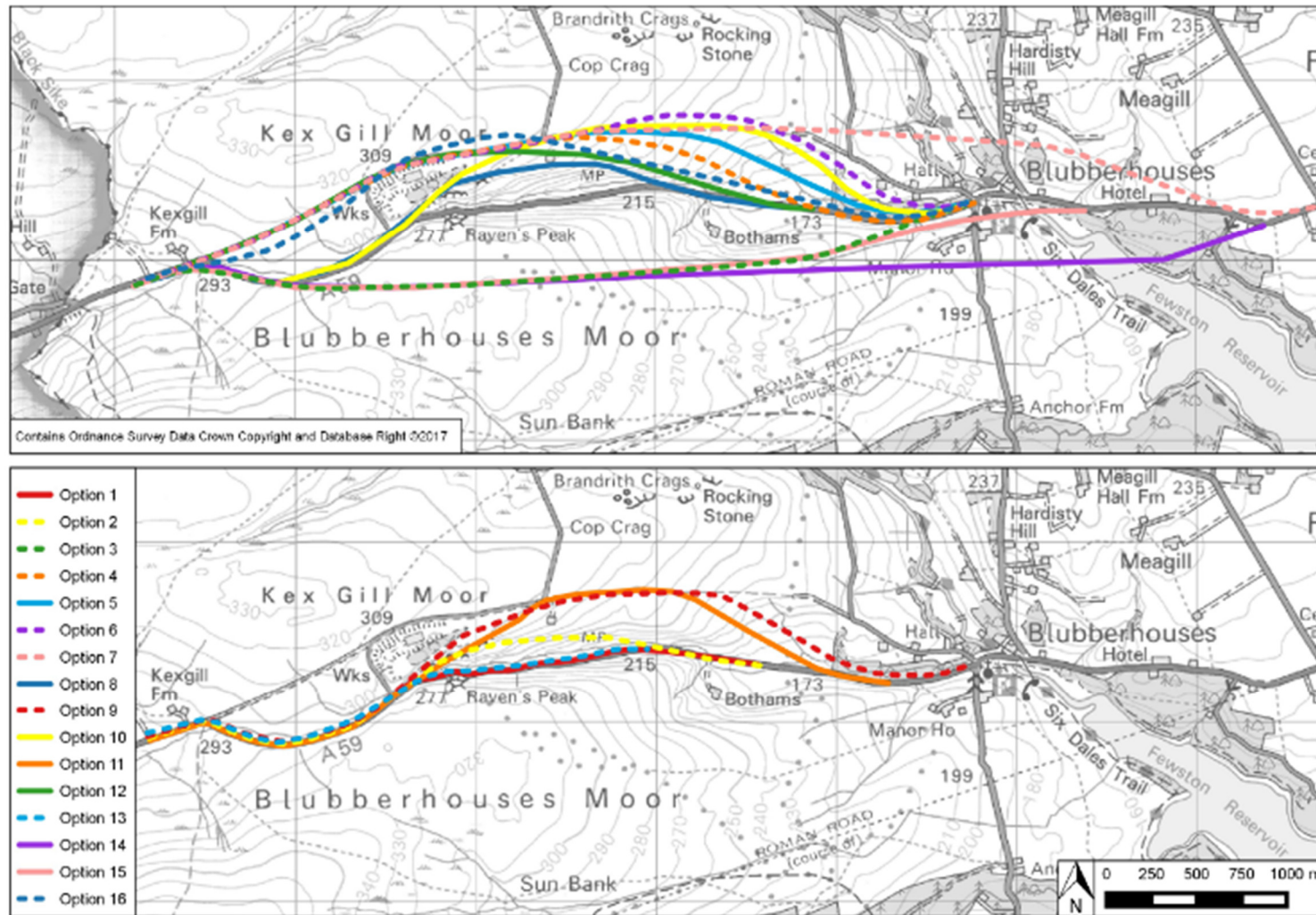
#### **Option 14**

Option 14 follows the route of the existing A59 south-east from Kex Gill Farm for about 500m. Where the existing route turns north-east, the option continues travelling east for around 3.8km, where the option crosses Shepherd Hill, around 350m south of Blubberhouses junction. After the junction the option continues east for around 500m, before crossing a new viaduct spanning about 370m over Fewston Reservoir. After the viaduct, the option curves north-east, passing over Busky Dike Lane, before meeting the existing A59 around 350m south west of Meagill Lane.

### **Option 15**

Option 15 follows the route of the existing A59 from Kex Gill Farm, heading south-east for about 500m, before travelling east where the existing road turns north-east. The option continues east for around 2.8km, before gradually turning north-east, and meeting Shepherd Hill around 100m south of the Blubberhouses junction. After the new junction, the option continues east for about 250m before crossing a new viaduct spanning about 200m over the River Washburn. The option then joins the existing A59 about 450m west of the Hopper Lane Hotel, before following the route of the existing A59 to Meagill Lane.

Figure 8-2 – 16 Options Schematic Plan



## 8.4 Corridors

Ahead of the sifting stage, which looks to use the DfT's Early Assessment and Sifting Tool (EAST) in order to shortlist preferred interventions, the 16 options were condensed into a series of corridors, given that many of the options were similar in alignment, thus allowing the EAST stage (which is a high level sift) to focus on shortlisting a preferred corridor(s).

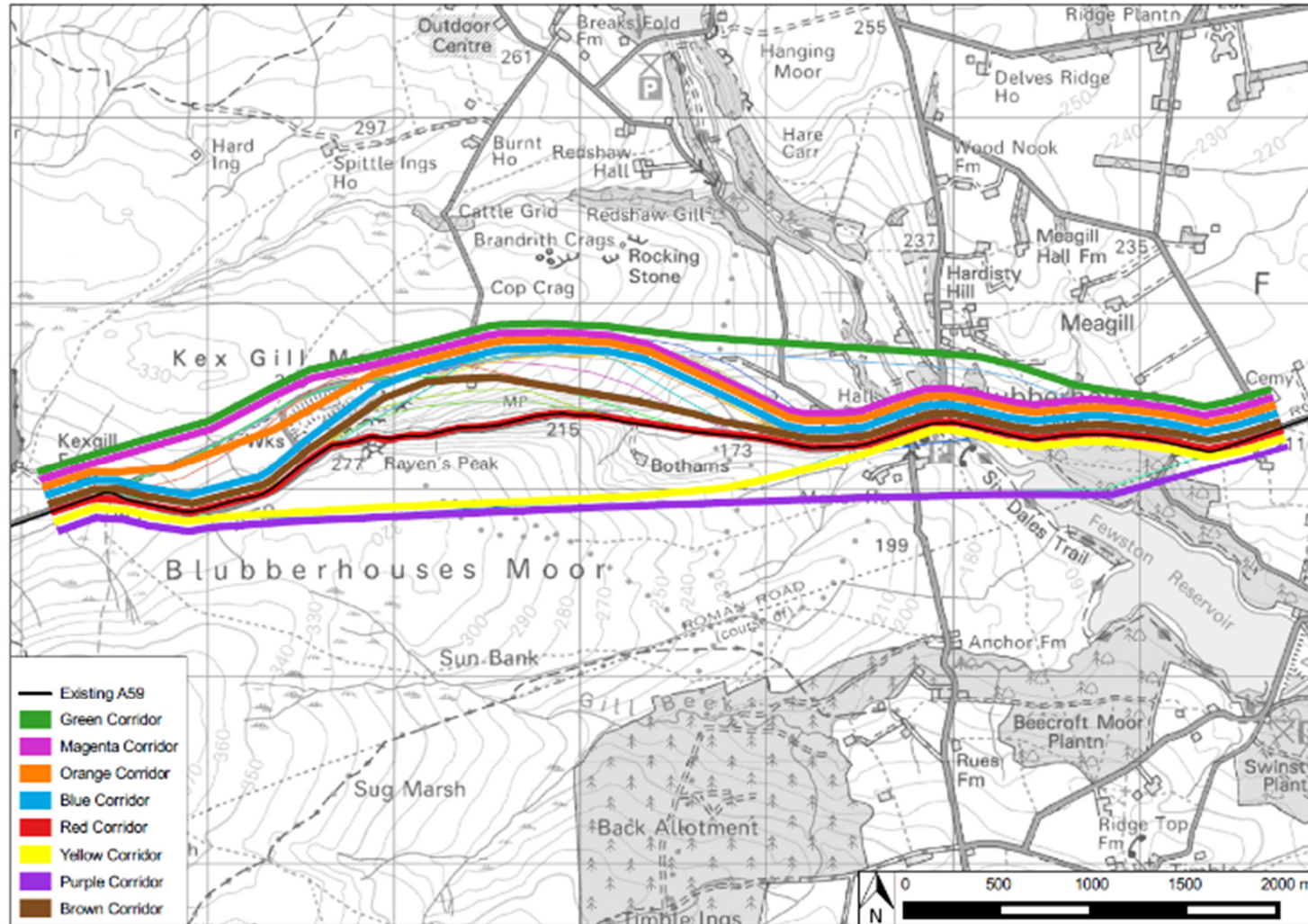
Table 8-1 summarises the eight corridors that have been developed as well as indicating the original options that broadly form each corridor. In addition, Figure 8-3 illustrates, schematically, the eight corridors that have been taken forward to be considered during the EAST based sifting exercise.

Table 8-1 – Corridor Descriptions

Corridor	Initial Option	Description
<b>Red</b>	1, 13	<ul style="list-style-type: none"> <li>- Smoothing the bend at Kex Gill Farm</li> <li>- Utilise existing A59 or improve its horizontal alignment, where the land slips have taken place, and provide geotechnical/structural protection.</li> </ul>
<b>Blue</b>	9, 10, 11	<ul style="list-style-type: none"> <li>- Smoothing the bend at Kex Gill Farm</li> <li>- Utilise existing A59 and create new alignment to the north of the valley, where the land slips have taken place, returning to existing A59 before Blubberhouse.</li> </ul>
<b>Yellow</b>	3, 15	<ul style="list-style-type: none"> <li>- Smoothing the bend at Kex Gill Farm</li> <li>- Utilise existing A59 and create new alignment to the south of the valley, above where the land slips have taken place, returning to existing A59 before or just after Blubberhouse.</li> </ul>
<b>Magenta</b>	4, 5, 6, 12	<ul style="list-style-type: none"> <li>- Start at Kex Gill Farm utilising the bridleway to take the corridor along the north edge of the valley beyond where the land slips have taken place before returning to the existing A59 before Blubberhouse.</li> </ul>
<b>Orange</b>	16	<ul style="list-style-type: none"> <li>- Start at Kex Gill Farm heading south of the bridleway to take the corridor along the north edge of the valley beyond where the land slips have taken place.</li> <li>- Maintain the corridor parallel with the existing A59 before returning to the existing A59 at Blubberhouse.</li> </ul>
<b>Green</b>	7	<ul style="list-style-type: none"> <li>- Start at Kex Gill Farm utilising the bridleway to take the corridor along the north edge of the valley beyond where the land slips have taken place.</li> <li>- Maintain the corridor parallel with the existing A59 and north of Blubberhouse and the Hopper Lane pub before returning to the existing A59 at the Meagill Lane junction.</li> </ul>
<b>Purple</b>	14	<ul style="list-style-type: none"> <li>- Smoothing the bend at Kex Gill Farm</li> <li>- Utilise existing A59 and create new alignment to the south of the valley, above where the land slips have taken place (Yellow Corridor), returning to existing A59 at Meagill Lane.</li> </ul>
<b>Brown</b>	2, 8	<ul style="list-style-type: none"> <li>- Smoothing the bend at Kex Gill Farm</li> <li>- Utilise existing A59 and create new alignment to the north of the existing alignment, midway up the valley, returning to existing A59 before Blubberhouses.</li> </ul>



Figure 8-3 – Schematic Plan of the Eight Corridors



## 9 Assessment and Sifting of Corridors

### 9.1 Overview

In order to determine the better performing interventions, a structured sifting process has been followed, in line with the DfT's Transport Appraisal Process guidance. The sifting of the corridors identified in the previous chapter, was undertaken using the DfT's EAST.

EAST is a tool that has been developed to summarise and present evidence on options in a clear and consistent format. This consistent approach supports decision making and aids comparison of how different interventions perform against a wide range of metrics. The EAST is designed to be consistent with the DfT's five case transport business case structure and considers the impact of the scheme under the following business case headings:

- Strategic;
- Economic;
- Managerial;
- Financial; and,
- Commercial.

The aim of the EAST based sifting is to present the strengths and weaknesses of each corridor in a consistent format that will allow the schemes to be compared and evaluated and conclusions drawn on which are the preferred corridor(s) which should be taken forward for further development and investigation.

### 9.2 Assessment Methodology

As detailed above, the EAST assessment examines the Strategic, Economic, Managerial, Financial and Commercial Cases for each corridor. Within each of these cases, there a series of metrics which each corridor is scored against. Table 9-1 summarises the metrics within each of the five cases and includes an outline of the scoring mechanism used to assess each corridor.

Table 9-1 – EAST Metrics

Case	Metric	Description	Scoring Mechanism
<b>Strategic</b>	Identification of the problems and objectives.	A description of the identified problems in the study area and the key scheme objectives.	Qualitative statement.
	Scale of impact.	An overall assessment of the impact of the scheme against the scheme objectives. (This assessment draws on the scores from a number of the EAST metrics to determine how the intervention meets the objectives of the scheme.	'1' (Very small) – '5' (Fully addresses the problem).
	Fit with wider transport and government objectives.	Assessment of the schemes fit with key transport and government objectives. Including: TfN – The Northern Transport Strategy: One Agenda. One Economy. One North YNYER LEP – SEP and Local Growth Deal NYCC – LTP4, Strategic Transport Prospectus, Emerging Minerals and Waste Plan Metro – West Yorkshire LTP WYCA – Transport Strategy HBC – Local Plan, Core Strategy. Corporate Plan, Emerging Local Plan CDC – Council Plan, Local Plan, Emerging Local Plan LCC – Core Strategy CBMDC – Replacement UDP, Emerging Local Plan. Nidderdale AONB – Management Plan	'1' (Poor fit) – '5' (Excellent fit).
	Fit with other objectives	Assessment of the schemes fit with key transport and government objectives.	Not assessed. All relevant policy objectives assessed in previous category.
	Key uncertainties.	Summary of the key uncertainties relating to the strategic objectives and the assumptions that have been made.	Qualitative statement.

Case	Metric	Description	Scoring Mechanism
	Degree of consensus over outcomes.	Assessment of the level consultation that has taken to place and/or the level of agreement around the impact of the intervention.	'1' (Little/no consultation/High level of disagreement) – '5' (Extensive consultation/High degree of consensus)
<b>Economic</b>	Economic growth.	Assessment of the impact of the scheme on: <ul style="list-style-type: none"> <li>- Connectivity.</li> <li>- Reliability.</li> <li>- Resilience.</li> <li>- Delivery of housing.</li> <li>- Wider economic impacts.</li> </ul>	RAG <sup>41</sup> scoring. ('1' Red – '5' Green). See Appendix 3 for further details.
	Carbon emissions.	Assessment of the impact of the scheme on: <ul style="list-style-type: none"> <li>- Activity.</li> <li>- Embedded carbon.</li> <li>- Carbon content.</li> <li>- Efficiency.</li> <li>- Overall effect on carbon emissions.</li> </ul>	RAG scoring. ('1' Red – '5' Green). See Appendix 3 for further details.
	Social and distributional impacts.	Assessment of the impact of the scheme on: <ul style="list-style-type: none"> <li>- Social and distributional impacts (Air Quality/Noise).</li> <li>- Economy.</li> <li>- Severance/Accessibility.</li> <li>- Safety.</li> </ul>	RAG scoring. ('1' Red – '5' Green). See Appendix 3 for further details.
	Local environment.	Assessment of the impact of the scheme on: <ul style="list-style-type: none"> <li>- Air quality.</li> <li>- Noise.</li> <li>- Natural environment, heritage and landscape.</li> <li>- Streetscape and urban environment.</li> </ul>	RAG scoring. ('1' Red – '5' Green). See Appendix 3 for further details.
	Wellbeing.	Assessment of the impact of the scheme on:	RAG scoring. ('1' Red – '5' Green).

<sup>41</sup> RAG 5 level scoring system: Red, Red/Amber, Amber, Amber/Green, Green

Case	Metric	Description	Scoring Mechanism
		<ul style="list-style-type: none"> <li>- Physical activity.</li> <li>- Injury or death.</li> <li>- Severance.</li> <li>- Crime.</li> <li>- Access to a range of goods, services, people and places.</li> </ul>	See Appendix 3 for further details.
	Expected VfM category.	Discussion on the potential VfM category for the intervention (i.e. the BCR) <sup>42</sup> .	RAG (1 red to 5 green)
<b>Financial</b>	Affordability.	Assessment of affordability, the estimated scheme cost against the level of funding anticipated.	'1' (Not Affordable) – '4' (Affordable).
	Capital cost.	Consideration of the estimated capital cost for delivery of the intervention.	'1' (£100m+) – '4' (<£30m).
	Revenue cost.	Consideration of the estimated revenue cost for the operation/maintenance of the intervention.	'0' (continued high maintenance and monitoring costs) – '1' (reduced maintenance and monitoring costs).
	Cost profile.	Qualitative statement regarding the anticipated profile of scheme costs, both capital and revenue.	Qualitative statement.
	Overall cost risk.	Assessment of the key areas of risk associated with assumptions informing the cost estimates. Summary of the level of risk and uncertainty contained within the estimates (e.g. level of optimism bias, proportion of contingency/uncertainty allowance).	'1' (High Risk) – '5' (Low Risk).
<b>Management</b>	Implementation timetable.	Estimate of the timescales for implementation, from inception through to delivery.	'1' (54-60 months) – '10' (0-6 months).
	Public acceptability.	Assessment of the level of public acceptability associated with the scheme, including the likely issues of importance to the public.	'1' (Low) – '5' (High).

<sup>42</sup> Note, at this stage of the study, it has not been possible to calculate actual Benefit Cost Ratios.

Case	Metric	Description	Scoring Mechanism
	Practical feasibility.	Assessment of the practical feasibility of delivering the option, including consideration of the statutory powers needed, planning implications and the construction/engineering feasibility of delivering the option.	'1' (Low) – '5' (High).
	Quality of supporting evidence.	Consideration of the quality/applicability of the information used as part of the scheme development and assessment.	'1' (Low) – '5' (High).
	Key risks.	Summary of the key scheme risks to the delivery of the intervention.	Qualitative statement.
Commercial	Flexibility of option.	Assessment of the extent to which the intervention can be scaled up or down, depending on the level of funding available, or amended to fit with changing circumstances.	'1' (Static) – '5' (Dynamic).
	Where is funding coming from?	Qualitative statement regarding the funding of the investment/operation costs for the intervention and the level of certainty.	Qualitative statement.
	Any income generated?	High level estimate of the level of income generated, if applicable.	Yes/No.



### 9.3 EAST Assessment Results

The following paragraphs provide a summary of the scoring for each of the eight corridor against each metric within the five cases. Table 9-2 provides an overall summary of the results of the EAST assessment of the eight corridors. Appendix 4 contains the full EAST assessment for each of the eight corridors.

#### 9.3.1 Strategic Case

**Scale of Impact** – the scale of impact has been assessed based on how each corridor scored against the specific scheme objectives, identified in Section 7:

- Prevent any future landslip related closures of the A59 at Kex Gill.
- Improve journey time reliability and journey times on the A59 between Skipton and Harrogate.
- Reduce road accident casualties.
- Reduce the volume of traffic using diversion routes in the event of a landslip at Kex Gill.
- Minimise environmental impact of the A59 route on the built and natural environment.
- Reduce the impact of scheduled/unscheduled maintenance on A59 users and communities on diversion routes.
- Reduce the financial impact of scheduled/unscheduled maintenance on NYCC.

Overall the Blue, Yellow, Magenta, Orange, Green and Purple corridors scored positively against these objectives, with the exception of the objective to minimise environmental impact, given the need for offline construction in an environmentally sensitive area. The Brown and Red corridors did not fit as well with the objectives, primarily due to the fact that their alignment continues to be within the area of landslip risk and the associated adverse effect of this on the majority of objectives.

**Fit with wider transport and government objectives and other objectives** – for this metric a number of regional and local policies and strategies have been reviewed in order to determine how well each corridor aligns with key strategic objectives, including:

- Economic growth.
- Connectivity.
- Safety.
- Maintaining, protecting, and enhancing environmental quality.

- Accessibility.
- Resilience.

Offline corridors (Blue, Yellow, Magenta, Orange, Green and Purple) align well with the majority key policies and strategies with the exception of those regarding the environment, given the need for construction in environmentally sensitive areas. The Brown and Red corridors do not score as well, given that they would be located in the area of landslip risk, therefore continue to have significant risks associated with safety and resilience of the route and therefore connectivity and economic growth.

**Key Uncertainties** – a qualitative assessment has considered the key uncertainties associated with development of an intervention. It is considered that these are equally applicable to each corridor. The key uncertainties include:

- **Scheme costs** – the cost estimates are high level in nature and based on limited information, particularly regarding ground conditions.
- **Funding availability** – funding is not committed.
- **Future landslip frequency/severity** – the frequency/severity of future landslips is an unknown quantity.
- **Ground conditions** – there is potential for unforeseen issues, including uncertain depth of soft soil, ground instability, bedrock conditions and groundwater conditions.
- **Acceptability** – stakeholder/public support for scheme is not currently fully understood.
- **Level of benefits** – the level of benefits has not been quantified at this stage.

**Degree of consensus over outcomes** – All corridors score the same for this metric. No public consultation has taken place to date and limited stakeholder engagement has been undertaken. Whilst it is considered that there is broad support for intervention to address the issues of landslips at Kex Gill at associated closure of the A59, it is not known whether there is a strong consensus for particular corridor, or indeed whether the solution should be offline or online.

### 9.3.2 *Economic Case*

**Economic Growth** – Appendix 3 sets out the factors considered as part of the assessment of economic growth. Based on the EAST RAG<sup>43</sup> scoring assessment the Blue, Yellow, Magenta, Orange, Green and Purple corridors score an Amber/Green rating, as they each demonstrate an improvement in connectivity, reliability and

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<sup>43</sup> RAG 5 level scoring system: Red, Red/Amber, Amber, Amber/Green, Green

resilience in the study area. The Brown and Red corridors score an Amber rating, as these corridors are located in the area of landslips risk and therefore cannot be guaranteed to provide a significant improvement in connectivity, reliability and resilience.

**Carbon Emissions** – Appendix 3 sets out the factors considered as part of the assessment of carbon emissions. The RAG scoring identified Blue, Yellow, Magenta, Orange, Green and Purple corridors as having an Amber rating, as emissions are considered to largely remain the same albeit there would be a slight improvement as a result of improved fuel efficiency on a smoother route and reduced risk of long diversions. The Red and Brown corridors will still be at risk of closure due to landslip events and so no benefits are expected, as such, a rating of Red/Amber has been applied. All corridors will result in embedded carbon due to the large scale construction work required. In addition, none of the corridors will impact on the update of a lower carbon content fuel.

**Social and Distributional Impacts (SDI)** – Appendix 3 sets out the factors considered as part of the assessment of SDI impacts. Based on the RAG scoring assessment, the Blue, Yellow, Magenta, Orange, Green and Purple corridors are anticipated to offer the best level of SDI impacts. This is due to the improved safety, connectivity and accessibility and reduction in severance associated with providing an alignment outside of the main area of landslip risk. In addition, the improved connectivity and resilience they offer may have some impact on any regeneration and economic growth. Conversely, the Red and Brown corridors do not score as well, as they continue to be affected by the adverse impacts associated with being located in the landslip risk area.

**Local Environment** – Appendix 3 sets out the factors considered as part of the assessment of local environment. The assessment of this metric concluded that the Red Corridor had an Amber rating, given the route will not represent significant change to existing conditions and avoids substantial new construction within the environmentally sensitive areas. The Blue, Magenta and Orange corridors score an Amber/Red rating as they are expected to adversely impact on the environmentally sensitive areas. The Yellow, Green and Purple routes have the most adverse score, a Red rating. This is primarily due to extensive construction required within environmentally sensitive areas.

**Wellbeing** – Appendix 3 sets out the factors considered as part of the assessment of wellbeing. Based on the RAG assessment for this metric, the Red and Brown corridors received an Amber rating, largely as a result of there being no improvement in severance, injury and accessibility factors as a result of the implementation of these corridors, as they remain in the main area of landslip risk. The remaining corridors score an Amber/Green rating, as they should all help reduce accidents along the route as well as providing a reduced risk of severance and improved accessibility through being located outside the landslip risk area.

**Value for Money (VfM)** – At this stage of the study it is not possible to develop an accurate assessment of the VfM of a corridor. Whilst high level indicative scheme cost estimates have been produced, in the absence of a suitable traffic model, it has not been possible to quantify the level of benefits offered by any corridor. This will be a key area of development as the study progresses.

### 9.3.3 *Financial Case*

**Capital Cost** – High level capital cost estimates<sup>44</sup> have been prepared for the construction of each corridor, including the following elements:

- Roadworks
- Structures
- Preliminaries
- Accommodation works
- Contingencies (10%)
- Other major items
- Works by others
- Land costs
- Preparation, design, management, supervision
- Risk allowance
- Optimism bias (45%)
- Inflation
- Non recoverable VAT.

The analysis demonstrated that the Blue, Magenta, Orange, Red and Brown corridors are have capital costs in the range of £30-£70m and are therefore considered to be affordable. Capital costs for the remaining corridors are in excess of £70m and therefore become increasingly unaffordable.

**Revenue Costs** – At this stage it has not been possible to develop accurate assessments of the maintenance, operating and monitoring costs for each corridor. What is known is that NYCC currently deems the existing route to be a high

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<sup>44</sup> *The capital cost estimates are developed for each of the 16 options. Based on these estimates, capital cost ranges are developed for each corridor.*

maintenance route and spends a significant proportion of its maintenance budget monitoring and maintain the route in the landslip risk area. In addition, the remedial works necessary after a landslip are an additional cost. Consequently, the Red and Brown corridors<sup>45</sup> are anticipated to continue to have high revenue costs associated with them, as they remain within the area of landslip risk. All other corridors are assumed to offer a lower level of revenue cost, given that they will be outside of the area of landslip risk<sup>46</sup>.

**Affordability** – At this stage, the assessment of affordability has been based on the level of funding available, relative to the anticipated capital costs of each corridor<sup>47</sup>. The DfT has established a fund/budget for resilience schemes across the country and it is considered that a scheme at Kex Gill could be a strong contender for a financial contribution from this fund. The Blue, Magenta, Orange, Red and Brown corridors are have capital costs in the range of £30-£70m and are considered to be affordable. Capital costs for the remaining corridors are in excess of £70m and therefore become increasingly unaffordable.

**Cost Profile** – At this stage of the study, no cost profiles have been developed for corridors. Whilst high level cost estimates have been developed for each corridor, further detailed consideration of the ground conditions and construction approach is needed before accurate cost profiles can be developed.

**Cost Risks** – In terms of cost risk, a high degree of risk exists for all corridors. The initial estimates developed for both capital and revenue costs are at high level and there is large uncertainty surrounding the inputs, particularly the known ground conditions for the majority of the study area, which have the potential to have a significant impact on the earthworks related costs. Given the high level of uncertainty, the capital costs developed include:

- Contingencies 10%.
- Optimism Bias 45%.

#### 9.3.4 *Management Case*

**Implementation** – High level implementation timeframes have been produced to assess the corridors ability to be delivered in line with indicative funding timeframes (i.e. construction by 2019/2020). This has included a consideration of the timescales associated with preliminary design, detailed design, statutory procedures,

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<sup>45</sup> Even if slope stabilisation schemes are implemented, the risk of landslip risk remains and NYCC will continue to have to monitor the route closely at a cost.

<sup>46</sup> It is assumed that for all offline corridors, the existing A59 alignment will be completely removed. New access for existing properties will be incorporated into the new designs.

<sup>47</sup> Revenue costs have not been considered in the assessment of affordability as it is anticipated that these would be funded through NYCC maintenance budgets.

construction preparation and construction itself. The Blue and Brown corridors score the highest due to the fact they have the shortest timeframes for implementation. Yellow, Green and Purple corridors have the lowest score as they have the longest implementation timeframe.

**Public Acceptability** – To date, there has been no public engagement regarding proposals. However, in line with the EAST guidance the assessment looked to consider whether there were likely to be any issues around public acceptability. This included consideration of the following factors:

- Requirement for construction in environmentally sensitive areas (e.g. SSSI, AONB, SAC, SPA).
- Providing a route free of the risk of landslip.
- Avoidance of disruption during construction.
- Delivery of improved route resilience and journey time reliability.
- Distance from existing properties/structures.
- Likelihood of the need for a Public Inquiry.

Blue, Magenta and Orange corridors performed the best when considered against these issues, as they were deemed to positively align with the factors identified, with the exception that they would involve construction in the environmentally sensitive areas and would be likely to require the need for a Public Inquiry. The Red and Brown corridors had the lowest scores, mainly due to the fact that they would continue to be located in the main area of landslip risk. It is assumed that the public would look extremely unfavourably on the spending of funds to deliver a route which would still carry the risk of being impacted by future landslips.

**Practical Feasibility** – A wide range of factors were considered in the assessment of the practical feasibility for each corridor, including:

- Type of option tested and proven to be practical and effective.
- Statutory powers and governance/legal protocols in place.
- Planning implications.
- High level assessment of ground conditions:
  - Extensive peat deposits with water courses crossing route causing stability/drainage issues.
  - Deep soft ground deposits at western end of Kex Gill, potential for large embankment settlements.



- Construction of embankment's over soft ground in valley floor in vicinity of Blubberhouses.
- Online construction on existing A59 between Kex Gill Farm and Blubberhouses
- Stabilisation of existing landslip features.
- Ability to use the existing A59 alignment as a diversion route during construction.
- Need for extensive structures.
- Need for departures from standard.

Based on the assessment of the above factors the Blue, Magenta and Orange corridors scored the best against this metric, primarily due to the ground conditions along their alignments, the ability to keep the existing route open during construction and the fact that, compared to some other corridors, the need for extensive structures was lower. Conversely Green and Purple corridors scored the lowest due to the need for large structures and the problematic ground conditions along sections of their alignments.

**Quality of supporting evidence** – the quality of supporting evidence informing the analysis of corridors is considered to be appropriate at this stage and the same score has been afforded for all corridors. In summary:

- For this stage of the study, there is a good level of information available regarding accidents, traffic flows, journey times, journey time reliability, closures of the road (including costs and durations).
- Mapping and highway related data available for developing conceptual designs (appropriate for this stage of the study) is also good.
- The environmental analysis has been undertaken as a desktop based exercise, appropriate to this stage of the study, and provides the necessary level of data to enable an understanding of the key environmental sensitivities.
- The quality of the available geotechnical data is mixed:
  - Ground Conditions - poor quality evidence – generally reliant on geological maps and site walkover inspection.
  - Landslip activity – good records of locations of existing landslide activity but lacking detail of ground conditions and landslip mechanisms.

- Groundwater conditions: Poor quality of evidence. Some anecdotal evidence along Red corridor<sup>48</sup>.

**Key Risks** – An assessment of the key risks has been undertaken, these are considered to be equally applicable to each corridor at this point in the study:

- Cost/affordability – DfT funding allocation for this scheme is not committed. Risk that scheme costs are in excess of any allocated funding and will therefore require additional funding to be secured.
- Acceptability – Stakeholder/public support is not known at this stage. Potential for adverse reaction to construction in the environmentally sensitive areas.
- Consents/Approvals – Statutory procedures need to be followed and permissions secured. It is likely that a Public Inquiry will be needed for the majority of corridors. Business case approval will also be required to secure DfT funding.
- Ground conditions:
  - Risk of future landslip events (low risk).
  - Unforeseen ground conditions
  - Increased earthworks construction costs
  - Increased cost of structural foundations
  - Increased drainage costs – relating to groundwater conditions
  - Future maintenance costs.
- Design – Uncertainties relating to ground conditions and statutory undertakers can impact design suitability.
- Construction programme and contractual risks – Risks associated with procurement and timely implementation of the scheme exist.

### 9.3.5 Commercial Case

**Flexibility of option** – The assessment of the flexibility of each corridor has considered a number of factors including:

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<sup>48</sup> Note that the ongoing GI on the central area of the Red corridor will provide extra data in the coming months.

- Degree to which elements of the scheme can be de-scoped, or the alignment amended, as a result of changing circumstances.
- Requirement for large/complex structures as part of the scheme.
- Ability to keep the existing A59 route open for a significant proportion of the construction timescale.
- Degree to which the corridor can be future proofed (e.g. widened, NMU provision enhanced).

Based on an assessment of these factors, it was concluded that the Blue, Yellow, Magenta and Orange corridors offered the best level of flexibility, whilst the Brown and Red corridors were considered to be the least flexible.

**Where is the funding coming from** – As previously outlined, the DfT has established a fund/budget for resilience schemes across the country and it is considered this scheme is a strong contender for receiving some funding<sup>49</sup>. The exact requirements for securing the funding (e.g. level of business case/competitive tender) are still to be confirmed. It is anticipated that NYCC would need to fund any additional cost over and above the potential funding from the DfT. Given the nature of the scheme, developer/private contributions are unlikely. This is equally applicable to all corridors.

**Income Generated** – As there are no plans to introduce any form of user charging along this section of the A59 (e.g. tolling), none of the corridors are expected to generate any income.

#### 9.4 Overall Results of Initial EAST Sift

Table 9-2 presents a summary of the EAST assessment of the seven corridors.

Table 9-2 – EAST Corridor Assessment Results

Case	Indicator	Scale	Corridor								
			R	B	Y	M	O	G	P	Br	
Strategic	Scale	1 (small) to 5 (significant)	2	4	4	4	4	4	4	4	2
	Fit with wider transport and government objectives	1 (low) to 5 (high)	3	4	4	4	4	4	4	4	3
	Fit with other objectives	1 (low) to 5 (high)	Not assessed.								
	Key uncertainties	Qualitative	Scheme costs; funding availability; ground conditions; future landslip frequency/severity; acceptability; level of benefits.								

<sup>49</sup> One of the requirements of the funding is that it must be spent by the end of the 2019/20 financial year.

Case	Indicator	Scale	Corridor							
			R	B	Y	M	O	G	P	Br
	Consensus over outcomes	1 (little) to 5 (majority)	2	2	2	2	2	2	2	2
Economic	Economic growth	RAG scale	A	A/G	A/G	A/G	A/G	A/G	A/G	A
	Carbon emissions		R/A	A	A	A	A	A	A	R/A
	SDI		A	A/G	A/G	A/G	A/G	A/G	A/G	A
	Local environment		A	R/A	R	R/A	R/A	R	R	R/A
	Wellbeing		A	A/G	A/G	A/G	A/G	A/G	A/G	A
	Expected VfM	1 (poor) to 5 (very high)	Not assessed.							
Financial	Affordability	1 (not affordable) to 4 (affordable)	3	3	2	3	3	1	1	3
	Capital cost (£m)	1 (£100m+) to 4 (<£30m)	3	3	2	3	3	1	1	3
	Revenue cost (£m)	1 (£1000m+) to 10 (£0m)	0	1	1	1	1	1	1	0
	Cost profile	Qualitative	Cost profiles not developed at this stage.							
	Overall cost risk	1 (high risk) to 5 (low risk)	1	1	1	1	1	1	1	1
Management	Implementation timetable	1 (10+ years) to 7 (0-1 month)	3	4	2	3	3	2	2	4
	Public acceptability	1 (low) to 5 (high)	2	4	3	4	4	3	3	2
	Practical feasibility	1 (low) to 5 (high)	3	4	3	4	4	2	2	3
	Quality of supporting evidence	1 (low) to 5 (high)	3	3	3	3	3	3	3	3
	Key risks	Text field	Costs/affordability; acceptability; consents/approvals; ground conditions; design; construction programme and contractual							
Commercial	Flexibility of option	1 (static) to 5 (dynamic)	2	4	4	4	4	3	3	2
	Where is funding coming from	Text field	DfT £100m resilience fund established. Kex Gill scheme is a strong contender for receiving a contribution from this fund. NYCC to fund any additional costs.							
	Income generated	Yes/No	No	No	No	No	No	No	No	No

Table 9-2 demonstrates that the Blue, Magenta and Orange corridors are amongst those which score positively against many of the EAST metrics. In particular, the assessment has demonstrated that these corridors fit well with government and wider transport objectives and demonstrates a significant positive impact in terms of economic growth, wellbeing, and SDI impacts, offering improved resilience, connectivity, reliability and safety. These factors also mean that these corridors score well in terms of their scale of impact, meeting the specific scheme objectives, in particular, removing the risk of landslip related closures of the A59. These three corridors are considered to be some of the more affordable corridors, demonstrate some of the shortest implementation timescales and offer a good degree of flexibility,

should wider circumstances change. The key disadvantage associated with these corridors is in relation to the need for construction within environmentally sensitive area, a key drawback of all of the offline highway interventions, though the degree of opposition to this is unknown, as stakeholder engagement is only just beginning. Despite this, these corridors are among those anticipated to be most acceptable to the public. Overall the Blue, Magenta and Orange corridors are deemed to be the best performing corridors.

Whilst the Yellow, Green and Purple corridors also score well against many of the same metrics analysed, there are several key reasons why, overall, they are not considered to be amongst the better performing corridors. The analysis of capital costs has demonstrated these corridors would require a step change in the level of funding, being in excess of £70m and in the case of the Green and Purple corridors, in excess of £100m. This means that they are deemed to be increasingly unaffordable, particularly as it is considered that they are unlikely to offer as marked an increase in the level of benefits over other, cheaper corridors, though this is still to be analysed in detail<sup>50</sup>. In addition, the implementation timescales are shown to be longer than that of other corridors. However, the key adverse factor associated with these corridors is the significant adverse impact on environmentally sensitive areas resulting from the extensive construction in areas designated as AONB, SSSI, SPA and SAC. This factor also manifests itself in a lower public acceptability scores. Finally, the practical feasibility of delivering these corridors is lower, partly due to the need to deal with extensive peat deposits with water courses crossing route causing stability/drainage issues and, in the case of the Green and Purple corridors, the need for large structures.

The Brown corridor, whilst being amongst the corridors deemed to be most affordable and having one of the shortest implementation timescales, does not score well in terms of scale of impact, failing to substantively meet many of the scheme objectives, primarily as it is located in an area of continues landslip risk and therefore offer little in the way of increased resilience, reliability, connectivity or safety. This factor manifest itself in low scores against many of the Economic Case metrics too. In addition, the corridor still requires construction in an environmentally sensitive area, though not on the scale of Yellow, Green and Purple corridors. The fact that this corridor involves construction in the AONB, SSSI, SPA and SAC whilst still being subject to the same landslip risks as the current route, means that this corridor is considered to be one of the worst performing in terms of public acceptability.

The Red Corridors is a predominantly online corridor, as such, its key strength is that it avoids extensive construction within the environmentally sensitive areas of the study area. Furthermore, it is amongst the more affordable corridors and has similar implementation timescales to others. However, as the corridor continues to be located in an area of continuing landslip risk it scores poorly against many of the

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<sup>50</sup> *It has not been possible to assess Value for Money (VfM) at this stage. In the absence of a suitable traffic model, it has not been possible to quantify the level of benefits offered by any corridor.*

metrics, in particular many of those within the economic case and the overall scale of impact, based on its limited impacts on the scheme objectives, as a result of offering little in the way of resilience, reliability, connectivity or safety improvements. These factors, combined with the fact that its construction would see extensive disruption to A59 users, as an extensive diversion would need to be put in place, means that the public acceptability of this corridor is low. The inability to use the existing A59 as a diversion route during construction also means that this corridor scores poorly in terms of flexibility and practical feasibility.

In summary, the Blue, Magenta and Orange corridors are deemed to be the preferred corridors, warranting further investigation. Conversely, the Yellow, Green, Purple, Brown and Red corridors are not considered to warrant any further development or consideration. The Red and Brown corridors continue to be located in an area of significant landslip risk and therefore fail to address the principal aim of an intervention, continuing to be subject to the same risks and issues which currently exist. Whilst Yellow, Green and Purple corridor offer many of the advantages of the Blue, Magenta and Orange corridors, the involve extensive construction in an environmentally significant area and involve a step change in the level of funding required, being in excess of £70m, whilst being unlikely to offer any comparable increase in the level of benefits.

# Appendices