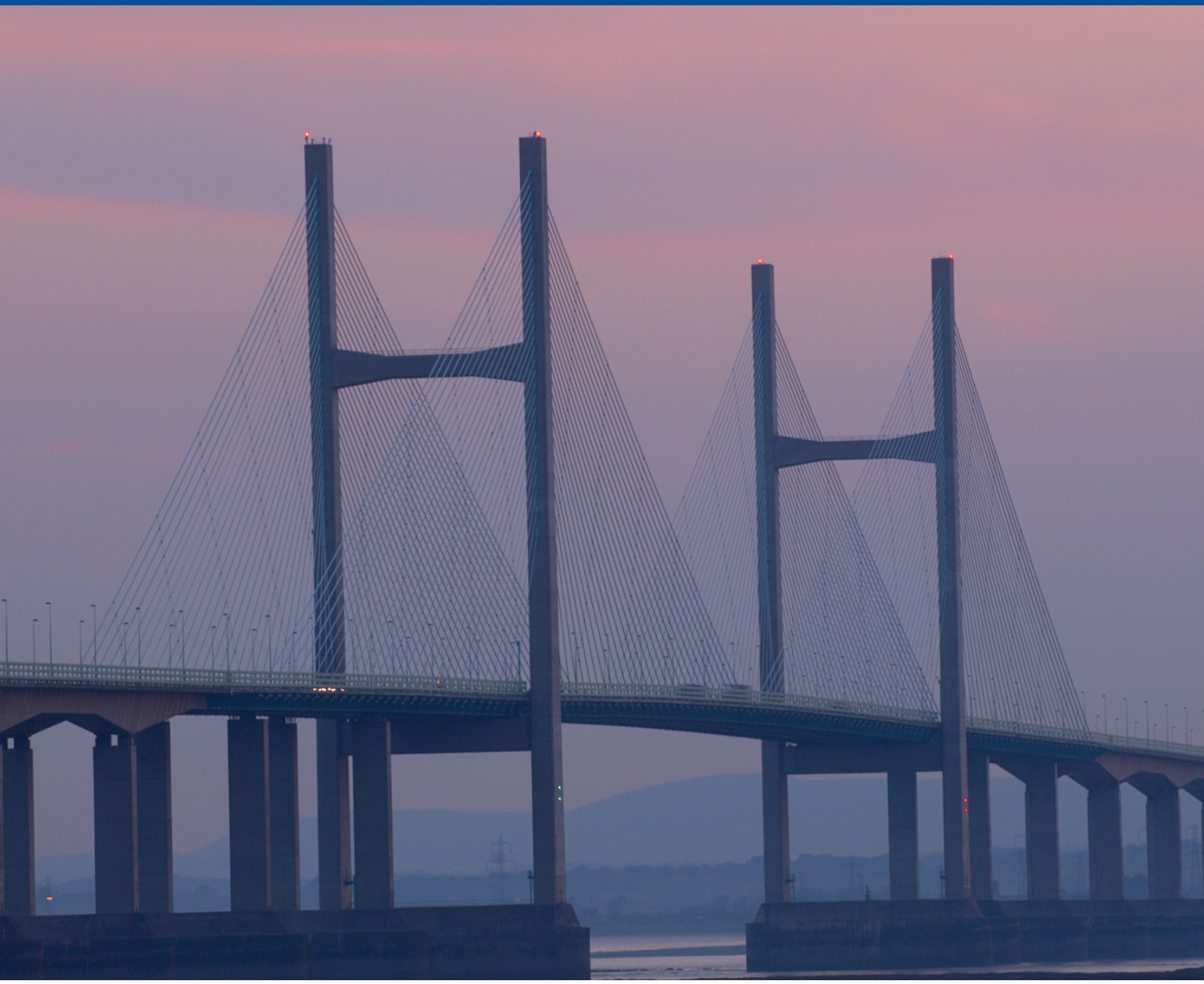
HIGHWAYS AGENCY

Safe roads, reliable journeys, informed travellers

London to Wales Route Strategy Evidence Report

April 2014



An executive agency of the Department for Transport

Document History

London to Wales route-based strategy evidence report

Highways Agency

This document has been issued and amended as follows:

Version	Date	Description	Author	Approved by
1	18/11/13	Draft of Chapters 1 & 3	Ian Parsons	Andrew Page-Dove
2	19/11/13	Revised Draft Chapters 1 - 3	Ian Parsons	Andrew Page-Dove
3	27/11/13	Revised Draft Chapters 1 - 3	Ian Parsons	Andrew Page-Dove
4	03/12/13	First draft issue to Highways Agency Chapters 1 - 4	Ian Parsons	Andrew Page-Dove
5	02/01/14	Report with amendments in progress	Ian Parsons	Andrew Page-Dove
6	09/01/14	New Template	Ian Parsons	Andrew Page-Dove
7	16/01/14	Final draft for publication	Agency SW RBS Team	Andrew Page-Dove
8	31/01/14	Final draft for stakeholders	Agency SW RBS Team	Annabelle Dexter
9	04/04/14	Final for publication	Agency SW RBS Team	Annabelle Dexter

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1 Introduction

1.1 Background

1.1.1 The Highways Agency is responsible for planning the long term future and development of the strategic road network.

1.1.2 Route-based strategies (RBSs) represent a fresh approach to identifying investment needs on the strategic road network. Through adopting the RBS approach, we aim to identify network needs relating to operations, maintenance and where appropriate, improvements to proactively facilitate economic growth.

1.1.3 The development of RBSs is based on one of the recommendations included in Alan Cook's report *A Fresh Start for the Strategic Road Network*, published in November 2011. He recommended that the Highways Agency, working with local authorities (LAs) and local enterprise partnerships (LEPs), should initiate and develop route-based strategies for the strategic road network.

1.1.4 The then Secretary of State accepted the recommendation in the Government's response (May 2012), stating that it would enable a smarter approach to investment planning and support greater participation in planning for the strategic road network from local and regional stakeholders.

1.1.5 The Highways Agency completed the following three pilot strategies which have been published on the Agency website:

- A1 West of Newcastle
- A12 from the M25 to Harwich (including the A120 to Harwich)
- M62 between Leeds and Manchester.

1.1.6 Building on the learning from those pilot strategies, we have divided the strategic road network into 18 routes. A map illustrating the routes is provided in Appendix A. The London to Wales route is one of that number.

1.1.7 RBSs are being delivered in two stages. Stage 1 establishes the necessary evidence base to help identify performance issues on routes and anticipated future challenges, takes account of asset condition and operational requirements, whilst gaining a better understanding of the local growth priorities.

1.1.8 In the second stage we will use the evidence to take forward a programme of work to identify possible solutions for a prioritised set of challenges and opportunities. It is only then that potential interventions are likely to come forward, covering operation, maintenance and if appropriate, road improvement schemes.

1.1.9 The RBS process will be used to bring together national and local priorities to inform what is needed for a route, while delivering the outcomes in the performance specification.

1.1.10 Using the evidence base and solutions identification studies, we will establish outline operational and investment priorities for all routes in the strategic road network for the period April 2015 – March 2021. This will in turn feed into the Roads Investment Strategy, announced by the Department for Transport in Action for Roads.

1.2 The scope of the stage 1 RBS evidence report

1.2.1 During the first stage of RBS, information from both within the Agency and from our partners and stakeholders outside the Agency has been collected to gain an understanding of the key operational, maintenance and capacity challenges for the route. These challenges take account of the possible changes that likely local growth aspirations, or wider transport network alterations will have on the routes.

1.2.2 The evidence reports:

- Describe the capability, condition and constraints along the route.
- Identify local growth aspirations.
- Identify planned network improvements and operational changes.
- Describe the key challenges and opportunities facing the route over the five year period.
- Give a forward view to challenges and opportunities that might arise beyond the five year period.

1.2.3 The 18 evidence reports across the strategic road network will be used to:

- Inform the selection of priority challenges and opportunities for further investigation during stage 2 of route-based strategies.
- Inform the development of future performance specifications for the Highways Agency.

1.2.4 A selection of the issues and opportunities identified across the route are contained within this report, with a more comprehensive list provided within the technical annex. This is for presentational reasons and is not intended to suggest a weighting or view on the priority of the issues.

1.2.5 The evidence reports do not suggest or promote solutions, or guarantee further investigation or future investment.

1.3 Route description

1.3.1 The London to Wales route is predominantly formed from the east-west M4 corridor, but also incorporates five additional corridors that connect

to the M4, these being the M48, M49, M32, A404/A404(M) and A308(M). Figure 1 shows the extent of the route.

1.3.2 The M4 is one of the key radial access routes to/from the capital city. It is also recognised that the route has a function and importance to the areas along the route but furthermore in the connections it provides to the regions beyond (including the South West and South Wales). The route is of critical importance to the growth agenda identified within the Local Plans of LAs, but also the aspirations of the LEPs for which strategic access is key in driving growth and ensuring a balance of opportunities across the country. Added to this is the fact that the route offers one of only two strategic routes between London and the South West region and the importance of network resilience in this respect.

1.3.3 Bristol and Greater London are two of the ten largest urban areas in England, and form two of the major attractors on this route, creating very distinct travel patterns. At the eastern extent of the route there are high levels of commuters travelling between junctions 12 and 4B of the M4 into Greater London and connecting to the M25 network. At the western extent these heavy flows are experienced between junctions 20 and 19 of the M4, connecting to the M32 leading into Bristol City Centre. There are distinct inter-urban sections of the route generally carrying lower levels of traffic, however, there are localised demands around both Swindon and Reading.

1.3.4 The M4 between junction 4B (the M25 interchange) and junction 23 (west of the River Severn) connects England and Wales via the Second Severn Bridge and is made up primarily of 3 lane dual motorway, with 2 and 4 lane stretches in some parts. The route is currently undergoing an upgrade to smart motorway between junctions 19 and 20 which will deliver a combination of controlled motorway and dynamic hard shoulder running when it becomes fully operational in spring 2014.

1.3.5 The M4 forms part of a major commuting route connecting many regional centres between London and South Wales including Slough, Maidenhead, Bracknell, Reading, Swindon, Bristol and the South Wales area (including Cardiff and Swansea), carrying a wide variety of passenger and freight traffic. The M4 is designated as part of the Trans European Transport Network (TEN-T) connecting Ireland with northern Europe. The reported traffic flows between junctions for the M4 range from nearly 29,000 to 144,000 vehicles per day, in both directions, depending on the location, of which an average of 19% is freight.

1.3.6 The element of the A404/A404(M) forming part of this strategy is a 10 mile north-south link providing a vital connection between the M4 (south of Maidenhead) and M40 (south of High Wycombe), which in turn provides onward connectivity to/from both Oxford and Birmingham. (Note that the A404 to the north of the M40 does not form part of the strategic road network within the Highways Agency's remit). For most of its length, the route is a dual carriageway with 2 lanes in each direction but the southern element is 2 lane dual motorway. The reported traffic

flows for the A404 range from over 46,000 to over 58,000 vehicles per day, in both directions, depending on the location, of which an average of 9% is freight. All but one of the junctions (Bisham roundabout) on the corridor are grade-separated (ie where the strategic and local road networks are at different heights and physically separated), but there are planned improvement works at the Bisham Roundabout as part of the national pinch point programme. Due to be completed in 2014 these works are designed to improve capacity and reduce congestion on this section of the link.

1.3.7 The M32 is one of the shortest motorways in the UK providing a 4 mile link between junction 19 of the M4 and Bristol city centre. The route is made up predominately of dual motorway with 2 lanes and forms one of the major access points into Bristol, with reported traffic flows of approximately 75,000 vehicles per day, in both directions, of which an average of 20% is freight.

1.3.8 The M48 is a 12 mile stretch of motorway providing an alternative crossing point over the River Severn, utilising the original Severn Bridge, between junctions 21 and 23 of the M4. This provides an alternative strategic link between England and Wales should road users be required to divert from the M4, but also provides access to Chepstow and the Forest of Dean. The route is made up of dual motorway with 2 lanes, carrying over 16,000 vehicles per day, in both directions, of which an average of 21% is freight.

1.3.9 The M49 is a further short section of motorway, 5 miles in length, forming a link between the M4 and M5 motorways. The route provides an alternative link into Bristol and further onward connections southwards on the M5, and has shortened journey times to/from Bristol Port and South Wales. The route is made up of 2 lane dual motorway, carrying over 18,000 vehicles per day, in both directions, of which an average of 22% is freight.

1.3.10 The A308(M) is a small length of network, at approximately 0.6 miles in length providing a connection between the M4 (south of Maidenhead) and the A308 in Maidenhead, providing access to this urban area. The route is made up of dual motorway with 2 lanes carrying over 22,000 vehicles per day, in both directions, of which an average of 8% is freight.

1.3.11 The Agency manages its network through area teams. With respect to these areas, the route spans three – these being Areas 2, 3 and 5. The M48, M49, M32 and M4 between junction 15 at Swindon and the Severn Crossing are within Area 2; the A404/A404(M), the A308(M) and the M4 between junction 5 at Slough and junction 15 at Swindon are within Area 3 and the M4 between junction 4B at its interchange with the M25 and junction 5 at Slough are within Area 5.

1.3.12 While not located directly on the route, the main gateways served include London Heathrow Airport at the eastern end of the route and the Bristol Port at the western end of the route.

1.3.13 This route connects with a number of other routes for which RBS are also being developed. These are:

- Birmingham to Exeter – at the M4 / M5 interchange
- South West Peninsula – at M4 junction 18 with the A46
- Solent to Midlands – at M4 junction 13 with the A34
- London to Scotland West – northern end of A404 at M40 junction 4
- London Orbital and M23 to Gatwick – at the M4 / M25 interchange

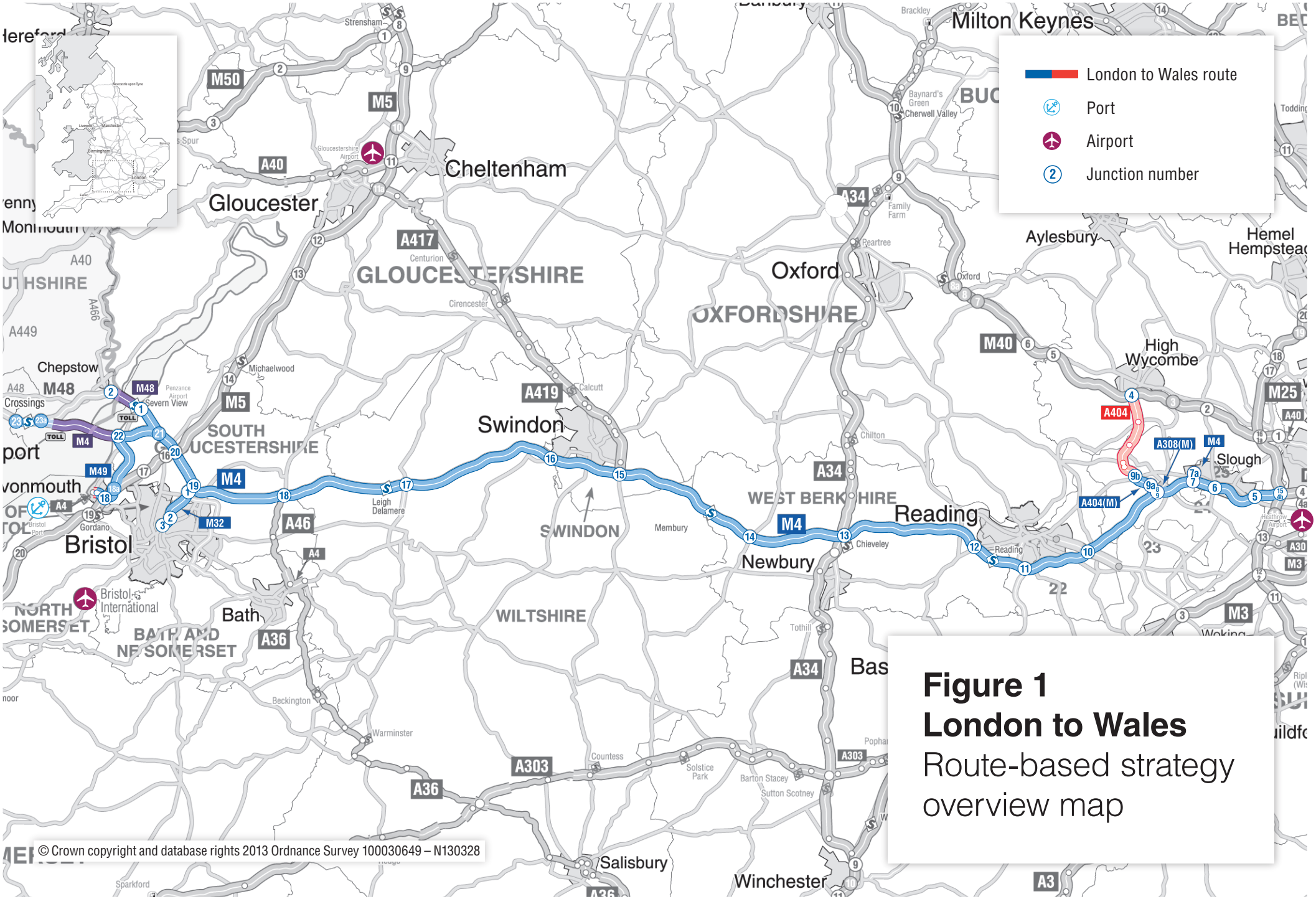

Figure 1
London to Wales
Route-based strategy overview map

2 Route capability, condition and constraints

2.1 Route performance

2.1.1 The strategic road network comprises only three per cent of England's road network, but it carries one-third of all traffic. Around 80 per cent of all goods travel by road, with two-thirds of large goods vehicle traffic transported on our network.

2.1.2 The route experiences significantly high two way flow levels on the urban elements of the network, most notably above 100,000 vehicles per day, in both directions, between the M4 junctions 4B and 12, and the M4 junctions 19 and 20. These sections on the M4 represent heavy commuter routes; the first providing access to Reading and London as well as a link to the A404(M) near Maidenhead providing onward connections to the M40, and the second providing access to the M32 leading directly into Bristol City Centre. This is in contrast to the link with the least flow levels, at just over 40,000 vehicles per day, between the M4 junctions 21 and 22 just to the east of the Severn Crossing.

2.1.3 The highest proportions of freight traffic on the route are generally experienced to the west of the M4 junction 14, near Swindon. The M4 junction 5 between the A4 and M4 junction 7 near Slough is a notably busy link with freight accounting for 40% of all traffic flows. Ten of the 16 links between junctions 14 and 22 of the M4 have freight traffic accounting for over 20% of traffic flows. Other links with over 20% of flows attributable to freight traffic include the M32, the M4 junction 21 to the M48 junction 1 and the M4 junction 22 to the M5 junction 18A. The connection to the M48 provides a link to the original River Severn Crossing, whilst the connection to the M5 provides a link toward Bristol Port.

2.1.4 While seasonality is a key feature in other areas linked to the London to Wales route, particularly in the South West region, analysis has identified that it is not a particularly significant issue for this route.

2.1.5 The ten busiest sections of this route are presented in Table 2.1. This is for the reporting period 1 April 2012 to 31 March 2013.

Table 2.1 Ten busiest sections on the route (1 April 2012 to 31 March 2013)

Rank	Strategic road network section	Annual Average Daily Traffic Flow (AADT) One directional flows	National Rank
1	M4 between M4 Junction 4B and M4 Junction 5	72,424	52
2	M4 between M4 Junction 5 and M25 Junction 15	71,501	62
3	M4 between M4 Junction 5 and M4 Junction 6	67,097	85

4	M4 between M4 Junction 6 and M4 Junction 5	65,934	97
5	M4 between M4 Junction 7 and M4 Junction 8	60,831	159
6	M4 between M4 Junction 6 and M4 Junction 7	60,766	162
7	M4 between M4 Junction 8 and M4 Junction 7	60,296	170
8	M4 between M4 Junction 7 and M4 Junction 6	60,031	172
9	M4 between M4 Junction 8 and M4 Junction 10	58,867	225
10	M4 between M4 Junction 10 and M4 Junction 8	56,298	233

Table Note – National Rank based on 2,475 links – rank 1 is the busiest section

2.1.6 However, busy roads in themselves don't necessarily represent an issue – our customers' experience of driving on the network is important to us. The *Strategic road network performance specification 2013-15*, sets us high level performance outcomes and outputs under the banner of an efficiently and effectively operated strategic road network. We currently measure how reliable the network is based on whether the 'journey' time taken to travel between adjacent junctions is within a set reference time for that period, ie 'on time'.

2.1.7 The greatest issue of reliability exists in the Bristol area on the M32 and its approach route from the west on the M4, where the percentage of link journeys on time is below 70%, creating a negative impact on journey times to/from Bristol City Centre. Another notable area to experience poor reliability, again below 70%, is the A404, negatively affecting the flow of traffic between the M4 and M40, which provides an alternative north-south link to that of the M25.

2.1.8 When benchmarked against all 2497 links on the SRN, the ten links highlighted in Table 2.2 are within the top 15% of worst performing links in the country. This is for the reporting period 1 April 2012 to 31 March 2013.

2.1.9 When compared with the national picture, the average on-time reliability measure for the route is 77.4% (national average 74.0%) and there are elements of the network, mainly on the M4 between junction 12 and junction 21, that perform well on this measure at above 90%.

Table 2.2 Ten least reliable journey-time locations on the route (1 April to 31 March 2013)

Rank	Location on the strategic road network	On-time reliability measure	National Rank
1	M32 between M32 Junction 2 and M32 Junction 3	56.7%	39
2	M32 between M32 Junction 1 and M4 Junction 19	57.1%	40
3	A404(M) between A404(M) Junction 9A and M4	60.6%	91

	Junction 8		
4	M32 between M32 Junction 3 and M32 Junction 2	61.7%	123
5	M4 between M4 Junction 19 and M4 Junction 20	62.6%	145
6	M32 between M32 Junction 1 and M32 Junction 2	64.4%	231
7	A404 between A4155 and M40 Junction 4	65.3%	276
8	M32 between M4 Junction 19 and M32 Junction 1	66.0%	317
9	A404 between A4155 and A308	66.0%	318
10	M4 between M4 Junction 5 and M4 Junction 4B	66.0%	322

Table Note – National Rank based on 2,497 links – rank 1 has the lowest on-time reliability measure. High score is better.

2.1.10 Through comparison of the top ten links identified in Tables 2.1 (busiest) and Table 2.2 (least reliable) it is apparent that while all the busiest links identified are at the eastern end of the route, the least reliable links are primarily associated with the Bristol urban area. Only one of the links in the top ten busiest list also appears in the top ten least reliable lists – this being the M4 between junction 5 and junction 4B.

2.1.11 Figure 2.1 illustrates the average speeds during weekday peak periods between 1 April 2012 and 31 March 2013. The peak periods are generally the busiest periods on the network and help us to understand the impact of the worst congestion on customers' journey times. Figure 2.1 also shows any known performance or capacity issues where the local road network interfaces with the route.

2.1.12 The majority of the central section of the M4 corridor (stretching from the M32 at Bristol to Reading), the M48 and the M49 operate at speeds close to national limits during peak hours with speeds in the range 61 to 70mph. There are two notable areas where average peak hour speeds are significantly lower than national limits, located at the eastern and western extents of the M4 corridor, towards London and Bristol respectively.

2.1.13 At the eastern extent during peak times, eastbound traffic speeds begin to slow from junction 12, near Reading, to between 51 and 60 mph. Speeds slow further to between 41 and 50mph from the M4/A404(M) interchange at junction 8 all the way to junction 4B, the interchange with the M25. Westbound traffic speeds between junctions 4B and 8 also have variable speeds below national norms ranging from 31 to 60mph.

2.1.14 At the western extent of the corridor at peak times, all approaches to the M4/M5 interchange suffer from low average speeds between 31 and 40 mph, significantly less than the national speed limit.

2.1.15 Furthermore, the M4 between junction 21 (M4/M5 interchange) and J20 (M4/M32 interchange) suffers low speeds around 31-40mph. The

connecting M32 generally maintains peak hour speeds between 51 and 60mph between the M4 and junction 3, but beyond junction 3 speeds begin to slow in the vicinity of Bristol city centre.

Figure 2.1

Network performance 2012/13

Peak period speeds

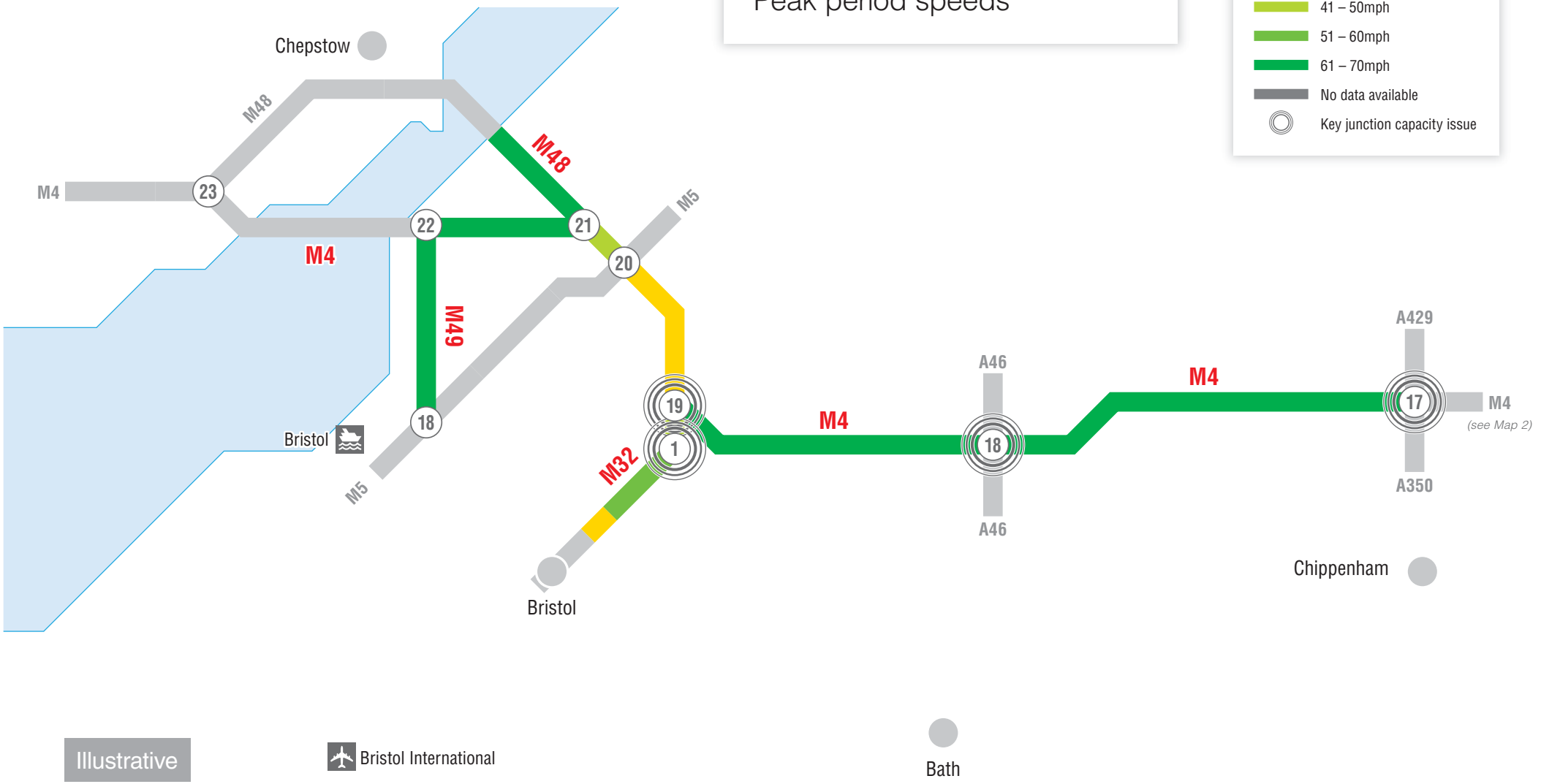

Figure 2.1

Network performance 2012/13
Peak period speeds

Average speed at peak times (mph) (April 2012 – March 2013)

Peak times are Monday to Friday 7–10am and 4 –7pm

- Less than 20mph
- 21 – 30mph
- 31 – 40mph
- 41 – 50mph
- 51 – 60mph
- 61 – 70mph
- No data available
- Key junction capacity issue

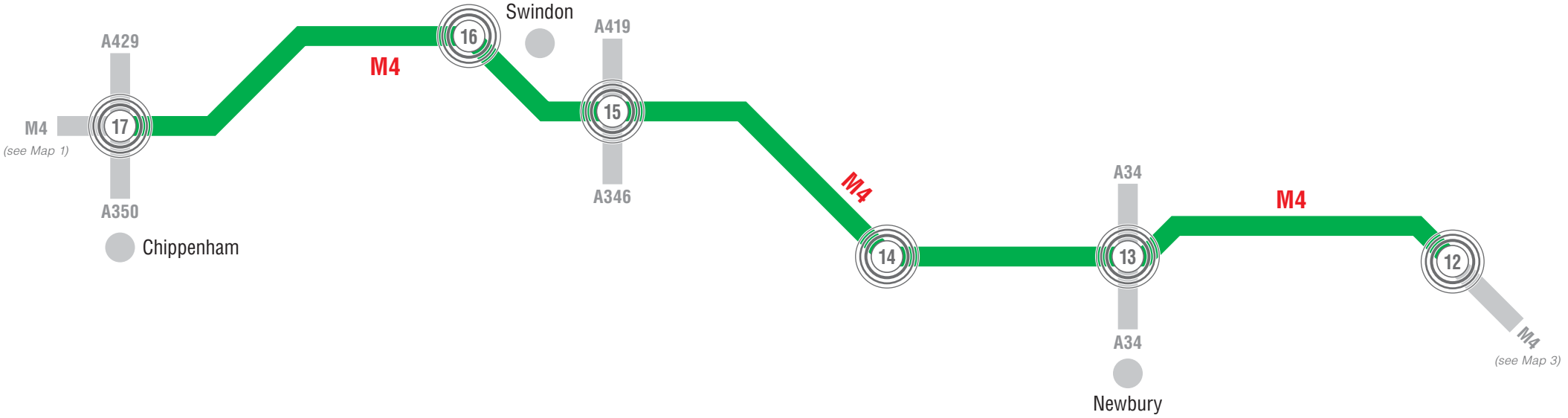

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Figure 2.1

Network performance 2012/13

Peak period speeds

HA media services, MCR N130433 London to Wales

2.1.16 The strategic road network is key in promoting growth of the UK economy, and alleviating congestion can realise economic benefits.

2.1.17 Figure 2.2 shows the delay on our network compared with a theoretical free-flowing network.

London to Wales – Route-based strategy – Map 1 of 3

Figure 2.2

Network performance 2012/13

Delay

Vehicle Hours Delay (April 2012 – March 2013)

Vehicle Hours Delay is an estimate of the total travel time experienced by all road users over and above the expected theoretical free-flow travel time.

- Top 10%
- Next 10%
- Next 20%
- Next 20%
- Next 20%
- Bottom 20%
- No data available

Explanation of data can be found in the Technical Annex.

Figure 2.2

Network performance 2012/13

Delay

Vehicle Hours Delay
(April 2012 – March 2013)

Vehicle Hours Delay is an estimate of the total travel time experienced by all road users over and above the expected theoretical free-flow travel time.

- Top 10%
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- Next 20%
- Bottom 20%
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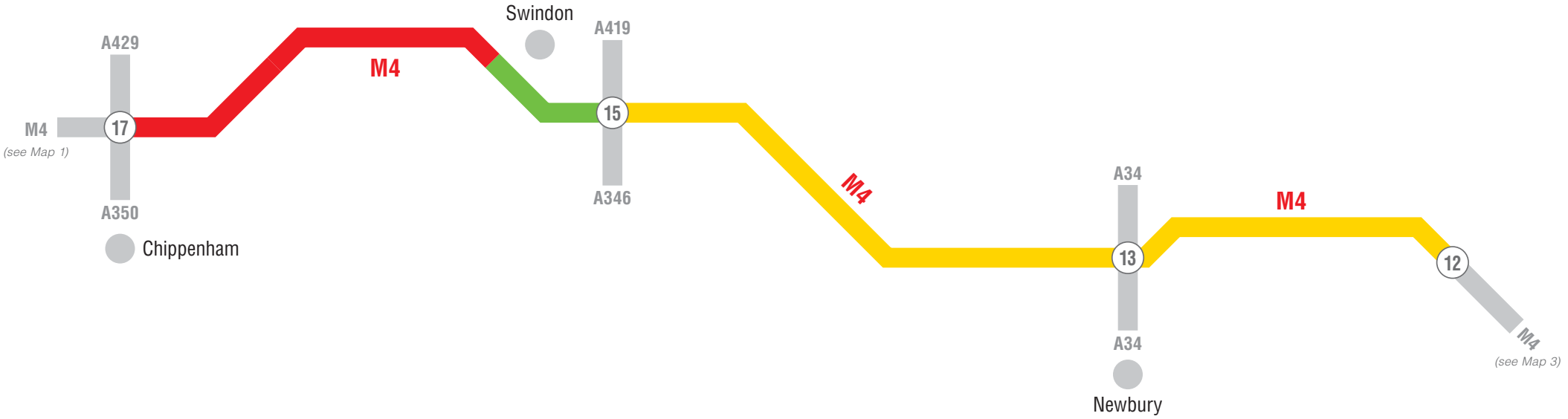
Explanation of data can be found in the Technical Annex.



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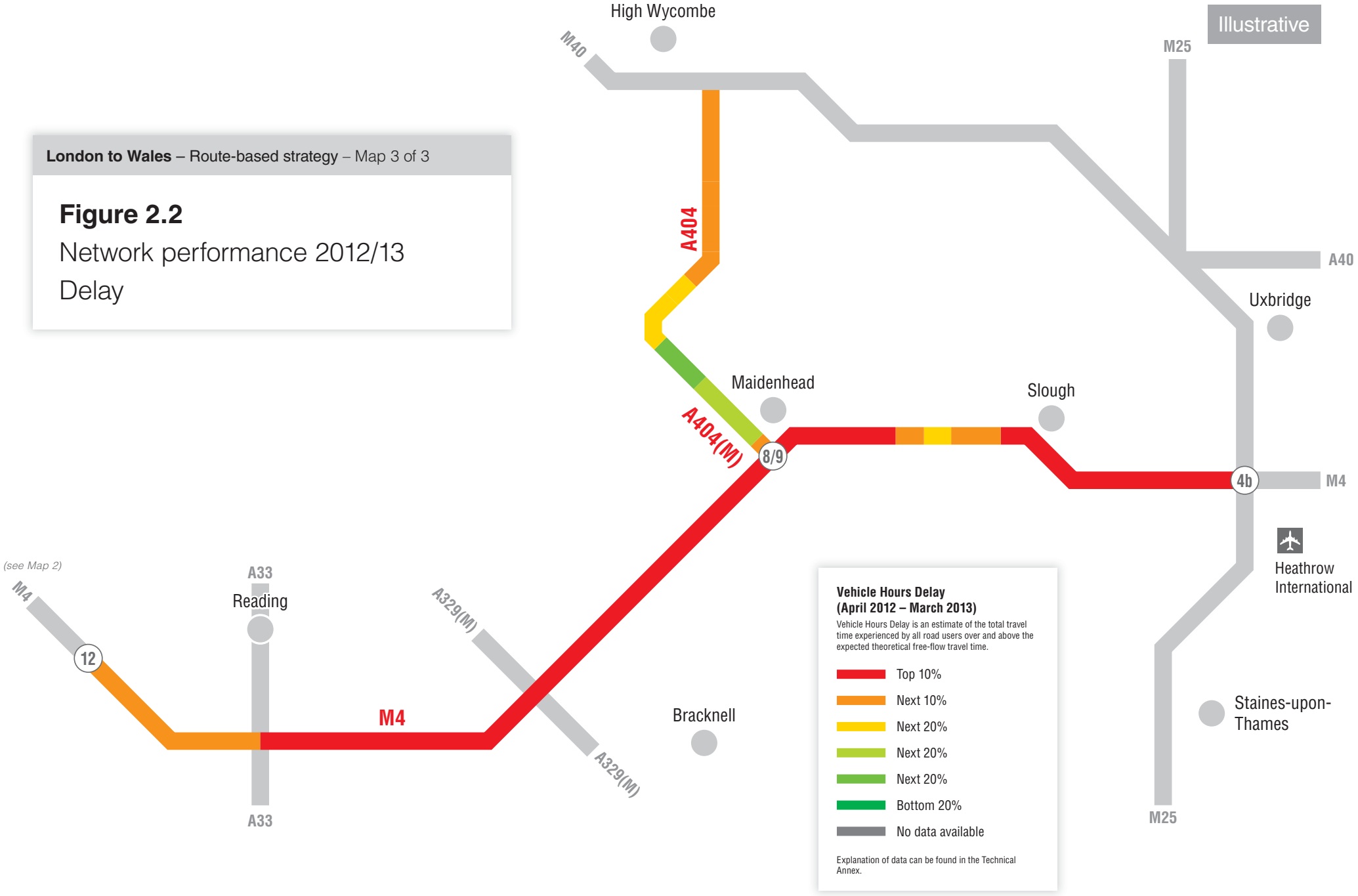
London to Wales – Route-based strategy – Map 3 of 3

Figure 2.2

Network performance 2012/13

Delay



2.1.18 Figure 2.2 highlights three key strategic links that have issues when considering delay, these being:

- M4 in the Bristol area (junction 19 to 20 in both directions and westbound junction 18 to 19)
- M4 eastbound (junction 17 to 16) on approach to Swindon
- M4 between Reading (junction 11) and the M25 interchange (junction 4B) in both directions.

2.1.19 On the basis of the information afforded within this section and based on all of the route characteristics assessed (traffic demand, reliability, speeds, and delay) there are four key sections of the route that perform poorly on multiple criteria, as follows:

- M4 approach links to and from Bristol
- M32 between Bristol and the interchange with the M4
- M4 between Reading and the interchange with the M25
- M4 approach links to Swindon from the west

2.1.20 It is clear that these links experience high traffic volumes, but are also in locations where there are high levels of interchange between major routes providing entry points to urban areas, and as such the issue may in part be attributable to poor performance at the junctions as well as the high levels of traffic on the links.

2.1.21 The M48 and M49 in their entirety and sections of the M4 between junctions 10 and 21, and the A404/A404(M) are noted to operate with little evidence of delay.

2.2 Road safety

2.2.1 As a responsible network operator and through the *Strategic road network performance specification 2013-15*, the Highways Agency works to ensure the safe operation of the network.

2.2.2 By 2020, *The strategic framework for road safety 2011* forecasts the potential for a 40% reduction of the numbers killed or seriously injured on the roads compared with 2005-2009. We are working toward this aspirational goal.

2.2.3 Figure 2.3 illustrates the rates of injury collisions and the top 250 casualty locations on the strategic road network between 2009 and 2011. Injury accidents are collisions where people were injured and their injuries were slight, serious or fatal. Damage only incidents have not been included. The top 250 casualty locations have been calculated nationally, and are based on the number of casualties which occurred within a distance of 100m. Locations with the same number of casualties have been given a “joint” ranking and therefore, there may be some locations with the same rank number.

2.2.4 Between 2010 and 2012 there were 1,112 collisions on the route. The number per year has ranged from 366 to 377 over this three year period.

2.2.5 Of the 1,112 collisions recorded, 25 (2.3%) included fatalities, 121 (10.9%) were classified as resulting in serious injuries and the remaining 966 (86.9%) included slight injuries.

2.2.6 Within the 1,112 collisions recorded there were 1,736 casualties at a rate of 1.6 casualties per collision.

2.2.7 In terms of vehicles/road users involved in the collisions:

- 79.8 % involved more than one vehicle
- 7.7% of vehicles involved were HGVs (>7.5 tonnes)
- Where the age of the drivers was known, 2.6% were young drivers (aged 16 – 19 years)
- 14.0% were older drivers (aged 60 or over where the age was known).

2.2.8 Analysis of link issues in terms of total casualties per billion miles highlight a number of sections which again correlate with the areas of high traffic flows on approach to major settlements, as follows:

- 13.5% occurred where the driver ‘failed to judge other person’s path or speed’;
- 13.5% occurred where the driver ‘failed to look properly’;
- 10.0% involved loss of control
- 7.7% were travelling too close
- 6.5% involved sudden braking
- 5.9% cited ‘careless, reckless or in an hurry’
- 5.2% involved a poor turn or manoeuvre
- 4.2% swerved
- 4.2% fatigue
- 3.8% were travelling too fast for the conditions
- 11% of collisions on this route had no contributory factors assigned.

2.2.9 In terms of considering these findings against the links identified in Table 2.1 (busiest) and Table 2.2 (least reliable) it is noted that while some links experiencing longer length of incident lane impacts are also some of the busiest (eg M4 junction 4 to 6) and some of the least reliable (eg M32 junction 2 to 3), those areas that experience lengthier impacts are more prevalent on the quieter, more reliable and mainly more rural areas. This is a result of the TOS strategy of prioritising

incidents / locating patrol vehicles to the more critical (busier and least reliable) elements of the network.

2.2.10 While we aim to reduce the numbers killed or seriously injured using and working on the strategic road network, we will always identify more safety interventions than our budget allows us to implement. We use a prioritisation process to help us and to ensure we are targeting the locations with the greatest opportunity to save lives and reduce the severity of injury.

London to Wales – Route-based strategy – Map 1 of 3

Figure 2.3

Safety on the network

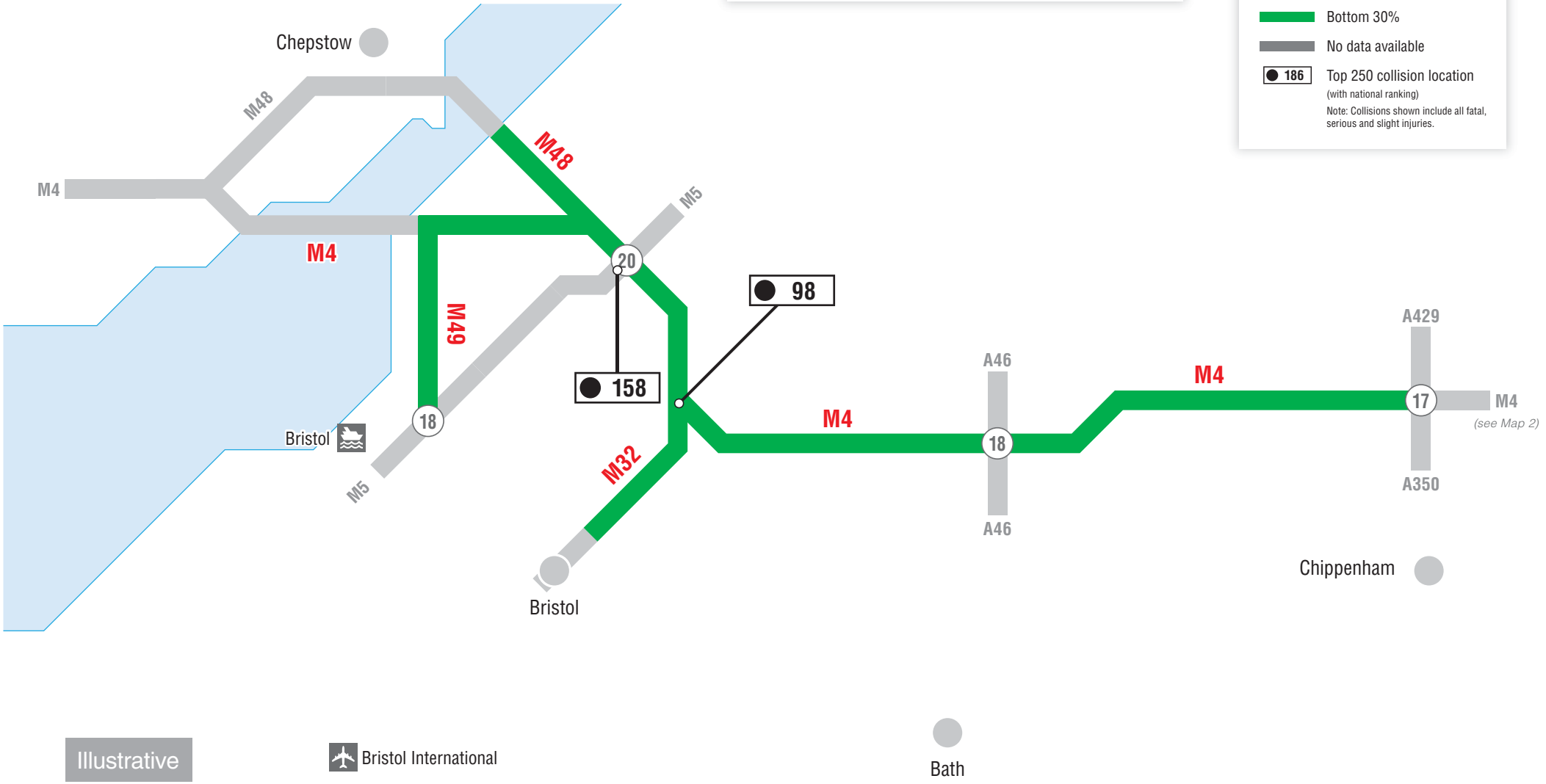
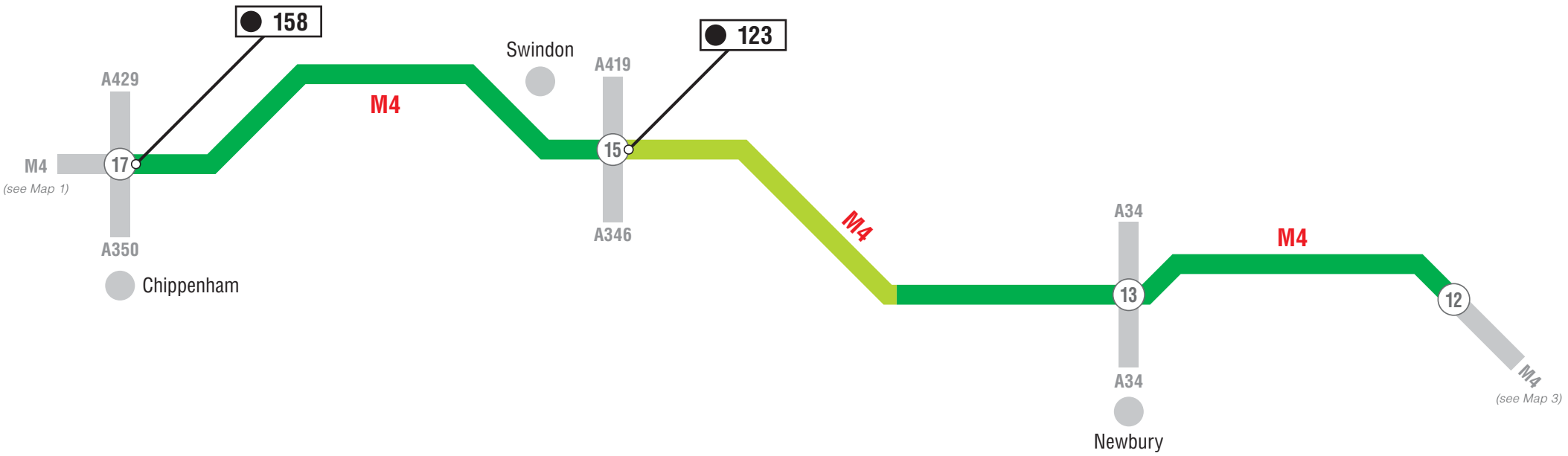


Figure 2.3
Safety on the network

Total casualties per billion vehicle miles (2009 – 2011)

- Top 10%
- Next 15%
- Next 20%
- Next 25%
- Bottom 30%
- No data available
- 186 Top 250 collision location (with national ranking)

Note: Collisions shown include all fatal, serious and slight injuries.



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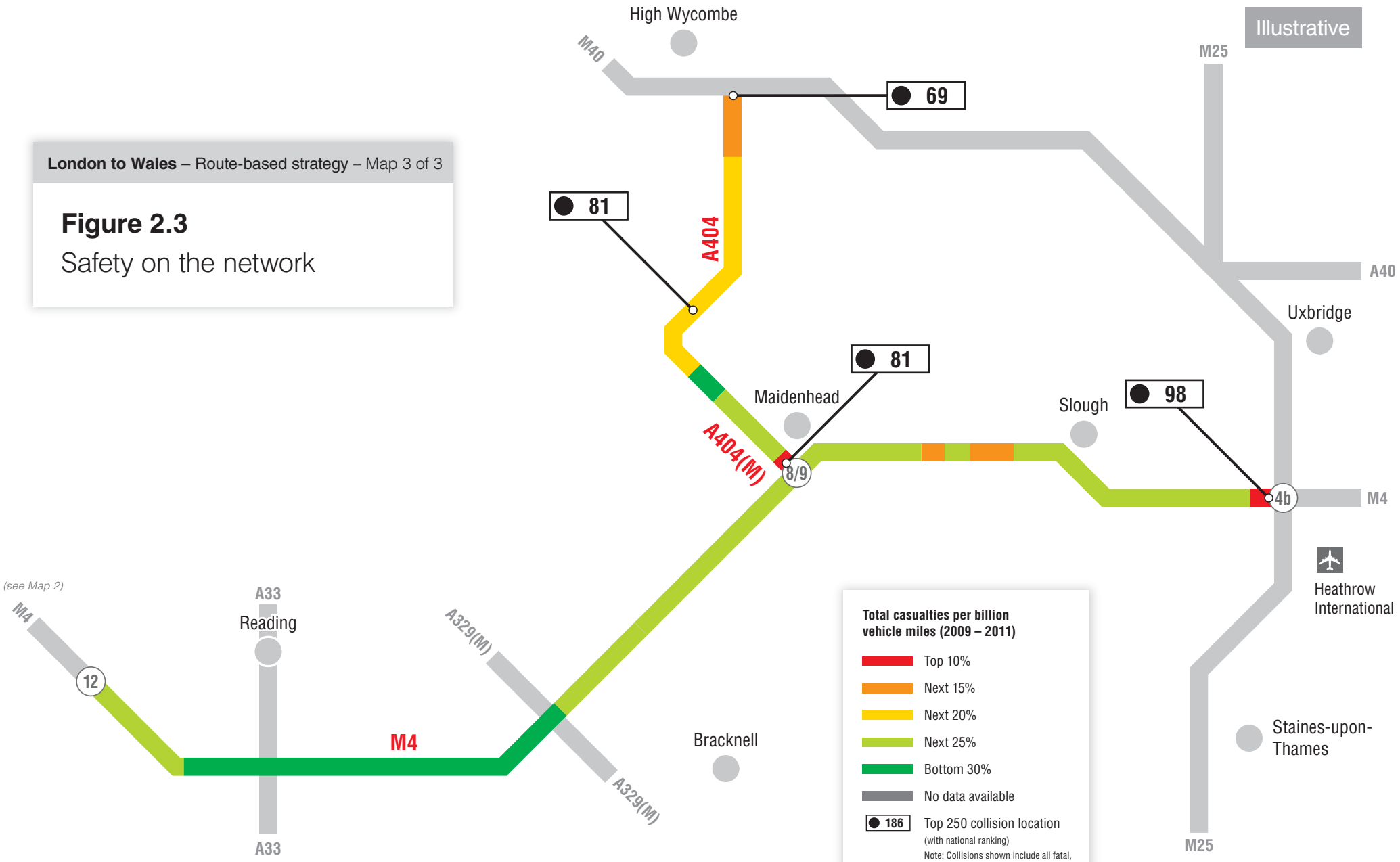
London to Wales – Route-based strategy – Map 3 of 3

Figure 2.3
Safety on the network



2.3 Asset condition

2.3.1 We carry out routine maintenance and renewal of roads, structures and technology to keep the network safe, serviceable and reliable. We also ensure that our contractors deliver a high level of service on the strategic road network to support operational performance and the long-term integrity of the asset.

2.3.2 From new, assets have an operational 'life' within which, under normal conditions and maintenance, the risk of failure is expected to be low. Beyond this period, the risk of asset failure is expected to increase, although for many types of asset the risk of failure remains low and we do not routinely replace assets solely on the basis that they are older than their expected operational life. We use a combination of more regular maintenance and inspection along with a risk-based approach to ensure that assets remain safe while achieving value for money from our maintenance and renewal activities.

2.3.3 We maintain a National Asset Management Plan as an annual summary of the Agency's network asset inventory and condition. It is aimed at ensuring there is sight of future issues affecting the asset and enabling strategic decision making.

Carriageway Surface

2.3.4 The road surface on the strategic road network is primarily surfaced with two types of flexible bituminous materials, namely Hot Rolled Asphalt (HRA) which has an approximate design life of 25 years and Thin Surface Course System (TSCS) with a lower construction cost and shorter design life of 10-15 years. Large tranches of HRA were laid in the 1990s and TSCS tranches laid in the 2000s resulting in a significant proportion of the network reaching the end of its design life by 2020.

2.3.5 It should be noted that, although carriageway surfacing may be identified as reaching or exceeding its design life, the surfacing will not necessarily require treatment at this point. Carriageway surfacing that is beyond its design life is at a higher risk of failure, with such risk increasing the further that the surfacing exceeds its design life. The increasing age of the surfacing could manifest in an increased frequency of maintenance interventions which, if a renewals scheme is not funded, may result in a higher cost both financially and in terms of disruption to road users to maintain the asset in a safe and serviceable condition.

2.3.6 Strategically key sections of the route where parts of the carriageway may be reaching the end of their design life by 2020 are predominantly found at:

- the western section of the M4 (mainly between the M48 and Swindon)

- sporadic short sections toward the eastern section of the M4 (mainly between the A34 at junction 13 and Reading)
- the M32 in its entirety
- large elements of the M48 between the M4 and the Severn Crossing
- sections of the A404(M)/A404 corridor

2.3.7 The more rural parts of the network between Swindon and the A34 at junction 13, and the eastern extent of the route toward London generally indicate a design life beyond 2020. In particular the M49 is a section in very good condition with a low proportion of the carriageway nearing the end of its design life.

2.3.8 High traffic flows on the network create a challenge when programming maintenance works. It is becoming increasingly difficult to programme works at times which will not create delay to customers – particularly at busy interchanges such as at the M4/M5 interchange and the M4/M25 interchange.

2.3.9 We also have concrete road surface material but this is only a very small proportion when compared to the length of flexible road surfaces. The amount of concrete road surface is also reducing as it is replaced by flexible material at the end of its serviceable life. Concrete is not a material we now use in new carriageway construction on any of the motorway and trunk road network.

Structures

2.3.10 There are a large amount of structures along the route, including bridges that span the motorway and bridges that carry the motorway over deviating terrain; from large culverts to small span structures; and from retaining walls to sign/signal gantries and mast schemes. A large proportion of the structures on this route were built in the period around the 1970s and are suffering from the material issues inherent with structures of this age such as failed waterproofing, leaking joints and thaumasite attack.

2.3.11 The M32 Eastville Viaduct is particularly critical to the operation of the network and has unique management issues. The viaduct poses a risk as the condition of the structure has deteriorated to such an extent that the renewal of major elements, including surfacing, drainage, barrier and street-lighting systems is now urgently required. The location of the structure poses particular difficulty whenever extensive intervention is required due to the arterial link to Bristol City centre offered by the M32.

2.3.12 The Winterbourne Lane underbridge between M4 junction 19 and junction 20 has ongoing concrete spalling of the central reserve lightwell which is a safety hazard to traffic travelling on the B4057 below the M4. Special inspections are taking place to monitor this with the aim of removing the spalling concrete.

2.3.13 The element of the route falling into Highways Agency Area 3 (ie the eastern sections) has a high proportion of bridges reliant on post tensioning for structural performance, primarily constructed on the M4 in the 1970s. The post tensioning can be vulnerable to corrosion and a programme of special inspections has been initiated by the Highways Agency.

Other key asset issues for routes

2.3.14 Other key issues in relation to the assets on the route can be summarised as follows:

- **Lighting** – We have tested the lighting columns on the M4 and have found no issues with the structures. The majority of the cabling and lanterns does require replacement though due to the age of the lighting.
- **Drainage** – Along the eastern extents of the route, defects are present, typically related to the steepness of the earthwork slope and drainage arrangements. The effect on the network is particularly apparent on the M4 where verge widths of embankments are typically narrow.

2.4 Route operation

Incident Management

2.4.1 We work hard to deliver a reliable service to customers and to reduce the number and impacts of incidents on road users.

2.4.2 Across the whole network, the Highways Agency Traffic Officer Service responds to around 20,000 incidents each month. We measure how effective we are at managing incidents by looking at the duration that incidents affect the running lanes.

2.4.3 There are 7 Regional Control Centres (RCC) across England co-ordinating incident management and control on road technology. There is one National Traffic Operations Centre (NTOC) which provides a strategic overview of the network. This centre co-ordinates the information services and events which may affect more than one region.

2.4.4 The Traffic Officer Service (TOS) covers all motorways and trunk roads within the network with varying levels of service.

2.4.5 At the present time, with the exception of the A404, the entirety of the London to Wales route has full operational TOS which includes the following:

- Customer information – Smart phone apps, Traffic England etc.
- Incident detection (virtual patrolling)
- NTOC overview - Strategic Traffic Operations (STO)

- Event planning and coordination
- RCC co-ordination of incident management resource (Police/contractors/TOS etc.)
- Control of on-road technology – Emergency Roadside Telephones, Closed-circuit television, Variable Message Signs, Smart Motorway etc.
- National Vehicle Recovery Service (NVRS)
- Full TOS on-road response capability (dedicated resource)

2.4.6 The A404 has a slightly lower level of service than the remainder of the route. The main differences are the following:

- Control of on-road technology applies only where this is available
- NVRS is only available in exceptional circumstances
- The TOS on-road response capability is limited and only available in exceptional circumstances

2.4.7 We have a good understanding of the types of incidents which are quick to clear up and those which take longer. In general, there are far more incidents which don't affect the running lanes for very long, and mostly these are caused by breakdowns in the live lanes, debris or damage only collisions. The longest duration incidents are mainly those caused by infrastructure damage, such as road surface repairs, bridge strikes, barrier collisions and spillages.

2.4.8 We continue to work with our partners in the emergency services to reduce the impacts on our network from serious collisions and long-duration incidents.

2.4.9 In relation to the London to Wales route, it is evident from the incident data which identifies the average duration of the lane impact that:

- Impacts of 60 minutes or more on the short section of the M48 from its interchange with the M4 to the Severn Crossing (due primarily to weather related incidents)
- Impacts of 30 to 60 minutes between M4 junction 20 to 22, M4 junction 13 to 19, M4 junction 10 to 11, M4 junction 4 to 6, M32 junction 2 to 3, and the M49 and A404(M) for their length
- The remainder of the network (and in many instances some of the more urban areas) suffer much less impact at under 30 minutes
- There are no data for the non-motorway element of the A404 corridor (so there could be unidentified issues due to lack of data).

Flooding

2.4.10 We have a responsibility to reduce flooding. Flooding of the Highways Agency's network impacts upon network performance and the safety of

road users. Flooding off the network has an impact on third parties living adjacent to the network.

2.4.11 Based on historic records of flooding incidents, we have identified those parts of the network that are at risk of repeated flooding.

2.4.12 There are many elements of the M4 that have been identified as having key flood risks (categorised as having a high or very high risk of flooding). While sporadic in nature, these are most prevalent to the east of Swindon. The southern and northern extremes of the A404 are also at risk from flooding.

2.4.13 It is noted that the M48 and M49 elements of the route have been identified as not having any flood risks.

2.4.14 The A34 (M4 junction 13 underpass) at Chieveley has been noted to be vulnerable to flooding in exceptional rain and in the event of pump or power failure. This has caused significant disruption when flooded.

Severe Weather

2.4.15 The Agency aims to minimise where possible, the impacts of severe weather on network performance and the safety of road users.

2.4.16 The route (mainly spanning central southern England) is not as prone to weather issues as the South West and other regions of the country. There are however elements of the route which are directly influenced by weather conditions, which when they do occur can have significant implications on the operation of the network.

2.4.17 The main example of this on the route relates to the Severn crossings where high winds impact on their operation. The M48 Severn Bridge now operates under a High Winds protocol based on wind speeds measured by anemometers situated on the Crossing. The measured wind speeds dictate the action taken, including advisory speed limits (30 knots), lane closures (35 knots), closure to motorcycles and high vehicles (40 knots) and full closure (60 knots). Such wind related closures are most common in the winter months between January - March and October – December. The M4 Crossing has been designed with wind shielding and has not had to close during any period of high winds.

2.4.18 There have been past occurrences (February and December 2009) when both of the Severn crossings have been closed due to falling ice from the structures. On these occasions significant delays were experienced.

2.5 Technology

2.5.1 The Highways Agency works hard to deliver a reliable service to customers through effective traffic management and the provision of

accurate and timely information. We provide information to our customers before and during their journeys.

2.5.2 We monitor key parts of our network using CCTV and use sensors in the road to monitor traffic conditions. These are used by our NTOC and seven RCCs to provide information to customers before their journeys, eg on the Traffic England website or through the hands-free traffic app for smartphones. Whilst on the network, we also inform our customers using variable message signs (VMS).

2.5.3 Technologies such as overhead gantries, lane specific signals and driver information signs also form part of how we can operate our network efficiently. In some locations we have controlled motorways, which is where we can use variable mandatory speed limits to help keep traffic moving. Smart motorways use both variable mandatory speed limits and the hard shoulder as an additional live traffic lane during periods of congestion. Ramp metering manages traffic accessing the network via slip roads during busy periods to help avoid merging and mainline traffic from bunching together and disrupting mainline traffic flow.

2.5.4 The provision of various elements of technology along the route are summarised in the Technical Annex, where it is evident that there is a strong relationship between the demands for the use of the route and the provision of technology. There does however exist a wider opportunity to fill some of the technology gaps to deal with specific operational issues.

2.5.5 Technology plays an integral role in operation and management of the route including the following technologies:

- Traffic Operation and Control
- Motorway Incident Detection and Automatic Signalling (MIDAS)
- Ramp Metering
- Variable Message Signs (VMS)
- Closed circuit television (CCTV)
- Emergency roadside telephones
- Data Collection
- Automatic Number Plate Recognition (ANPR) cameras
- Traffic Counting Equipment
- Weather / Meteorological instruments
- Highways Agency Weather Information System (HAWIS)
- Meteorology Sensors

2.6 Vulnerable road users

2.6.1 The route has a number of interactions with routes for vulnerable road users, including long distance public rights of way and national trails, as well as many other local public footpaths, cycleways, bridleways and byways. These include national trails such as:

- the Cotswold Way (east of junction 18)
- Ridgeway (east of junction 15 Swindon)
- the Thames path (A404 and M4 between junctions 7 and 8)

2.6.2 There are also numerous elements of the national cycle network including:

- Route 4 - a long distance route between London and Fishguard, interacting with the route at various points
- Route 23 – linking Reading to Southampton with an interaction between junction 11 and 12 of the M4
- Route 45 – linking Swindon to Salisbury with an interaction between junctions 15 and 16 of the M4
- Route 254 – following part of the Wiltshire Cycleway with interactions between M4 junction 16 and 18
- Route 410 – the Avon Cycleway, with various interactions
- Route 461 – linking Farnham Common to Slough and Windsor – interacting with the M4 south of Slough

2.6.3 Given the nature of the route, the majority of these interactions are physically separated enabling vulnerable road users to cross over or under the network on local routes and traffic free routes. No public rights of way run alongside the A404 although there are two crossing points connecting footpaths on either side: one at Bisham Roundabout and the other near Marlow.

2.6.4 Many of the cross-network needs and demands for vulnerable road users are concentrated where public rights of way intersect with the SRN along the route. It is at these locations where the provisions for such road users are focussed and to which stakeholder discussions related during the engagement process.

2.7 Environment

2.7.1 As a responsible network operator and through the *Strategic road network performance specification 2013-15*, the Highways Agency works to enhance the road user experience whilst minimising the impacts of the strategic road network on local communities and both the natural and built environment.

Air quality

2.7.2 We recognise that vehicles using our road network are a source of air pollution which can have an effect on human health and the environment. We also appreciate that construction activities on our road network can lead to short-term air quality effects which we also need to manage.

2.7.3 The Highways Agency is committed to delivering the most effective solutions to minimise the air quality impacts resulting from traffic using our network. We will operate and develop our network in a way that works toward compliance with statutory air quality limits as part of our broader Environmental Strategy.

2.7.4 Along the route, the following Air Quality Management Areas (AQMAs) are identified as having a relationship with the route:

- Bristol AQMA: which includes the M32 south of junction 1
- Reading AQMA: which includes junction 11 of the M4
- Wokingham AQMA: encompassing properties along the M4 motorway
- Royal Borough of Windsor and Maidenhead – Bray / M4 AQMA: encompassing part of Bray where the M4 crosses the A308
- South Bucks District Council – South Bucks AQMA: covering a section of the M4 between Maidenhead and Slough
- Slough Borough Council – Slough AQMA no.1: encompassing land adjacent to the M4 motorway along the north carriageway between junction 5 and 7, and along the south carriageway between junction 5 and Sutton Lane

2.7.5 Defra identifies exceedance of European air quality limits for annual average levels of nitrogen dioxide (NO_2) in all of these AQMAs.

Cultural heritage

2.7.6 Wherever possible, balanced against other factors, Agency schemes are designed to avoid impacts on cultural heritage assets.

2.7.7 There are no significant areas on the London to Wales route that directly impact upon cultural heritage assets, such as world heritage sites, scheduled monuments or registered battlefields. There are however a number of registered parks and listed buildings within the vicinity of the route, as follows:

2.7.8 Registered Parks

- Dodington House (near to M4 junction 18) – country house and estate

- Badminton House (between M4 junction 17 and junction 18) – country house and park
- Ditton Park (near to M4 junction 5) – part of the Manor of Ditton

2.7.9 Listed Buildings

- Bridge Farmhouse and attached outbuilding (Grade 2, North of M32 junction 2)
- The Laurels and Marigold Court (Grade 2, East of M4 junction 19)
- Dray Cottage (Grade 2, between M4 junction 16 and junction 17)
- Former Stable West of 1-2 Lockside Cottage (Grade 2, between M4 junction 16 and junction 17)
- 38 Old Purton Road(Grade 2, between M4 junction 16 and junction 17)
- Wharf Farmhouse (Grade 2, between M4 junction 15 and junction 16)
- Inholmes Thatched Cottage (Grade 2, between M4 junction 14 and junction 15)
- Milestone (Grade 2, near to M4 junction 5)
- Mile Post on A404 North East of Junction 9A (Grade 2)
- Old Beams Cottage (Grade 2, A404)
- Ice House (Grade 2, A404)

Ecology

2.7.10 The Agency's activities, including road construction projects and maintenance schemes, have the potential to impact on protected sites, habitats and species. We aim to minimise the impact of our activities on the surrounding ecology and wherever possible contribute to the creation of coherent and resilient ecological networks by maximising opportunities for protecting, promoting, conserving and enhancing our diverse natural environment.

2.7.11 There are number of local nature reserves (sites which are of importance for wildlife, geology, education or public enjoyment) in proximity to the route:

- Three Brooks (46.69 hectares, between M4 junction 19 and junction 20)
- Royate Hill (1.88 hectares, between M32 junction 2 and junction 3)
- Jubilee Lake (3.95 hectares, near M4 junction 16)
- Coate Water (21.58 hectares, near M4 junction 15)
- Hosehill Lake (23.59 hectares, near M4 junction 12)

- Ocwells Park (9.3 hectares, near M4 junctions 8 and 9)
- Braywick Park (12.71 hectares, near M4 junctions 8 and 9)

2.7.12 There are a number of sites directly alongside the route classified as Sites of Special Scientific Interest (SSSI) (sites of wildlife/geological importance) at the following locations:

- Severn Crossings – Severn Estuary SSSI
- M4 junction 17 – Stanton St. Quintin Quarry and Motorway Cutting SSSI
- M4 near junction 15 – Burderop Wood SSSI and Coate Water SSSI
- M4 between junctions 13 and 14 – River Lambourne SSSI
- M4 between junctions 12 and 13 – Coombe Wood, Frilsham SSSI and Sulham and Tidmarsh Woods and Meadows SSSI
- East of the A404 - Bisham Woods SSSI

2.7.13 There are two Special Areas of Conservation (SACs) (areas that under the EU's Habitats Directive, have been given special protection to a variety of wild animals, plants and habitats) along the route:

- Severn Estuary
- River Lambourne (between M4 J13 and J14)

2.7.14 The Severn Estuary is also classified as a Special Protection Area (SPA) – being classified as internationally important to rare and vulnerable species of birds.

Landscape

2.7.15 Roads and other transport routes have been an integral part of the English landscape for centuries. However, due to large increases in traffic, combined with modern highway requirements, they can be in conflict with their surroundings. We are committed, wherever possible, to minimise the effect of our road network on the landscape.

2.7.16 Parts of the route fall within Areas of Outstanding Natural Beauty (AONB), including:

- The Cotswolds AONB represents the largest AONB in England and Wales and stretches from Bath and Wiltshire in the South to Warwickshire and Worcestershire in the north. The Cotswolds AONB interacts with the route between junctions 17 and 18 of the M4
- The North Wessex Downs AONB stretches into Berkshire, Hampshire, Oxfordshire and Wiltshire. The North Wessex Downs

AONB interacts with the route between junctions 12 and 15 of the M4 near Swindon

- The Chilterns AONB within which the northernmost sector of the A404 falls.

Noise

2.7.17 Traffic noise arising from the Highways Agency's network has been recognised as a major source of noise pollution.

2.7.18 We take practical steps to minimise noise and disturbance arising from the road network. This includes providing appropriate highway designs and making more use of noise reducing technologies.

2.7.19 In 2012, the Department for Environment, Food and Rural Affairs (Defra) completed the first round of noise mapping and action planning which identified the top one per cent of noisiest locations adjacent to major roads. These were based on the conditions in 2006. The locations in this top one per cent are known as Important Areas.

2.7.20 There are a number of recognised noise Important Areas on the London to Wales route, which can be summarised as follows:

- M48 junction 1 – south eastern element of the junction
- M4 junction 22 – east and west of the junction
- M4 east of junction 22 – east and west of A403 overbridge
- M4 west of junction 21
- M4 north of junction 20 – at A38 overbridge
- M4 between junctions 19 and 20 – two long sections of the link
- M4 junction 19 – covering the junction and the M4 to the east towards the Bromley Heath Road underbridge
- M32 – from north of junction 2 to junction 3 in the south
- M4 between junctions 18 and 19 north of Parkfield
- M4 east of junction 18 – at Marshfield Road overbridge
- M4 between junctions 17 and 18 - two locations south of Littleton Drew
- M4 between junctions 16 and 17 – various locations including the Seagry Road overbridge, Dodford Lane overbridge and south of Dauntsey and to the north of Royal Wootton Bassett
- M4 junction 16 – western element of junction
- M4 between junctions 15 and 16 – near to A4361 Croft Road overbridge
- M4 junction 15 – various elements of the junction

- M4 between junctions 14 and 15 – including east of Baydon, west of Lambourne Woodlands and south of Woodlands St Mary
- M4 between junctions 13 and 15 – various locations south of Welford
- M4 between junctions 12 and 13 – various locations north of Hermitage and south of Yattendon
- M4 between junctions 11 and 12 – various locations
- M4 between junctions 10 and 11 – various locations including south of Whitley Wood, south of Lower Earley and south of Winnersh
- M4 between junctions 9 and 10 – two locations south of White Waltham
- A404(M) through the southern urban elements of Maidenhead
- A404 – several elements between the Bisham roundabout and the A4155 junction and a single section between the A4155 and the M40
- M4 east of junction 8 – at Bray
- Significant elements of the M4 corridor between junction 4a at the M25 and junction 8

Water pollution risk

2.7.21 We have a duty not to pollute water courses and ground water. We have identified those highway discharge locations across our network where there is an existing potential water pollution risk.

2.7.22 There are a number of locations along the route that have been identified as having key water pollution risks (categorised as having a high or very high risk of water pollution). These include locations where surface water run-off from the carriageway has a potential pollution impact on local water courses:

- A single point on the M4 between junctions 18 and 19 north of Pucklechurch
- A cluster of points on the M4 between junctions 16 and 17 south of Dauntsey
- A single point east of M4 junction 16
- A single point on the M4 between junctions 15 and 16 north of Burderop Park
- A cluster of points on the M4 between junctions 13 and 14 stretching from north of Wichkam to north of Boxford
- A cluster of points on the M4 between junctions 12 and 13 south of Tidmarsh

- A single point at M4 junction 12
- A single point east of M4 junction 12
- A cluster of points on the M4 to the west of junction 11 south of the Madejski Stadium
- A cluster of points west of M4 junction 8
- A cluster of points near to M4 junction 6 south of Slough

3 Future considerations

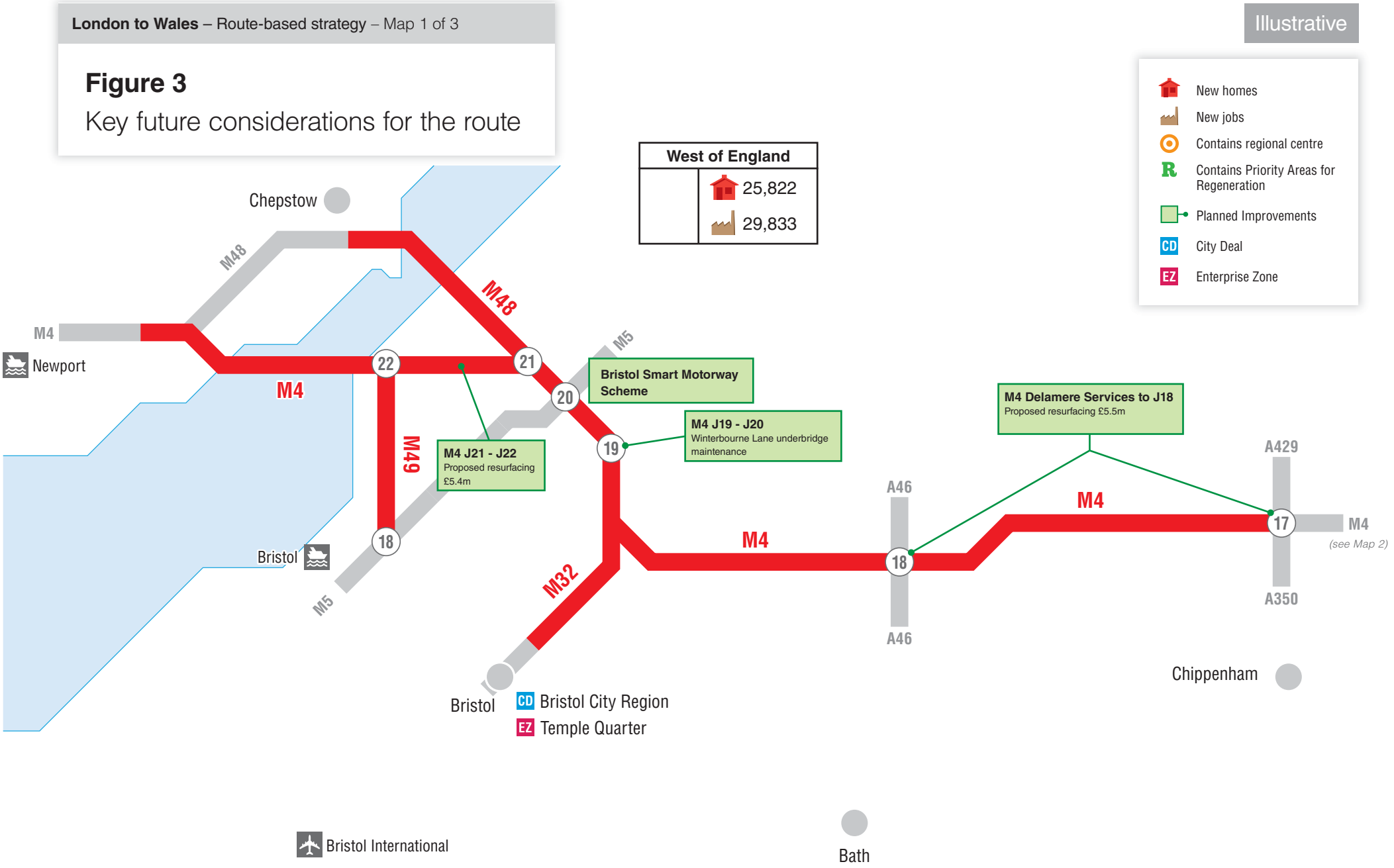
3.1 Overview

3.1.1 There is already a lot known about the planned changes to and around the route. Local authorities and the development community are already pushing forward the delivery of their housing and economic growth aspirations, as set out in their local plans. The Highways Agency has a large programme of schemes it has to deliver, plus an even larger programme of pipeline measures that could come forward after the general election. Local authorities, together with port and airport operators, are progressing measures to improve the operation and performance of their transport networks and facilities.

3.1.2 All of these issues have the potential to directly influence the ongoing performance and operation of the route. Figure 3 summarises the anticipated key future issues and the following sections summarise those issues in more detail.

Figure 3

Key future considerations for the route



Illustrative

Figure 3

Key future considerations for the route

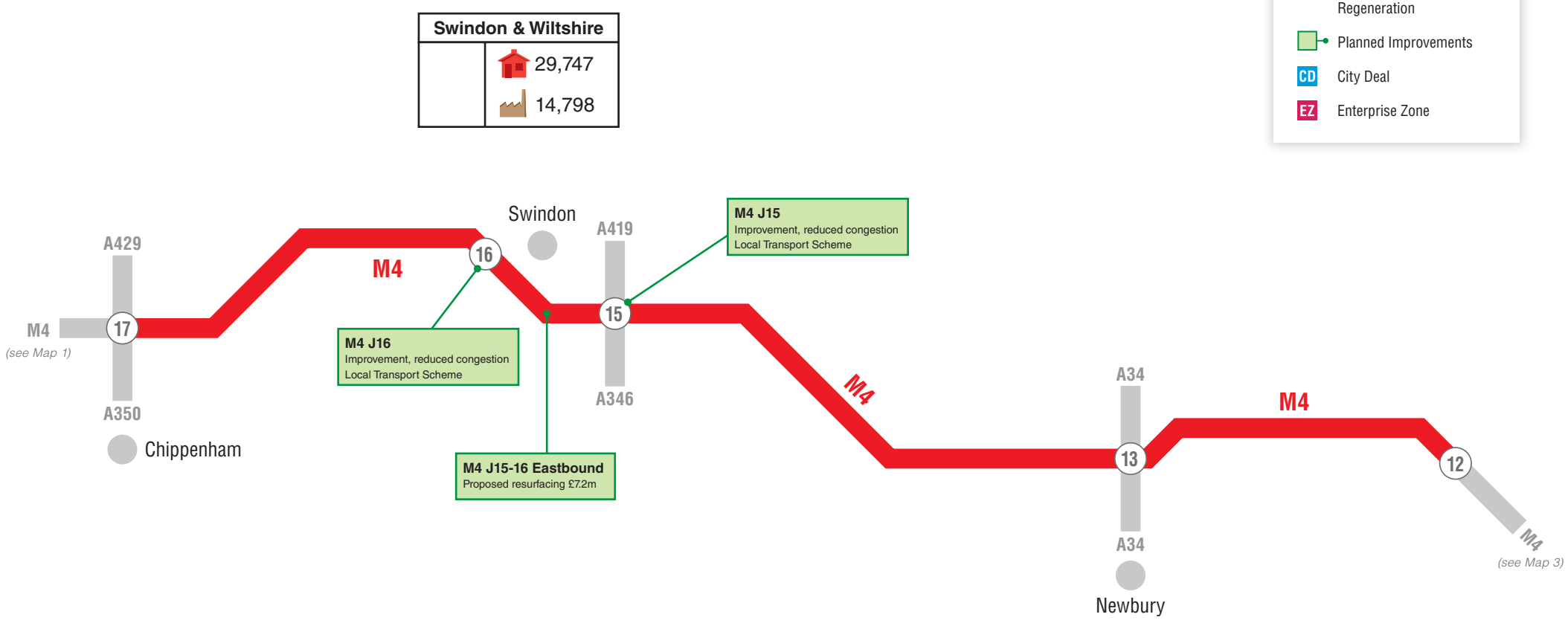
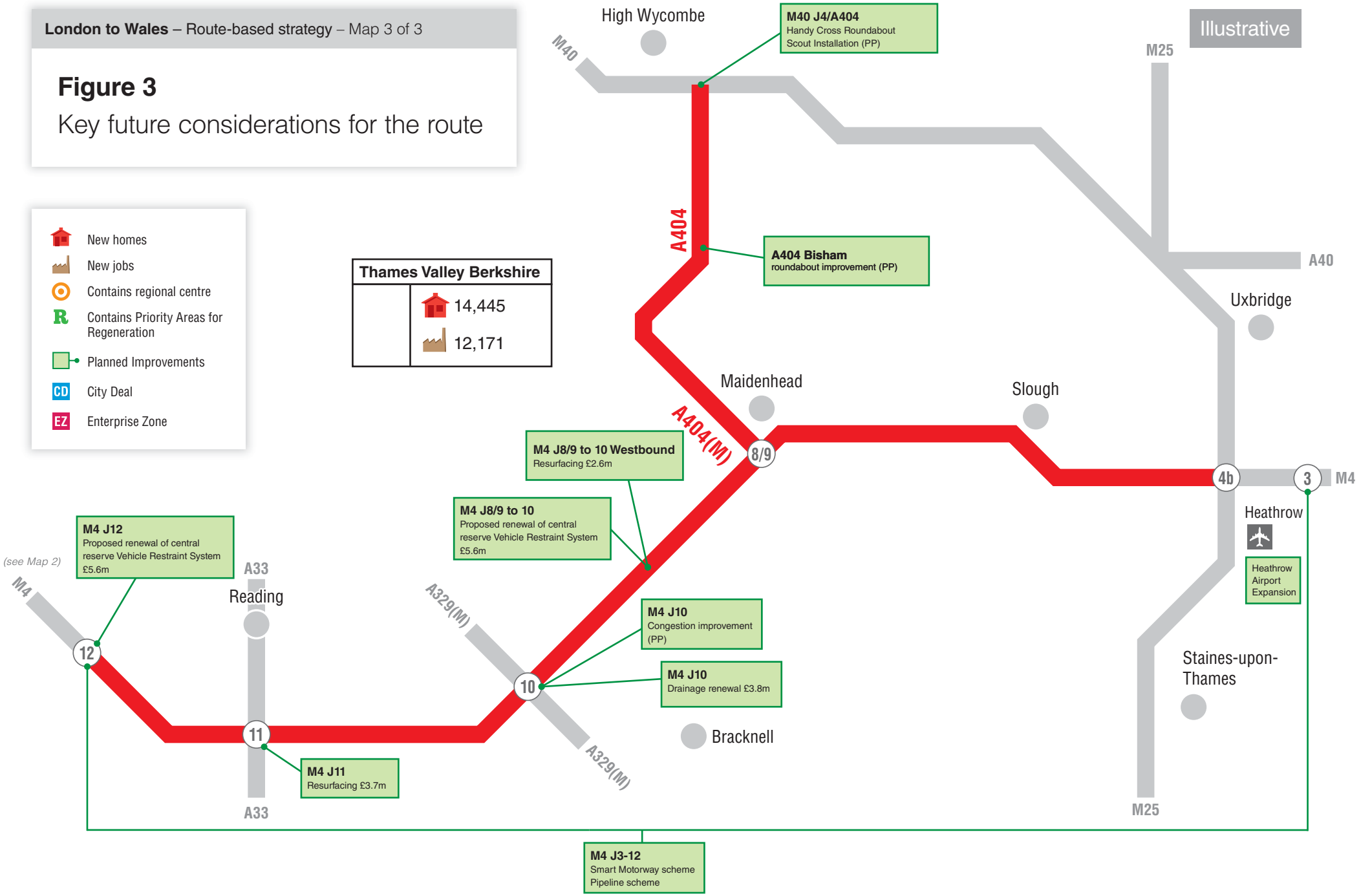


Figure 3

Key future considerations for the route



3.2 Economic development and surrounding environment

3.2.1 A key aspect of managing the route effectively will be ensuring that it is capable of supporting future local housing and economic growth aspirations. This will involve preparing the route through effective management and public investment to be in the best possible position to cater for the planned demands placed upon it, whilst ensuring that the developments themselves effectively mitigate their local impacts.

3.2.2 Figure 3 summarises the known key housing and economic growth aspirations that would impact on the route, with Table 3.1 below providing more context about some of those key developments the nature, scale and timing of the proposals. Table 3.1 summarises key housing and economic growth proposals by Local Planning Authority area. It then outlines specific proposals which are likely to have an effect on the SRN (due to a combination of their size and proximity to the strategic road network). In order to source this information, use has been made of the most recent Development Plan Document [DPD] available for the authorities.

Table 3.1 Key housing and economic growth proposals

Location of Development	Development Type	Scale by 2015	Scale by 2021	Scale by 2031	Anticipated Location of Impact on Route
City of Bristol Council (total)	**Residential** **Commercial**	**1,932 units** **1,735 jobs**	**3,478 units** **3,124 jobs**	**5,410 units** **4,859 jobs**	**M32 corridor and M4 junction 19**
Key development areas within City of Bristol: - Bristol City Centre	Commercial	1,059 jobs	1,985 jobs	3,088 jobs	M32 corridor
South Gloucestershire Council (total)	**Residential** **Commercial**	**8, 508 units** **9, 250 jobs**	**21,607units** **18,500 jobs**	**29,716 units** **28,300 jobs**	**M32, M48, M49** **M4 J18 to J22 &** **M5 J14 to 18**
Key development areas within South Gloucestershire:					
- Cribs Patchway	Residential Commercial	90 units unknown	2,371 units unknown	5,700 units 12,000 jobs	M5 J15 to 17
- Rest of Bristol North Fringe	Residential Commercial	2,830 units unknown	7,011 units unknown	6,616 units 7,000 jobs	M4 J19, & J20 M32 J1 & 2
- Yate / Chipping Sodbury	Residential Commercial	755 units unknown	2,371 units unknown	3605 units 8,000 jobs	M4 J18 & M32 J1
Wiltshire Council (total)	**Residential** **Commercial**	**9,200 units** **4,205 jobs**	**16,560 units** **7,569 jobs**	**25,760 units** **11,775 jobs**	**M4 Junction 16 to 18**
Key development areas within					

Wiltshire:				875 units	
- Royal Wootton Bassett	Residential Commercial	337 units 127 jobs	562 units 212 jobs	330 jobs	M4 junction 16 to 17
Swindon Borough Council (total)	**Residential** **Commercial**	**7,326 units** **4,016 jobs**	**13,187 units** **7,229 jobs**	**20,513 units** **11,245 jobs**	**M4 Junction 14 to junction 16**
Key development areas within Swindon:					
- Wichelstowe	Residential Commercial	974 units 282 jobs	2,438 units 707 jobs	3,793 units 1,100 jobs	M4 junction 15 to 16
- Commonhead	Residential Commercial	213 units 339 jobs	534 units 849 jobs	830 units 1,320 jobs	M4 junction 15
West Berkshire Council (total)	**Residential** **Commercial**	**1,575 units** **Unknown**	**4,725 units** **Unknown**	**7,350 units** **Unknown**	**M4 junction 11 to 14**
Key development areas within West Berkshire:					
- Newbury Racecourse	Residential	Unknown	1,500 units	Unknown	M4 junction 13
Reading Borough Council (total)	**Residential** **Commercial**	**1,640 units** **Unknown**	**4,919 units** **Unknown**	**7,651 units** **Unknown**	**M4 Junction 10 to 12**
Wokingham Borough Council (total)	**Residential** **Commercial**	**1,985 units** **Unknown**	**5,954 units** **Unknown**	**9,261 units** **Unknown**	**M4 junction 10**
Key development areas within Wokingham:					
- Wokingham Strategic Development Location	Residential	732 units	2,928 units	3,863 units	M4 junction 10
- Arborfield Garrison	Residential	352 units	2,470 units	3,120 units	M4 junction 10 to 11
- South of M4 Strategic Development Location	Residential	724 units	2,172 units	2,502 units	M4 junction 11
Bracknell Forest Council (total)	**Residential** **Commercial**	**1,671 units** **Unknown**	**5,013 units** **Unknown**	**7,797 units** **Unknown**	**M4 junction 10**
Key development areas within Bracknell Forest:					
- Former TRL, Crowthorne	Residential	143 units	1,000 units	Unknown	M4 junction 10
Windsor and Maidenhead Council (total)		**Unknown**	**Unknown**	**Unknown**	**M4 junction 7 to 10**
South Bucks District Council (total)	**Residential**	**420 units**	**1,260 units**	**1,960 units**	**M4 junction 6 to 8**

Slough Borough Council (total)	**Residential** **Commercial**	**938 units** **2,160 jobs**	**2,813 units** **3,600 jobs**	**4,375 units** **Unknown**	**M4 junction 5 to 7**
Key development areas within Slough: - Slough Trading Estate	Commercial	2,160 jobs	3,600 jobs	Unknown	M4 junction 6 to 7

Table Note – Populated based on most recent Development Plan Document (DPD) information

3.2.3 Temple Quarter in Bristol was designated an Enterprise Zone in 2012. Its target is to create 4,000 jobs in the first five years and around 17,000 in the 25 year lifespan of the project. Alongside the Enterprise Zone, there are also five Enterprise Areas in the West of England; Avonmouth Severnside, Bath City Riverside, Emersons Green, Filton and Junction 21.

3.2.4 Bristol and the surrounding area agreed a deal under the City Deals programme announced in July 2013. The Government has devolved new responsibilities to give the city the flexibility it needs to attract private investment, close skills gaps and attract new jobs. As part of the City Deal, the Bristol City Region expects the deal to help deliver an additional 40,000 jobs and over £1 billion of investment to support local growth over the next 30 years.

3.2.5 This scale of development is likely to have an impact on the M32, which runs to/from the centre of Bristol, but given the scale, the impacts are likely to extend to the M4 corridor of this route.

3.2.6 During the stakeholder workshops, comments were made in relation to the importance of economic growth and job creation and how transport and infrastructure are key to facilitating and supporting this growth. These discussions identified that the focus of new jobs and housing is likely to be focussed around existing urban centres.

3.2.7 During the stakeholder engagement, particular mention was made to the following developments:

- The Reading to London element of the network and access to London Heathrow Airport was identified as a key priority. Issues of reliability for London Heathrow Airport passengers accessing the airport was also identified on this section of the M4 and the section falling in the London Orbital and M23 to Gatwick RBS report.
- Possible Heathrow expansion to a third runway could produce further impacts along the M4 corridor.
- Severnside is a major growth area, with the possibility to provide up to 8,000 new jobs. This includes a proposal for Avon Power station. Specific mention was made in relation to the need for the M49 motorway to accommodate this growth, and there were numerous comments regarding the need for a new junction on the M49 in this area to provide strategic access.

- A power station is proposed on the bank of the River Severn to the north of the M48 crossing (Oldbury Power Station), which could affect the M48 and M5.
- North Fringe and South Bristol are the housing priorities within the greater Bristol area, both of which have the potential to increase traffic flows on the SRN around Bristol.
- A planning application for an IKEA at M4 junction 12 which was given consent in 2012. They may submit a revised application in 2014 creating additional pressures at this junction.
- M4 junctions 16 and 17 are already busy and additional development planned nearby is likely to exacerbate pressures at these junctions.
- The Science Vale development (towards Oxford) could have an impact on the M4 corridor at M4 J13.
- The impact of development in Surrey and Buckinghamshire also needs to be considered as Berkshire has a wide influence. Potential growth in this area could have implications for the M4.

3.2.8 The route serves London Heathrow Airport and Bristol Port. This information is covered in more detail in Section 3.4 (Wider Transport Networks).

3.3 Network improvements and operational changes

3.3.1 The Agency is already delivering a large capital programme of enhancement schemes nationally. This includes Major Schemes greater than £10m in value, plus smaller enhancement schemes including the current pinch point programme. Table 3.2 below summarises the current committed enhancement schemes proposed along the route, which have also been represented on Figure 3.

Table 3.2 Committed SRN enhancement schemes

Location	Scheme Type	Completion Year	Anticipated Benefits
M4 junction 19-20	Bristol Smart Motorways Scheme.	2014	Reduced congestion by using technology to vary speed limits and hard shoulder running. Benefits delivered at a significantly lower cost than conventional motorway widening and with less impact on the environment during construction.
M4 junction 10	Pinch point Scheme.	2015	Improved links between the M4 and A329(M), providing increased capacity at the junction and improving traffic flows.
M4 junction 2 – 3	Bus Lane Suspension Scheme.	Ongoing	Reduced congestion through opening up the lane to all motorists travelling towards the capital - not just licensed black taxis, motorcycles and buses.

A404 Bisham Roundabout Improvement	Pinch point Scheme.	2014	Reduced journey times for road users, improved safety and providing a boost to the economy.
A404 Handy Cross Roundabout	Pinch point Scheme.	2014	Split Cycle Offset Optimisation Technique (SCOOT) Installation to increase capacity. (SCOOT is an adaptive system which automatically responds to traffic flow fluctuations through the use of detectors embedded in the road.)

3.3.2 The smart motorway project for the Bristol Box is the only Highways Agency Major Project (a Major Project is identified as being greater than £10 million in value) due to be completed on this route in 2014. In addition to the technology assets, this scheme will add a significant number of structures to the asset.

3.3.3 The 2013 Spending Review and subsequent report from HM Treasury Investing in Britain's Future referenced a series of potential new pipeline schemes for the strategic road network. Table 3.3 below provides a summary of the pipeline improvement schemes that would impact this route, subject to value for money and deliverability.

Table 3.3 Declared pipeline schemes

Location	Scheme Description
M4 junction 3 - 12 London to Reading	Smart motorway scheme. Reduced congestion by using technology to vary speed limits and hard shoulder running. Benefits delivered at a significantly lower cost than conventional motorway widening and with less impact on the environment during construction.

3.3.4 The HM Treasury report Investing in Britain's Future also promoted undertaking a number of feasibility studies that the government will undertake to inform potential future investment in highway improvements. While not directly considering this London to Wales route, the A303/A30/A358 Corridor Feasibility Study considers a route with which the London to Wales route has a strong relationship.

3.4 Wider transport networks

3.4.1 The June 2013 report from HM Treasury Investing in Britain's Future also listed the local transport schemes either completed, under construction or due to start before May 2015. Table 3.4 below lists the schemes from that report that will influence the ongoing operation of this route, plus any other funded local network commitments that will be delivered before 2021.

Table 3.4 Committed local transport network enhancement schemes

Project	Scheme Type	Completion Year	Anticipated Impacts on the Route
Bath Transportation Package	Public Transport	2015	Increasing Park and Ride capacity, better bus routes and improving transport flows could remove local traffic from the network.
MetroBus	Public Transport	2015	North Fringe to Hengrove MetroBus could remove local traffic from the M32 and M4.
MetroWest Phase 1	Public Transport	2019	Scheme involves reopening the Portishead rail line, which could remove some local traffic from the M49.
West of England Better Bus Area	Public Transport	2012 onwards	Improved bus services could remove some local traffic from the M4.
Western Rail Access to Heathrow	Public Transport	Early 2020's	Improved access to Heathrow Airport from Reading.
Crossrail	Public Transport	2018	Improved public transport access to Heathrow from London and Maidenhead.
Reading Station area redevelopment	Public Transport	2015	Increased levels of development close to Reading station and an increase in passengers using Reading station.
M4 junction 15 Improvements	Road		Reduced congestion at M4 junction 15
M4 junction 16 Improvements	Road		Reduced congestion at M4 junction 16
Great Western Main Line Electrification	Public Transport		Reduced congestion at M4

3.4.2 The two Severn Crossing bridges are currently operated by a private company but the Welsh government has an aspiration to take control when they return to public ownership in about 2018. This could potentially lead to the abolishment of the current toll system and a report for the Welsh government has identified that abolishing the tolls would increase traffic by an estimated 12%.

3.4.3 From 2026 onwards, the West of England Joint Local Transport Plan states that there will be investigation of additional transport links including a new road link between the M5 and South Bristol, A36/A46 link and M4 link.

3.4.4 In the Wiltshire area, improvements to the M4 junctions 15 and 16 have been prioritised by the Swindon and Wiltshire Local Transport Body which has submitted schemes to the DfT for approval.

3.4.5 In the Thames Valley Berkshire area, there is an aspiration to develop Slough to Heathrow Mass Rapid Transit which could reduce pressure

on the M4. There is also an aspiration to construct a third Thames crossing, to the east of the Reading urban area.

3.4.6 Cornwall Council's "Connecting Cornwall: 2030 Strategy" states that they will work with partners to deliver a second strategic route to the south west to reduce reliance on the M4/ M5 strategic link.

3.4.7 The London to Wales route serves London Heathrow Airport and Bristol Port.

3.4.8 London Heathrow Airport is a major international airport, which is the busiest in England. The airport sustains 76,600 jobs directly and around 116,000 indirectly in the immediate area (*Heathrow Related Employment*, Optimal Economics Ltd, 2011). In January 2009 the Transport Secretary announced that the UK government supported the expansion of Heathrow by building a third runway and a sixth terminal building. A decision on this plan is expected in 2015, after the general election. Any expansion is likely to have an impact on the M4, mainly towards the eastern end of the corridor.

3.4.9 Bristol Port is a key employer supporting some 7,600 jobs either directly, through associated activity, or through linkages within the local economy.

3.4.10 In March 2010, Bristol Port received planning consent for the construction of a Deep Sea Container Terminal. It is projected (*Avonmouth Severnside Outline Development Strategy*, AMION Consulting Limited, 2012) that the proposed port expansion will require about 1,500 jobs when fully operational, in both direct port employment and port associated activities such as transport services, shipping and freight forwarding. A further 260 jobs would be generated through multiplier effects. Some 360 new full-time equivalent jobs are expected during the construction phase.

3.4.11 Whilst the M49 is currently operating within capacity these proposals will have an effect on the M49 and it's junction with the M5 in particular, but also have a knock on effect on the M32, M48 and M4.

4 Key challenges and opportunities

4.1 Introduction

4.1.1 It is not possible to show all the challenges and opportunities identified in this evidence report. This chapter shows a selection based on those where our internal and external stakeholders viewed these as a priority and these are supported by evidence. A full list of all the identified challenges and opportunities are provided in the Technical Annex.

4.1.2 Figure 4 summarises some of the key issues and challenges that the route will experience during the 5 years from 2015, with the following sections and Table 4.1 explaining these issues and challenges in more detail.

Timescales

4.1.3 To understand the timescales of when the key challenges identified become critical and when opportunities on the route could be realised, the following definitions have been made in Table 4.1:

- **Short Term:** current
- **Medium Term:** before March 2021
- **Long Term:** not before 2021

4.1.4 These timescale categories provide a guide for informing when a future intervention may be required to meet the anticipated future operational performance needs, or when interventions may be needed to help facilitate local housing and economic growth aspirations.

4.1.5 In informing the timescales, consideration has been given to the various factors that influence when it is expected the opportunities and challenges arise, including a consideration of the current conditions and with a view to the intensity of future growth aspirations.

Local Stakeholder Priorities

4.1.6 Input from stakeholder and road user groups linked to the route have been used to inform the development of this evidence report. This included getting their views on what they deemed to be the priorities within their area and identifying their “top priorities” locally. This has been collated according to the route to which those views related.

4.1.7 Table 4.1 presents a summary of whether the challenges and opportunities identified were a priority for our stakeholders in their particular area. This exercise does not seek to prioritise the challenges and opportunities along the length of the route by trying to compare one issue against another, but reports the feedback from local discussions.

4.1.8 This picture of stakeholder priorities is subjective and has been informed by discussions regarding the top priorities locally at the stakeholder events, and in conversations with stakeholders who couldn't attend the events.

4.1.9 We recognise that the picture we build through this categorisation will be influenced by the representatives and organisations we have engaged with, and that consequently we may not have achieved a statistically balanced view and certain priorities may not have been identified as a "top priority". We will be conscious of the limitations of the reporting of stakeholder priorities as we move into the second stage of RBS.

4.2 Operational challenges and opportunities

4.2.1 A number of challenges and opportunities have been identified in relation to the operation of the route.

4.2.2 In relation to the Traffic Officer Service (TOS) it is clear that a full operational service is provided on the entire route other than the A404. However, the evidence suggests that there are elements of the route where the impacts of incidents are felt greatest, most notably the M48 at the Severn Crossing and the more rural areas of the network.

4.2.3 The challenge is to consider the specific reasons for such locations being more at risk to lengthier incident impacts, but also to develop processes and location specific responses that can better deal with such. A careful balance needs to be made looking at the network as a whole in ensuring a balance is made with the seemingly good incident response performance at the busier and least reliable elements of the network where the benefits of focussing TOS activities may be greatest. Stakeholders further identified that a more consistent approach to incident management is required.

4.2.4 Technology provision along the route is again largely focussed on those elements of the network that require such in order to operate efficiently – essentially those elements where traffic demands are greatest. This is further reflected by the smart motorway scheme between M4 junctions 19 and 20 and the planned smart motorway scheme between M4 junctions 3 and 12 which will provide a further technology capability to reduce congestion (see Table 3.3).

4.2.5 The future performance of the network has many influences, but it is clear that there will be operational challenges, not least associated with the future growth aspirations along the route. Opportunities exist to implement further technology based solutions on the network where they offer benefits to its operation and these will be needed to respond to increasing demand on the already busy parts of the network, but also in wider areas of the network where traffic demands will add further pressures and changing operational conditions.

4.2.6 Opportunities to enhance the technology provisions on the route were also identified by stakeholders including the use of a free-flow charging system on the Severn Crossing (as currently being trialled on the Dartford crossing) and the better use of personal technology to share information with road users. Many other examples were identified but it was apparent that the co-ordination of technology delivery across the strategic and local network in terms of planning, delivery platforms and information sharing would offer benefits to the road user.

4.2.7 A key output from the stakeholder discussions was in relation to diversion routes, be it the formal strategic routes identified in co-operation with LAs in the event of roadworks or major incidents or those of a more informal nature which road users seek to use in reaction to the operating conditions of the strategic road network. Stakeholders identified that there is a lack of ability for the alternative local routes to cater for the demands experienced in such instances. Some clear examples of local routes not being able to cater for such demands were identified at the stakeholder events, with the A329/A322 corridor in the Bracknell area and the local network in the Bristol area being clear examples of this.

4.2.8 The challenge of ensuring a resilient network extends to the influence and interaction that the route has over a large geographical area, with clear relationships between the performance of the route and strategic corridors some distance away. Clear examples include the relationship of the M4 corridor with the A303 for access to the South West region and the relationships of the A404 with the A34 and the M25 for those wanting to link between the M4 and M40. Incidents or road works on one of these routes can significantly influence the operation of the alternative route.

4.2.9 The economic growth aspirations along the route have been fully explored as part of this evidence gathering stage with chapter 3 summarising the key influences on the route. The route plays a key role in supporting this economic growth and providing the strategic access that facilitates it, but in turn the growth presents challenges in additional demands for use of the network.

4.2.10 These growth challenges have been fully considered and given the diverse and wide-ranging future influences they cannot be fully detailed here. To point to a few however, there was wide recognition that:

- London Heathrow airport and its future expansion is likely to represent a specific challenge, with increased demands, but also with a need to be well served by a reliable transport network. This also applies to Bristol Port.
- Growth and expansion of the main urban areas along the route including Swindon and the Thames Valley settlements, are likely to result in junction specific issue, for instance at junctions 12, 16 and 17.

- The various growth designations in the Bristol City Area, including the City Deal, the Enterprise Zone, the Enterprise Areas and the wider growth aspirations of the City of Bristol and South Gloucestershire will lead to increased demands on what is an already highly trafficked part of the route.
- There are areas of the network which are reliant on new infrastructure of a strategic nature. Stakeholders were particularly clear with regard to the need for a new junction on the M49 motorway to accommodate growth and provide strategic access to the growth opportunities at Severnside.
- The wider South West and South Wales economies, while not considered in detail as part of this evidence gathering stage given their more distant relationship, are reliant on the route in providing strategic access.

4.2.11 Finally, the physical form of the network itself was identified by stakeholders as a constraint to its operation in some instances. Elements such as the discontinuous hard shoulder between M4 junction 7 and the M25 were identified as contributing to specific issues on the network, in addition to areas of poor signage and lane marking (particularly noted on the western elements of the route).

4.3 Asset condition challenges and opportunities

4.3.1 The condition of the asset is critical in relation to the ability of the route to operate safely and efficiently. Part of the evidence gathering stage of this route-based strategy, some key challenges have been identified.

4.3.2 Perhaps the most prevalent issue relates to the condition of the carriageway surface. The evidence has identified that a significant element of the route will reach the end of its design life by 2020, with an increased risk of failure. Specific sections have been identified as being particularly exposed to this risk, including the western section of the M4, and the M32 and M48 corridors, but sporadic elements of the entire route are also identified.

4.3.3 One of the key challenges in tackling this issue is in relation to programming the maintenance works and the associated delay that such can cause to customers. Many sections of the network are critical to the areas that they serve and in many instances relate to the economic needs of the network in supporting future growth and the very nature of tackling this issue therefore requires careful planning. The M32 was identified through stakeholders as a specific example of an area of the network where this issue will be critical, also identifying the importance of the strategic diversion routes during any maintenance activities.

4.3.4 Opportunities to resurface key elements of the network are already being realised, for example the resurfacing that is planned on the A404 in Berkshire in both directions in the short term. The DfT document

Action for Roads – A network for the 21st century makes the commitment to resurface 80% of the network by 2021. On the current assumption that the route would receive its share of this commitment, significant betterment of the future network would be made, reducing the risks associated with an ageing surface.

4.3.5 The structures asset has been identified as having specific issues at locations such as the M32 Eastville Viaduct which has specific challenges associated with future maintenance, and again the influence that planning such maintenance has on our customers in the event of works affecting the live carriageway, with the M32 offering a key arterial link to Bristol.

4.3.6 Early opportunities are being taken to deal with other known structural issues, such as the maintenance schemes planned to be completed in 2014 for both the M4 junction 7 bridge and M4 junction 11 – 12 Theale Railway Bridge. A forward-looking challenge is faced in inspecting and maintaining the structural assets as they age. This can be extended to the lighting and drainage assets which in some cases have been identified to be in poor condition and defective or ineffective.

4.3.7 In relation to the asset as a whole and in managing associated maintenance of the network, opportunities were identified by stakeholders for more collaborative working processes. These were particularly identified with a view that better information exchange and co-ordination could aid customers through the better identification of diversion routes and provision of better quality and timely information.

4.4 Capacity challenges and opportunities

4.4.1 The capacity challenges and opportunities have been defined through a combination of evidence that the Agency has gathered as detailed in chapters 2 and 3 of this report, and the input of stakeholders through the engagement events.

4.4.2 Some clear themes and corresponding geographical areas were established and these are detailed in this section.

4.4.3 Network capacity issues have been identified on elements of the route most evidently on the links to and from Bristol, the M32 between Bristol City Centre and the interchange with the M4, the M4 on its approach links to Swindon from the west, the M4 corridor between Reading and the interchange with the M25 and the A404 corridor.

4.4.4 These capacity issues are mainly, but not limited to, the more urban areas of the network where commuter patterns allied with Bristol, Swindon and extending from Reading to London influence the operation of the route. A combination of link-based issues (where the traffic volumes are particularly high), junction issues (the ability of vehicles to get on and off the strategic road network) and the nature and form of the network (eg high levels of interchange in some places) contribute to

these capacity issues. Together these lead to consequences to the customer in terms of journey time reliability, influences on the speed that vehicles can travel at and delay.

4.4.5 Unsurprisingly the focus of future growth is in the locations that the network already experiences its greatest demands and the challenge to ensure that the route can support these aspirations, and the traffic demands they will bring, is clear.

4.4.6 As summarised in chapter 3, the Agency has a number of committed and pipeline schemes that seek to enhance the operation of the network. The synergy between the location of these and some of the key capacity problems identified (such as the smart motorway schemes and the pinch point schemes) highlights that the measures are being directed to the right locations. Further, these schemes not only respond to current issues but seek to provide benefits to the delivery of future growth. Stakeholders were keen to consider the effect that the smart motorways schemes would have on the route, prior to being able to identify their adequacy in dealing with future challenges.

4.4.7 Future network challenges and growth aspirations will provide further opportunities to identify and deliver schemes which can benefit the operation of the route. The Agency will need to work with its partners to ensure resources are directed to the most appropriate places and where the greatest benefits can be achieved.

4.4.8 While this strategy is focussed on the strategic road network, a number of local transport network enhancement schemes (as identified in chapter 3) have the potential to influence travel patterns along the route, including bus and rail improvements and park and ride provisions. Stakeholders identified this as a key challenge in ensuring that the Agency and the LAs / other transport providers work in a collaborative manner that ensures the maximum benefits are realised and that the right solutions are being sought to tackle the problems. A particular example was cited by stakeholders in relation to the potential for better liaison between the Agency and Network Rail given the relationship between the Great Western rail route and the M4 corridor.

4.4.9 Two key international gateways, London Heathrow Airport, at the eastern end of the route, and Bristol Port, at the western end, have aspirations for future growth – an additional runway and a deep sea terminal respectively. These will bring challenges to the network in terms of additional and type of demands they will bring. The operation and success of these gateways and the ability for them to serve the UK economy are heavily reliant on the transport connections and the strategic links afforded by the London to Wales route.

4.5 Safety challenges and opportunities

4.5.1 Through interrogation of data the Agency collects in relation to collisions and casualties it has been identified that the main safety challenges

along the route are focused, in the main, on the eastern sections of the route on the M4 between Reading and the M25 and the A404 corridor.

4.5.2 The analysis of historic trends has identified that the rate of collisions and casualties on the route as a whole has been reducing over a number of years. While this can be seen as a positive, there exists opportunities to reduce rates further through further measures, be this through implementation of physical measures or wider initiatives to influence driver behaviour on the strategic road network.

4.5.3 We have identified a particular trend in the number of incidents on the M4 between junction 5 and 4B near to the interchange with the M25 – ranked as the 3rd highest casualty location in the country. Better understanding the reasons for this and developing interventions that could be implemented to improve the situation represents a challenge, but also a significant opportunity at this specific location.

4.5.4 The outcomes of the stakeholder engagement events support the findings of the evidence base in relation to the areas of issue and some potential reasons as to why such safety issues are apparent, for instance at the link between junction 5 and 4B near to the interchange with the M25, issues associated with merging and diverging traffic and the weaving patterns was identified as a likely contributor to the issue.

4.6 Social and environmental challenges and opportunities

4.6.1 It has been established that the route has a number of interactions with routes for vulnerable road users where they are physically separated (see Section 2.6). The main challenge for vulnerable road users is therefore in relation to cross-network needs including at road junctions, in facilitating sustainable modes and access to existing and future developments. Opportunities were identified as part of the stakeholder engagement to better provide for these cross-network needs as part of junction schemes, but with recognition of the challenge that is faced in accounting for often local benefits of schemes on the strategic road network, and also in quantifying these benefits through the scheme appraisal process.

4.6.2 Air Quality and Noise represent specific challenges in locations on the route. Air Quality Management Areas (AQMAs) are identified including the M32 corridor in Bristol and the M4 at various locations between Reading to Slough where EU limits are being exceeded. The need to meet the EU defined targets is challenging. Stakeholders identified a particular challenge in the fact that the strategic road network is a major contributor to the air quality issues but noting that the Agency nor LAs have no influence on the root cause. Noise Important areas are also identified along the route and stakeholders emphasised this issue with the identification of key issues in the West Berkshire, Wokingham and Chievelely areas of the M4 corridor. An opportunity exists to tackle such issues with the proposed resurfacing on the network by 2021.

4.6.3 While various areas of the route have been identified as being susceptible to flooding, this issue is of a sporadic nature and been identified as being a challenge at specific points of the network.

4.6.4 It has been identified that the route has a number of direct relationships with areas having environmental designations. Reducing or minimising the impacts that vehicular traffic has on these designations will be a challenge that will be further emphasised with likely increased demand.

4.6.5 A final social issue relates to the intrinsic relationship between the operation of the strategic road network and the local network, with instances identified of poor operating conditions on the route having knock-on consequences on the local networks. This also extends to the ability for public transport services to operate a reliable service, reducing the effectiveness of the sustainable modes that the Agency seeks to promote.

Table 4.1 Schedule of challenges and opportunities

	Location	Description	Is there supporting evidence?	Timescales			Was this Identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Network Operation	M4 junctions 7 to 10 (Slough, Maidenhead, Bracknell area)	The M4 journey times between M4 junctions 7 and 10 are seen as overambitious and unreliable. Creates problems for Heathrow travellers.	No	✓			✓		✓	
Network Operation	M4 junction 7 to 4B (Slough area)	The discontinuous hard shoulder between M4 junction 7 and the M25 causes minor incidents (and is a risk of major incidents). This also influences capacity (as a result of exiting from or joining onto the main line).	Yes (see chapter 2)	✓			✓		✓	
Network Operation	M4 (in general)	Diversion routes are not being agreed between the Agency and LA's.	No	✓			✓		✓	
Network Operation	M32 (in general)	The M32 runs into a very urban area. There is a transition of speed limits to 30mph in the conurbation. Hengrove to M32 bus link improvements are underway. If there is an issue on the M4, drivers divert on to the M32 and central Bristol becomes gridlocked.	No	✓			✓	✓		

	Location	Description	Is there supporting evidence?	Timescales			Was this Identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Network Operation	M4 and M48 (Severn Crossings)	Possibility of introducing free flows, to allow for a quicker crossing. Dartford crossing are currently trialling this. The Severn crossings cause problems at peak times and represents a barrier to entering Wales, particularly for haulage (perception an issue, being held up). New developments in South Wales will increase flows on the bridge.	No		✓		✓	✓		
Network Operation	M48 and M49 (in general)	Considered that signage and lane marking on these areas of the network is confusing.	No	✓			✓	✓		
Network Operation	M32 (in general)	There is a need for some form of priority for freight and public transport as these presently get held up on their way in and out of Bristol.	No	✓			✓	✓		
Network Operation	M4 junction 19-20 (Bristol area)	It is unclear, at this time, as to how the smart motorways (previously known as managed motorways) will operate once open, and the effect they will have on congestion.	No	✓			✓	✓		
Network Operation	M4 (in general)	A challenge is faced in relation to better managing incidents which are currently considered to lack a consistent approach.	No	✓			✓	✓		
Network Operation	M4 (in general)	Ramp metering and demand management approaches are not adequately coordinated between LAs and the Agency.	No	✓			✓	✓		

	Location	Description	Is there supporting evidence?	Timescales			Was this identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Network Operation	M4 (in general)	HGV activity and overtaking can effectively reduce capacity. There exists a possible opportunity for an education campaign or further mechanisms to better manage HGV activity.	No	✓			✓	✓		
Network Operation	M4 (in general)	Better liaison is required between the Agency and Network Rail with regards to strategic planning for capacity. The Great Western rail route effectively follows the M4 corridor and there is a need to consider and co-ordinate modes better in planning terms.	No	✓	✓	✓	✓	✓		
Network Operation	A404 (in general)	Contingency planning required as the route is currently being used as an alternative route to the A34 and M25. Opportunity for more VMS to be used and better access provided to emergency vehicles.	No	✓			✓		✓	
Network Operation	M4 (Bracknell area)	A feeling that the Agency concentrate on the A322 / A329 corridor between M4 junction 10 and M3 junction 3, but the Local Enterprise Partnership (LEP) finds this challenging. The challenge is finding funding to address the resulting "rat run" through Bracknell, but it is perceived that the Local Authority (LA) / LEP does not get the required support from the Agency.	No	✓			✓		✓	
Network Operation	M4 Junction 19 (Bristol area)	There is a desire for Emersons Green to be served from the motorway.	No			✓	✓	✓		

	Location	Description	Is there supporting evidence?	Timescales			Was this Identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Network Operation	M4 (Reading area)	Coordination between the Agency and the police is needed on works and incident management - there is a lack of information on the impact of issues on the SRN on Reading town centre.	No	✓			✓	✓		
Network Operation	M4 junction 12 (Reading area)	Drivers can observe the operational state of the M4 when they cross the bridge at junction 12 and then choose the A4 if it appears congested.	No	✓			✓	✓		
Network Operation	M4 (in general)	When there are issues on the network, traffic diverts to the local road network. An example of this occurring was during a recent air balloon event.	No	✓	✓		✓	✓		
Network Operation	M4 (in general)	There is poor co-ordination and consultation around the M4 corridor demand management initiatives and recent revocation of bus lane orders.	No	✓			✓	✓		
Network Operation	M4 (in general)	Diversion routing following an incident on the M4 - personal technology (sat-navs and smartphones) are often used to aid navigation.	No	✓			✓		✓	
Network Operation	M4 (in general)	Digital exchange - the change by the Agency from Urban Traffic Management and Control (UTMC) to DATEX (traffic information exchange) is causing an issue with LAs. LAs used different ITS Tools to the Agency. UTMC is not being used by the Agency in digital exchange terms as the Agency uses a different operating system. LAs could not fund a changeover.	No	✓			✓	✓		

	Location	Description	Is there supporting evidence?	Timescales			Was this Identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Network Operation	M48 and M49 (in general)	Signage / lane marking is confusing.		✓			✓	✓		
Asset Condition	M32 (in general)	Concerns about the amount of re-surfacing needed and how this can be delivered without impacting upon the core operation of the network. Strategic diversion routes are also key to this (during resurfacing). Maintenance of the Eastville viaduct is an issue.	Yes (see chapter 2)	✓	✓	✓	✓	✓		
Asset Condition	M48 (Severn Crossing)	Old cables which need attention. The road is in need of waterproofing and access needs to be found to allow this.	No	✓	✓	✓	✓	✓		
Capacity	M49 (Severnside area)	Considered to be a bottleneck to the area as it is so congested. Future development includes up to 8,000 new jobs at Severnside. There is a need for additional infrastructure in the form of a new junction on the M49 – a key opportunity to facilitate economic growth. A lot of evidence has been produced already identifying this as an issue in terms of a barrier to growth and this is a top priority for the LEP.	Yes		✓		✓			✓

	Location	Description	Is there supporting evidence?	Timescales			Was this identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Capacity	M4 (Thames Valley area)	Thames Valley is a key business catchment area for Heathrow Airport - journeys are important to the UK economy. The outcome of the Airports Commission will have an impact on the demand for travel to Heathrow. It will be attracting more passengers/freight in future.	Yes (see chapter 3)	✓			✓			✓
Capacity	M32 (in general)	The corridor is over capacity. Major queuing problems and poor journey time reliability.	Yes (see chapter 2)	✓			✓			✓
Capacity	A404 / A4155 junction (Marlow area)	Severe congestion identified during the peak periods. Constraining business in the area.	No	✓			✓			✓
Capacity	M4 Junction 20 (Bristol area)	The interchange has a national role in connecting England and Wales and providing access to the South West, but also a local role in providing access to local communities and developments. A challenge exists in balancing getting local trips onto the network and the need to enable national growth.	No	✓	✓	✓	✓		✓	
Capacity	A404 and North-South links (in general)	The linkage between Reading / M4 and the M40 is difficult and there are a lack of alternatives in the Thames Valley area. Issues extend to the local road network. Opportunity for redundant rail lines (eg Maidenhead to High Wycombe) to be better utilised.	No			✓	✓		✓	

	Location	Description	Is there supporting evidence?	Timescales			Was this identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Capacity	M4 junction 16 (Swindon area)	Potential for a park and ride site at Royal Wootton Bassett which would be near to the Ministry of Defence Lyneham facility. There is a need to develop a long term strategy for Wootton Bassett. M4 junction 16 is a key constraint for Stagecoach and their Wiltshire and Swindon services.	No	✓			✓		✓	
Capacity	Reading area (in general)	There is a need for better north-south connectivity at Reading (mainly east of Reading) - a third Thames Crossing would be a solution (extension of A329). Congestion at Reading - at least 20 minutes is added to commuter trips between Reading and Slough. M4 used as a local bypass route around Reading. Effects of redevelopment on both sides of Reading Station. Projected increase in passengers using Reading station.	No	✓			✓		✓	
Capacity	M32 junction 1 (Bristol area)	Capacity issues at the junction of the A4174 ring road with the M32 - A well used junction, Ministry of Defence etc. Ring road is incomplete which puts pressure on the network.	No	✓			✓	✓		
Capacity	Bristol Port	There are ambitions for this to become a deep water port. Additional cruises, coaches etc. Would the network cope with this development?	Yes (see chapter 3)				✓	✓		

	Location	Description	Is there supporting evidence?	Timescales			Was this Identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Capacity	M4 Junction 19 (Bristol area)	Suffers in peak hours and capacity issues to the west of the junction.	Yes (see chapter 2)	✓	✓		✓	✓		
Capacity	M4 junction 15 (Swindon area)	A key strategic junction which is constrained. There are congestion issues now. The junction is an immediate issue to the growth coming forward in the future and the junction is the second priority of the LEP and the third priority for the Local Transport Board.	Yes (see chapter 2)	✓			✓			✓
Capacity	M4 junctions 8/9 (Maidenhead area)	Capacity issues (eastbound), resulting in delays on the M4 and A404.	Yes (see chapter 2)	✓				✓		
Capacity	M4 Junctions 18 to 19 (Yate/Thornbury area)	Longer term issue, putting pressure on local roads. 3,000 new homes are planned. Routes to the M4 are poor, and couldn't cope with much more development.	Yes (see chapter 3)			✓	✓	✓		
Capacity`	M4 junctions 11 to 4B (Reading to London)	Capacity / congestion on the M4 between Reading and the M25 not only during peak times but now throughout the day.	Yes (see chapter 2)	✓			✓		✓	
Capacity	M4 junction 17 (Chippenham area)	Not currently seen as an issue, but may suffer capacity issues as development comes forward in the longer term (including development that is not currently identified in planning policy documents).	No			✓	✓	✓		
Capacity	M4 junction 11 (Reading area)	HGV strategy required for access to Reading/M4 junction 11 (for A33).	No	✓			✓	✓		

	Location	Description	Is there supporting evidence?	Timescales			Was this Identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Capacity	M4 junction 12 (Reading area)	Congestion on M4 junction 12 eastwards.	Yes (see chapter 2)	✓			✓	✓		
Capacity	M4 junction 18 (Yate area)	Heavy traffic on the M4 leads to many Bristol-bound drivers leaving the M4 at Junction 18 near Bath and using local roads to complete their journey. Particular problem through Pucklechurch and Mangotsfield.	No	✓			✓	✓		
Capacity	Bristol area (in general)	Significant growth is expected on the fringes of the Bristol and there are issues on the local network in the vicinity of SRN junctions.	In part (see chapter 3)		✓	✓	✓	✓		
Safety	M4 Junction 4B (M25)	Junction safety issues due to traffic queuing trying to join the slip road. A serious safety issue: the 3rd highest national area	Yes (see chapter 2)	✓			✓	✓		
Safety	M4 junction 10 (Wokingham area)	Risk of run-off flooding at Winnersh (A329).	No	✓			✓	✓		
Safety	M4 (Slough area)	Safety issue due to weaving / poor signing after junction 6 (eastbound).	No	✓			✓	✓		
Safety	M4 (in general)	There is a lack of turnaround points on the M4.	No	✓			✓	✓		
Social and environment	M4 (in general)	Air quality impacts - largest contributor to these issues is the M4 and the LAs have no influence on the root causes.	Yes (see chapter 2)	✓			✓		✓	

	Location	Description	Is there supporting evidence?	Timescales			Was this identified through stakeholder engagement?	Stakeholder Priorities		
				Short-term	Medium-term	Long-term		Low	Medium	High
Social and environment	M4 (West Berkshire area)	Major noise and light pollution issues have been highlighted by parish plans within West Berkshire. Complaints have been received with regards to resurfacing.	Yes (see chapter 2)	✓			✓	✓		
Social and environment	A34 and M4 (Chieveley area)	Noise from old roads is a problem.	Yes (see chapter 2)	✓			✓	✓		
Social and environment	M4 (Wokingham area)	Noise issues.	Yes (see chapter 2)	✓			✓	✓		
Social and environment	M4 (Wokingham area)	AQMA's along the M4 lie within the boundaries of Wokingham BC.	Yes (see chapter 2)	✓			✓	✓		
Social and environment	M4 junctions 5 to 7 (Slough area)	AQMA with action plan along the M4 past Slough.	Yes (see chapter 2)	✓			✓	✓		
Social and environment	M4 (Slough area)	Overnight parking is an issue for lorries and Air Freight Hauliers who try to avoid parking charges.	No	✓			✓	✓		
Other	Route wide	The need for greater cooperation and better communication with neighbouring local authorities, especially during incident management.		✓			✓			✓

4.7 Conclusion

4.7.1 The evidence compiled about the route has shown that the performance of the network is characterised by existing capacity issues which are most prevalent within and surrounding the urban areas of the network. These can affect the customer in terms of journey time reliability, the speed they can travel at and the delay suffered.

4.7.2 The route is a focal point for future economic growth, most prevalently in the urban extents of the route (Bristol, Swindon and Reading to London). In addition to the future development aspirations of the Local Authorities (LAs) along the route, additional growth is expected to materialise from the wider aspirations of the Local Enterprise Partnerships (LEPs), the advancement of the Bristol Temple Quarter Enterprise Zone, and the growth aspirations of airports (notably London Heathrow) and ports (particularly Bristol Port).

4.7.3 Linking the above two issues, it is evident that the focus of future growth is in the locations where the network already experiences its greatest demands and operational pressures. The challenge is to ensure that the London to Wales RBS route can adequately support these aspirations and demands.

4.7.4 Detailed assessment of the various growth programmes and the ability of the strategic road network to accommodate the traffic flows arising from such growth will enable a clearer understanding to be established in relation to when future capacity problems are likely to arise and where intervention is likely to be required.

4.7.5 In considering the operational performance of the route, on the basis of the evidence within this report, it is clear that there are elements of the network that perform well. These include sections of the M4 corridor (mainly between Bristol and Reading) and the M48/M49 corridors. While, in many instances, these elements of the network are mainly in rural areas that are not suitable for locating future growth, there are elements such as in the vicinity of Severnside where it could be considered that sufficient capacity exists on the surrounding strategic road network to support future growth.

4.7.6 Sections of the asset have been identified as being increasingly susceptible to failure and requiring maintenance due to their age (eg much of the carriageway surfacing on the network reaching its design life by 2020). Other specific asset issues have been identified at locations on the network (eg the condition of the structure at the M32 Eastville Viaduct).

4.7.7 Not surprisingly, the condition of the asset in the more rural areas is not as severe an issue as urban areas, one reason being linked to the reduced level of traffic on these sections of the route. The challenge exists in accessing the busiest and neediest parts of the network without causing severe operational implications to road users.

4.7.8 Road safety is a priority for the Agency and will continue to be a key challenge. While overall data identify a positive progression towards reducing collisions, further work is required in specific areas of the route. Figure 2.3 identifies casualty locations on the route in the top 250 national casualty locations.

4.7.9 A further key challenge identified during consultation related to the knock-on impacts of collisions and the ability of the wider network to accommodate the traffic demand diverted as a consequence.

4.7.10 There are a number of environmental issues along the route. Most commonly are the air quality issues in the AQMAs, again located mainly in the urban areas where greatest traffic demand exists and future growth aspirations are focussed (see Technical Annex A2.7). Traffic is a significant contributor in many cases and the need to meet EU guidelines is a key future consideration, evidenced by the recent announcement of the proposal to reduce the speed limit on the M1 in Derbyshire and Yorkshire to 60mph, with a direct view to improving air quality.

4.7.11 In relation to the challenges identified above, it is noted that there are a number of schemes that will contribute to improved network conditions at specific locations. These schemes are either committed (such as the two A404 pinchpoint schemes), in the pipeline or on the wider transport network (see Section 3.4). While many of these schemes are focussed on elements of the network which are currently operating with capacity issues and in locations that will be the focus of future economic growth, further work will be needed to understand whether they will address all the capacity issues that the route may experience by 2021.

4.7.12 With a view to the above, there exist further opportunities to improve the route operation through:

- Establishing a clearer view as to projected future operational performance, not only on the strategic road network itself, but also at the interactions with the local road network at junctions.
- Further implementation of technology across the route. Stakeholders identified further potential technology solutions, such as free-flow charging on the Severn Crossings.
- The coordinated approach of managing the network with other partners (including emergency services and local highways authorities), in reacting to incidents on the network that are more susceptible to lengthy incident durations.
- Providing a more resilient network, including through better management of diversion routes, in collaboration with partners, such that they are capable of catering for increased demands in the event of incidents (or the need to access the network for future maintenance).

- Providing better ability for vulnerable road users to navigate the route by cross-route movements. In seeking to promote sustainable travel, the ability of such users to navigate the junctions on the network is an area worthy of further investigation, particularly where such locations of the network are the focus of future growth aspirations.

4.7.13 While a range of issues and opportunities have been identified as part of this evidence report, the main consensus of the evidence and stakeholder input has identified the importance of the route to the current economy and to future economic growth.

4.7.14 A number of significant growth aspirations rely on the performance of the route including future Local Plan developments, the growth aspirations of the LEPs and the key international gateways of London Heathrow airport and Bristol Port. Importantly, the need to support economic growth extends beyond areas directly related to the route and includes the contribution that the route makes to the regional economies of the South West and South Wales.

4.7.15 As evidenced, the route has existing issues covering a range of areas and locations, many of which are going to be further increased by future traffic growth and economic aspirations. This amplifies the importance of the strategy that is ultimately developed to identify a strategic approach and interventions which tackle the existing issues whilst ensuring that the network is resilient to future changes.

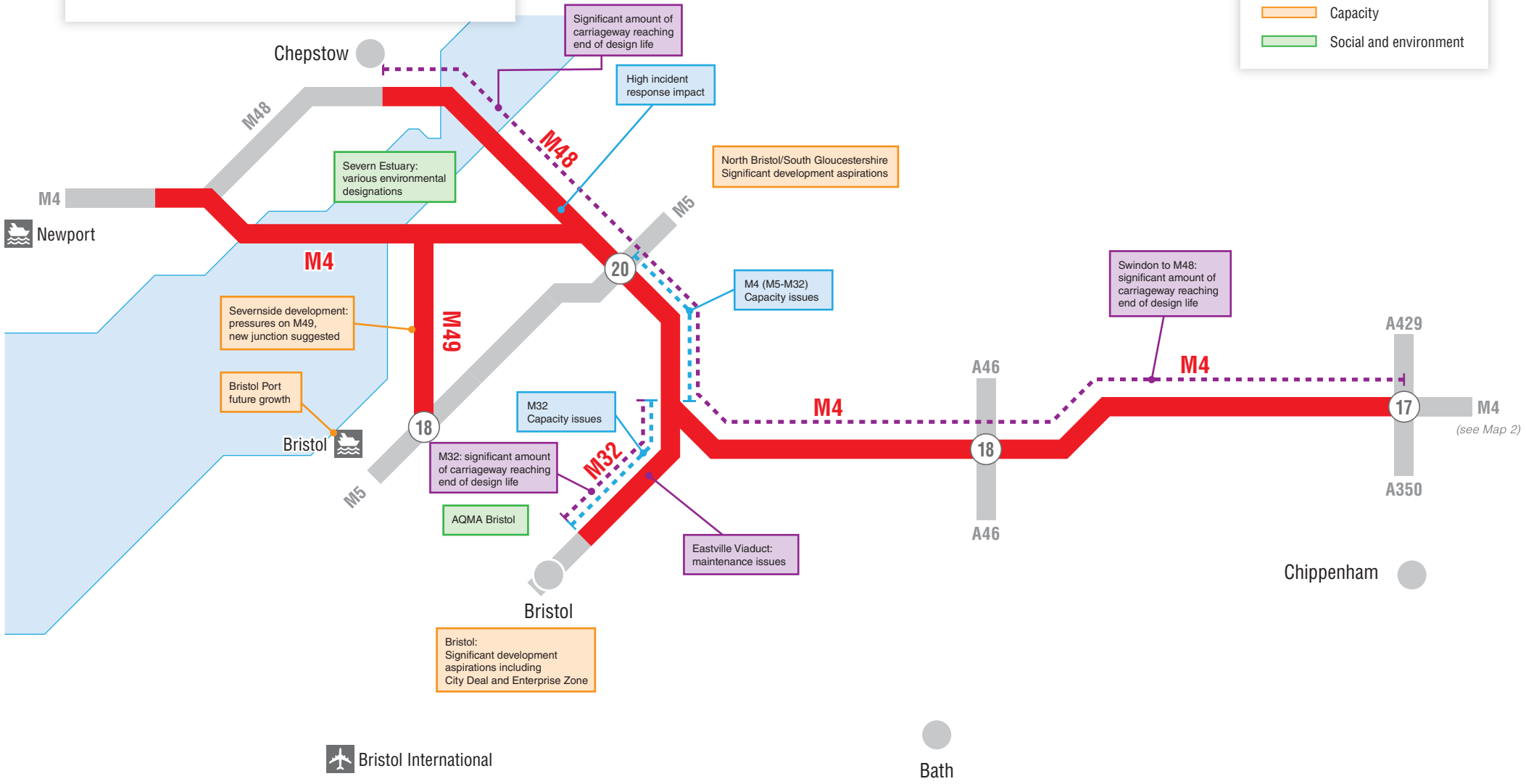
4.7.16 This strategy will need to balance the impact of additional road traffic associated with the economic aspirations, with the wider needs of the route including road safety, the environment and asset condition.

4.7.17 Overall the stakeholder events were generally well received and were taken as a sign by stakeholders of a new collaborative approach to the identification of future transport solutions.

Illustrative

Figure 4

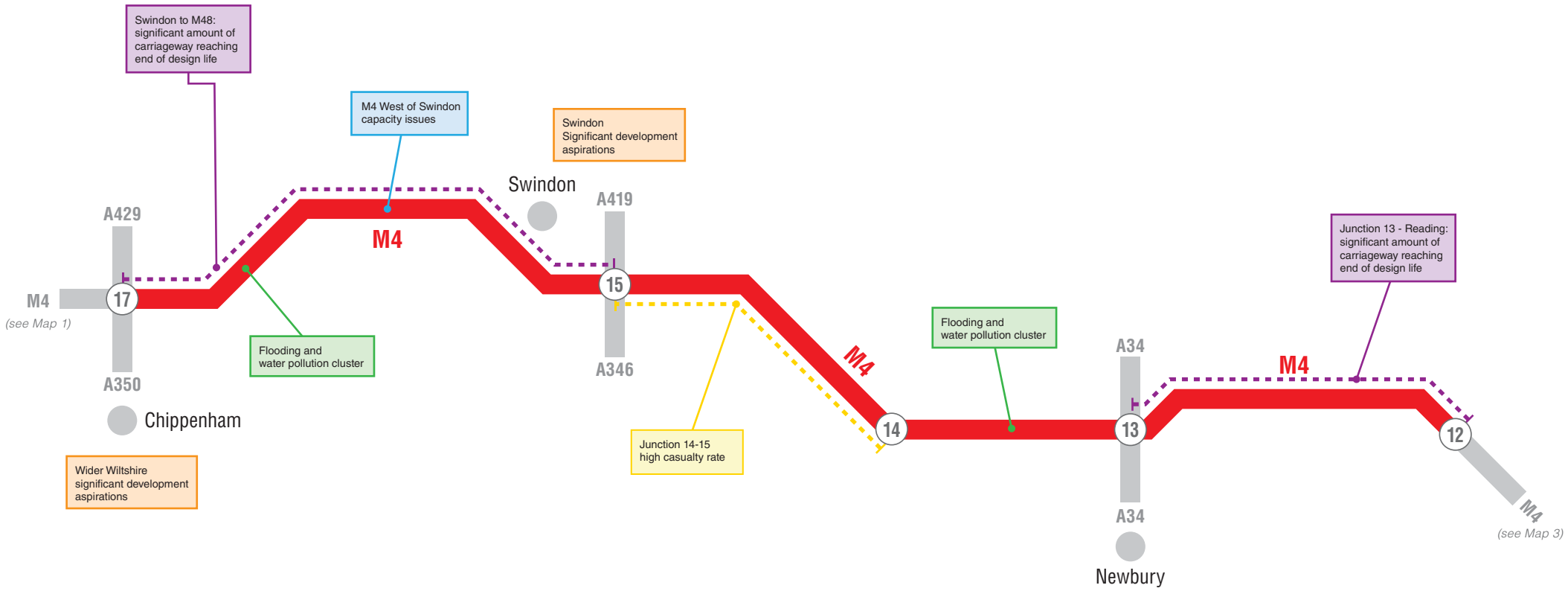
Key opportunities and challenges for the route



Illustrative

Figure 4

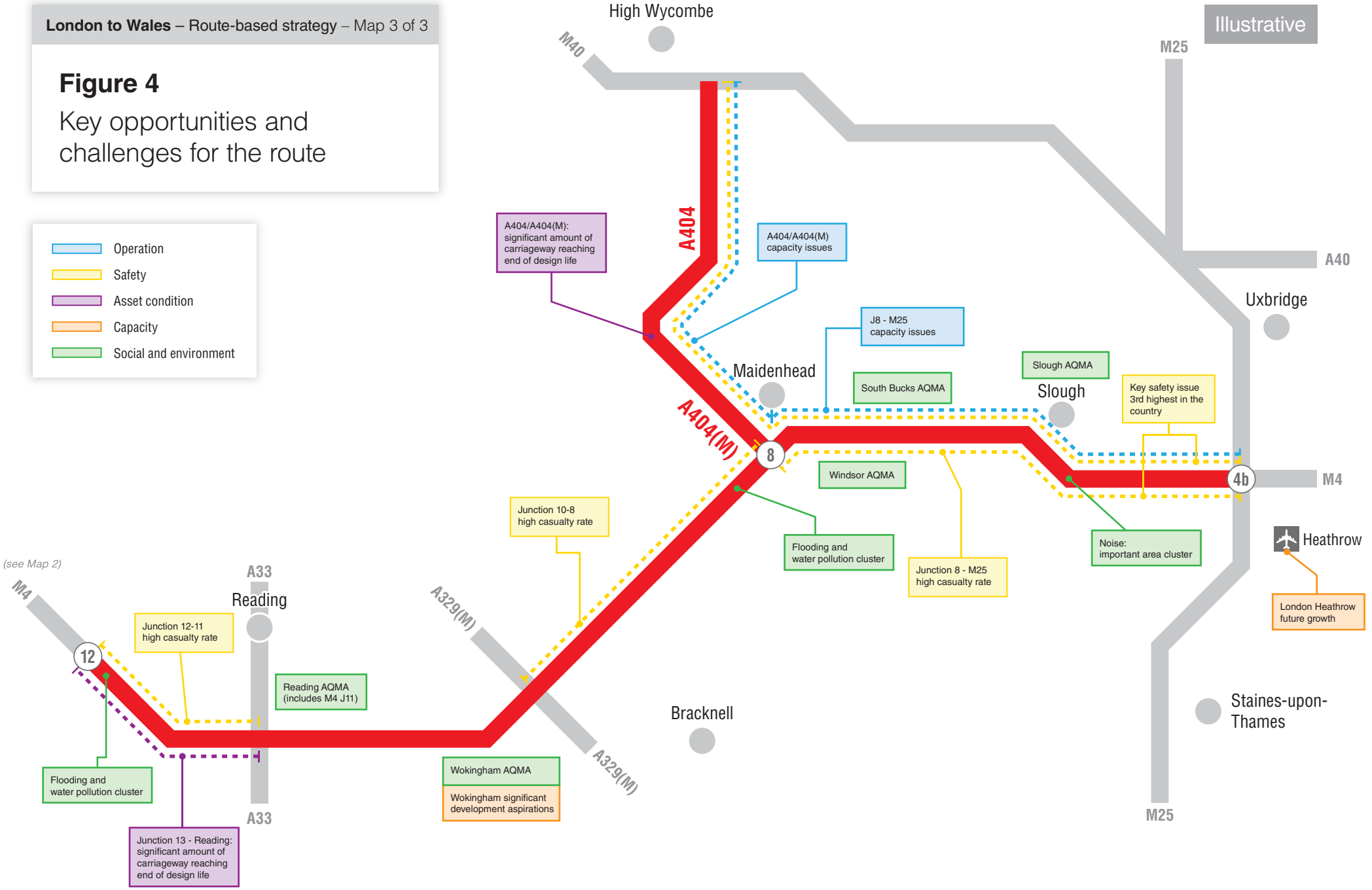
Key opportunities and challenges for the route



London to Wales – Route-based strategy – Map 3 of 3

Figure 4

Key opportunities and challenges for the route



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HIGHWAYS AGENCY

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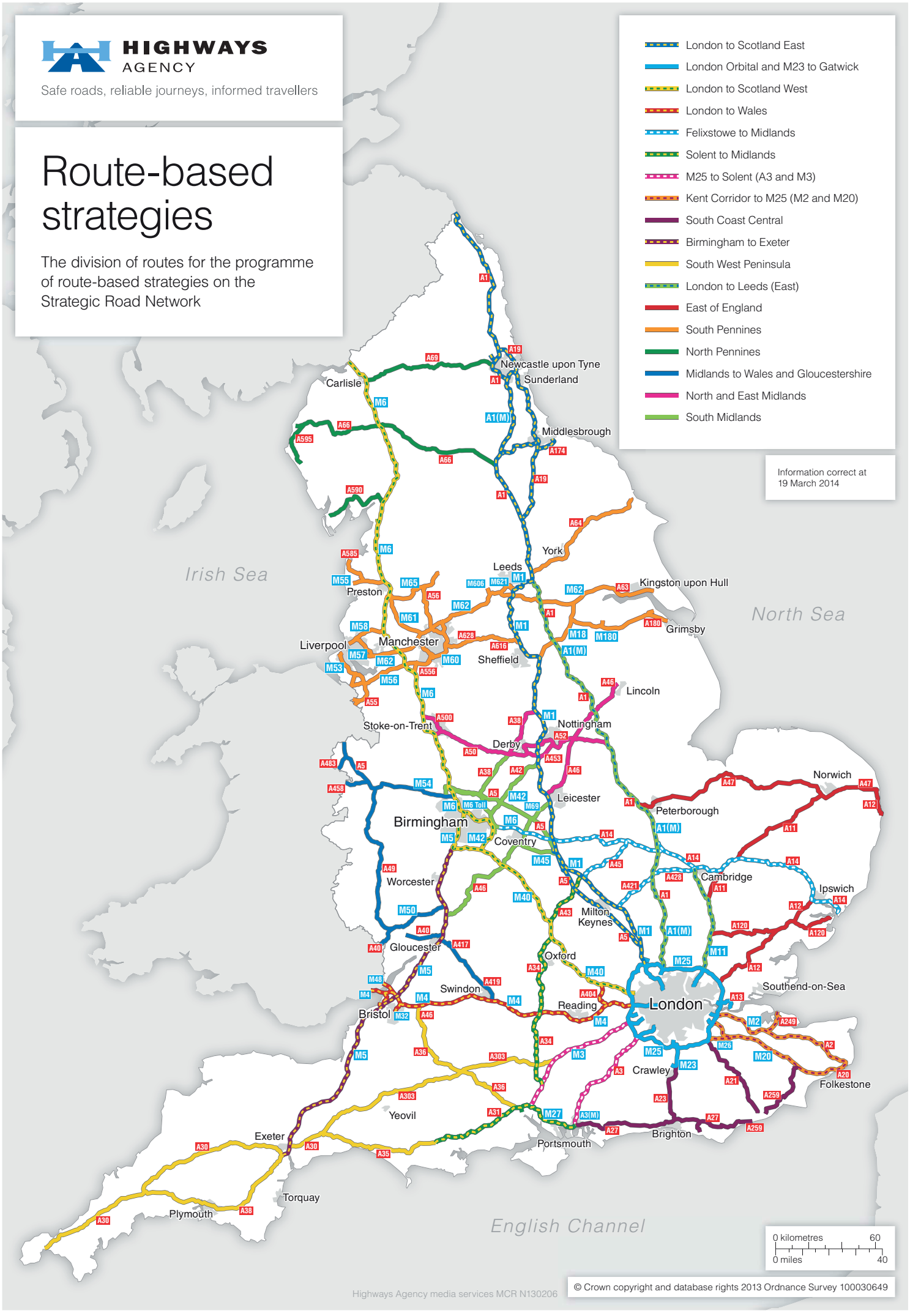
Route-based strategies

The division of routes for the programme of route-based strategies on the Strategic Road Network



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Appendix B Glossary

Abbreviation	Description
AADT	Annual Average Daily Traffic
ANPR	Automatic Number Plate Recognition
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
CCTV	Closed circuit television
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
HAWIS	Highways Agency Weather Information System
HRA	Hot Rolled Asphalt
LAs	Local Authorities
LEPs	Local Enterprise Partnerships
MIDAS	Motorway Incident Detection and Automatic Signalling
NO_2	Nitrogen Dioxide
NTOC	National Traffic Operations Centre
NVRS	National Vehicle Recovery Service
RBSs	Route-based strategies
RCC	Regional Control Centre
SACs	Special Areas of Conservation
SPA	Special Protection Area
SRN	Strategic road network
SWP	South West Peninsula
STO	Strategic Traffic Operations
SSSI	Sites of Specific Scientific Interest
TEN-T	Trans European Transport Network
TSCS	Thin Surface Course Treatment
TOS	Traffic Officer Service
VMS	Variable Message Signs

Appendix C Stakeholder involvement

Organisation	Contact Name	Provided Input
Avon and Somerset Constabulary	Matt Ayres	Yes
Avon Fire and Rescue	Gary Carr-Smith	Yes
Aylesbury Vale District Council	Andy Kirkham	Yes
BAA Heathrow	Chris Joyce	Yes
Bracknell Forest Borough Council	Stuart Jefferies	Yes
Bristol City Council	Laurence Fallon	Yes
Bristol Cycling Campaign	Martin McDonnell	Yes
British Horse Society	Janice Bridger	Yes
British Motorcycling Federation	Carenza Ellery	Yes
British Motorcycling Federation	Johnny Curtis	Yes
Buck Thames Valley LEP	Warren Ralls	Yes
Buck Thames Valley LEP	Richard Harrington	Yes
Buckinghamshire County Council	Stephen Walford	Yes
Buckinghamshire County Council	Ryan Bunce	Yes
Buckinghamshire County Council	Tony Blackmore	Yes
Bus User Group	David Redgewell	Yes
Caravan Club	Walter Girven	Yes
Connect A30/A35	Andy Dean	Yes
CPRE (Campaign to Protect Rural England) Berkshire	Gloria Keene	Yes
CTC – the national cycling charity	Margaret Willmot	Yes
Department for Transport	M Pullen	Yes
Dorset County Council	A Shaw	Yes
Eastleigh Borough Council	E Vokes	Yes
Eastleigh Borough Council	D Airey	Yes
Eden Shopping Center	Daniel Tomkinson	Yes
Enterprise M3 LEP (Parsons Brinckerhoff)	M D'Alton	Yes
Enterprise M3 Local Transport Body (Hants CC)	K Travers	Yes
Enterprisemouchel	Nick Carter	Yes
First Bristol	Axel Fisher	Yes
First Great Western	Maggie Rolfe	Yes
Forward Swindon	Paul Johnson	Yes
Freight Transport Association	Ian Gallagher	Yes

Gordano – Welcome Break MSA	Charlotte Phillips	Yes
Guildford Borough Council	J Palmer	Yes
Guildford Borough Council	D Yell	Yes
Hampshire and Isle of Wight Local Nature Partnership	C Chatters	Yes
Hampshire County Council	A Gray	Yes
Hampshire County Council	K Wilcox	Yes
Hampshire County Council	D McGrath	Yes
Hampshire County Council	D Wilson	Yes
Heathrow Airport Ltd	C Joyce	Yes
Highways Agency (Asset Manager)	Nigel Dyson	Yes
Highways Agency (Asset Manager)	Sean Walsh	Yes
Highways Agency (Asset Manager)	Andy Roberts	Yes
Highways Agency (Asset Manager)	Ed Halford	Yes
Highways Agency (RIU Analyst)	Helen Stone	Yes
Neighbourhood HA area route leads	Surinder Bhangu	Yes
North Somerset Council	Darren Gilbert	Yes
Poole BC	N Hutton	Yes
Portsmouth City Council	F Tidbury	Yes
Reading Borough Council	Ruth Leuillette	Yes
Reading Borough Council	Simon Beasley	Yes
RMS	Mike Reid	Yes
Royal Borough of Windsor & Maidenhead	Tony Carr	Yes
Runnymeade District Council	G Pacey	Yes
Rushmoor Borough Council	J Pettitt	Yes
Rushmoor Borough Council	R Dibbs	Yes
Skanska	Marcus Anning	Yes
Skanska	Donald Gordon	Yes
Slough Borough Council	Mike Finch	Yes
Slough Borough Council	Joseph Carter	Yes
Solent LEP (Hants CC)	S Baker	Yes
South Gloucestershire Council	Jon Munslow	Yes
South Gloucestershire Council	Steve Evans	Yes
South Gloucestershire Council	Pete Slane	Yes
South West Ambulance Service Trust	Michael Thomson	Yes
South West Ambulance Service Trust	Joel Freeland	Yes

Southampton City Council	F Baxter	Yes
Surrey County Council	I Reeve	Yes
Surrey County Council	L Mendes	Yes
Sustrans	Alistair Millington	Yes
Sustrans	N Farthing	Yes
Swindon Borough Council	Gwilliam Lloyd	Yes
Tamar Bride Co	David List	Yes
Test Valley Borough Council	A Tomlinson	Yes
Thames Valley Berkshire LEP	Steve Capel-Davies	Yes
Thames Valley Environmental Records Centre - representing Berkshire Local Nature Partner	Camilla Burrow	Yes
Thames Valley Police	John Croxton	Yes
Thames Valley Police	Colin Clark	Yes
Thames Valley Police	Claire Benson	Yes
Visit Cornwall	Malcolm Bell	Yes
Waverley Borough Council	P Falconer	Yes
Welsh Government	Sheena Hague	Yes
Welsh Government	Andy Falleyn	Yes
Wessex Cross Border Working Group	Jon Noeken	Yes
West Berkshire Council	Melvyn May	Yes
West Berkshire Council	Navtej Tung	Yes
West Berkshire Council	Chris Sperring	Yes
West of England LEP	Pete Davis	Yes
Wiltshire County Council	Fleur de Rhé-Philipe	Yes
Wiltshire County Council	Peter Binley	Yes
Wiltshire County Council	John Smale	Yes
Wiltshire Fire and Rescue Service	Byron Standen	Yes
Woking Borough Council	E Amoako	Yes
Wokingham Borough Council	Matt Gould	Yes
Wokingham Borough Council	Matt Davey	Yes
Wycombe District Council	Ian Manktelow	Yes
Wycombe District Council	Charles Brocklehurst	Yes
Wycombe District Council	Rosie Brake	Yes

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