

A27 Worthing and Lancing
History of large scale options

20 June 2022

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Introduction and background

1. Introduction and background

1.1 Purpose of report

National Highways is the government company charged with operating, maintaining and improving England's motorways and major A roads to the benefit of road users, people who live next to or depend on the network, and the natural, built and historic environment.

National Highways is delivering the Department for Transport's (DfT) Road Investment Strategy (RIS) which has the objective of creating a road network that is safe, reliable and efficient for everyone – whether they are cyclists, drivers, passengers or pedestrians.

For RIS and the second Road Period (RP2: 2020/21 – 2024/25), National Highways is working closely with key stakeholders to identify and deliver a package of potential improvements to '*improve the capacity and flow of traffic on the A27 from Worthing to Lancing*'. The latest scheme proposals will be set out as part of a public consultation during 2022.

The purpose of this report is to summarise all the historical work carried out on various larger-scale improvement options on the A27 at Worthing and Lancing, including previously considered options for tunnels, bypasses and grade-separated junctions. This report sets out the history of scheme development, the decisions made, and the key factors involved in considering the case for larger-scale options. The information presented in this report is also summarised in an accompanying leaflet.

1.2 Background

Context and summary of scheme history

The A27 runs east – west along the south coast of England providing access to the coastal urban centres of Eastbourne, Brighton and Hove, Worthing and Chichester. The route connects the A259 in the east, the M27 in the west and a number of north-south strategic routes including the A3 and A23. The A27 is diverse and serves both a strategic role as well as being heavily used as a local distributor road with shorter distance trips crossing the route causing substantial interaction at many junctions.

There are sections of highway along the route of different standards, varying from high grade dual two-lane carriageways to single lane roads¹. The A27 through Worthing and Lancing has a distance of approximately 8.5km, comprising 7 major at-grade junctions, more than 50 side road intersections and more than 200 properties with frontage access. There are no grade-separated junctions present on the Worthing and Lancing sections of the A27. The section of the A27 through the urban area of Worthing reduces from a dual to single carriageway for almost 4km.

There are many longstanding and extensively studied challenges around capacity, delays, journey time and reliability, safety and the environment. Since the development of the A27 route in the 1980s and the subsequent construction of the Brighton Bypass and Southwick Hill Tunnel in the 1990s, major transport infrastructure improvements at Worthing and Lancing have not progressed to delivery. Since the 1990s, plans for the improvement of the route have tended toward smaller-scale road improvements and measures that improve travel by other sustainable modes of transport.

¹ The standards for highway infrastructure on motorway and all-purpose trunk roads are set out in the Design Manual for Roads and Bridges which provides requirements and advice for all aspects of highway design.

Policies and objectives

National Government, the DfT and National Highways develop and adopt policies, strategies and plans which guide the specification, development and delivery of specific transport schemes, including those National Highways has considered on the A27 at Worthing and Lancing.

In 2015, the Secretary of State for Transport (SoS) appointed National Highways (formerly Highways England) as a government-owned company by way of an order in accordance with the Infrastructure Act 2015. As licence holder, National Highways has responsibility as highway, traffic and street authority to plan, design, build, operate and maintain England's motorways and major A roads, known as the strategic road network (SRN). The licence² sets out the SoS's mandate for delivering Government's vision and plans for the network, as set out in DfT RIS.

The first RIS was published in December 2014 for the first five-year road period (2015/16 to 2019/20). RIS1 set a long-term vision for England's SRN, a multi-year investment plan, high-level objectives and a performance specification³ with key performance indicators. The plan included a commitment to "*online improvements at Worthing and Lancing*" and sustainable transport measures. In November 2015, the government outlined plans to develop the next RIS, covering the second road period (RIS2) post-2020.

During RIS1, DfT published its Transport Investment Strategy⁴ which set out how high performing infrastructure helps deliver balanced growth across the country. The strategy explains that providing an integrated network of maintained and upgraded transport infrastructure connects communities and businesses which helps support country-wide growth. National Highways has articulated economic growth priorities within The Road to Growth⁵ which explains a contribution to the economy through investment to maintain and enhance the network, supporting business productivity and competitiveness.

RIS2 (2020/21 to 2024/25) is DfT's strategy that supports the provision of safe, reliable, predictable and rapid journeys for both people and goods between the main centres of population, major ports, airports and rail terminals, and regions within England. Investment into roads is identified as essential to support a high quality and resilient transport network due to the mixed use of roads by vehicles, pedestrians, cyclists and horse-riders. RIS2 includes a set of scheme commitments in the south, including the A27 Worthing and Lancing improvements. The RIS2 commitments were informed by a series of route strategies, including the South Coast Central Route Strategy⁶.

In response to the release of RIS2, National Highways Strategic Business Plan⁷ (supported by the Delivery Plan⁸) was published. These plans provide a high-level direction for every part of National Highways for the second RIS period. These plans set the outcomes and strategic priorities for delivery, which include the creation of a safe, dependable and durable road network that is well-operated and maintained. Alongside road investments, these plans articulate funding for the reduction in the carbon footprint associated with road investment in support of a plan for net zero highways⁹.

Other regional and local policies and objectives

National Highways work closely with key stakeholders such as regional transport bodies and local highway and planning authorities on the development and alignment of plans, strategies and schemes. These regional and local policies are part of the framework that guides scheme development decisions.

² Highways England: License, Department for Transport, April 2015

³ Road Investment Strategy: Performance Specification, Department for Transport, December 2014

⁴ Transport Investment Strategy, Department for Transport, July 2017

⁵ The Road to Growth, Highways England, March 2017

⁶ South Coast Central Route Strategy, Highways England, March 2017

⁷ Strategic Business Plan 2020-2025, Highways England, 2020

⁸ Delivery Plan 2020-2025, Highways England, 2020

⁹ Net zero highways: our 2030 / 2040 / 2050 plan, National Highways, 2021

Transport for the South East (TfSE)'s transport strategy¹⁰ acknowledges that the A27 faces multiple challenges and issues that the region needs to build a consensus on a way forward. An orbital coastal journey is considered to require a multi-modal approach which tries to reduce conflicts between the multiple users on this corridor and improve interchange facilities.

West Sussex County Council's (WSCC) current Local Transport Plan¹¹ articulates the importance of sustainable improvements in quality of life, local economic performance and social inclusion for all the borough's residents and visitors. One of the highest priorities of the transport plan is to improve *"the A27 trunk road and complementary public transport improvements to the current bottlenecks at Chichester, Arundel and Worthing to increase capacity, improve reliability and safety and increase the competitiveness of local businesses and attract investment."*

WSCC is developing a new draft West Sussex Transport Plan¹² which will update the County Council's approach to investment in, and management of, the transport network. WSCC also set out priorities associated with the reduction of transport emissions and to protect and enhance the county. The draft plan identifies some of the priorities to *"improve performance of the A27 in Worthing"* and deliver *"new active travel crossings of the A27"*.

Local planning policies are set by a number of authorities within the area of the A27 at Worthing and Lancing. This includes Adur and Worthing Councils and the South Downs National Park Authority¹³. Worthing Borough Council is developing a new Local Plan¹⁴ which was submitted to the SoS in June 2021 for examination. The submission draft Worthing Local Plan identifies that it will *"support improvements to the road network including the A259 and A27 ... provide appropriate mitigation measures to address capacity issues at a number of key junctions and road safety impacts on identified road links"*. The need for *"improved access across the A27"* is also specifically identified.

¹⁰ Transport Strategy for the South East, Transport for the South East, June 2020

¹¹ West Sussex Transport Plan 2011 – 2026, West Sussex County Council, February 2011

¹² West Sussex Transport Plan 2022 to 2036 – Draft for consultation, West Sussex County Council, 2021

¹³ South Downs Local Plan – Adopted 2 July 2019 (2014 – 33), South Downs National Park Authority, 2019

¹⁴ Submission Draft Local Plan 2020 – 2036, Worthing Borough Council, January 2021

Historical larger-scale options

2. Historical larger-scale options

2.1. Introduction

An extensive literature review has been undertaken in order to summarise the history of proposed larger-scale infrastructure on the A27 at Worthing and Lancing. This review has considered a set of documents produced over a 30-year period since the early 1990s, including reports, technical studies, brochures, and drawings. From this review, the larger-scale options are described, and key events associated with the appraisal and decision-making of the options are summarised. The review concludes with a timeline of events from the 1990s through to the present day.

2.2. Overview of options

The larger-scale improvements for the A27 at Worthing and Lancing have been put forward in various plans and strategies over a period of decades but have not progressed. The four key phases of study during this period are:

- 1992 – 1996 – A27 Worthing Bypass Inquiry
- 2001 – 2003 – South Coast Multi-Modal Study
- 2013 – 2015 – A27 Corridor Feasibility Study
- 2015 – 2020 – Road Investment Strategy (Roads Period 1)

Seven specific larger-scale options have been considered historically during these four phases of study comprising bypasses, tunnels or grade-separation. These are illustrated in Table 2-1 and Figure 2-1.

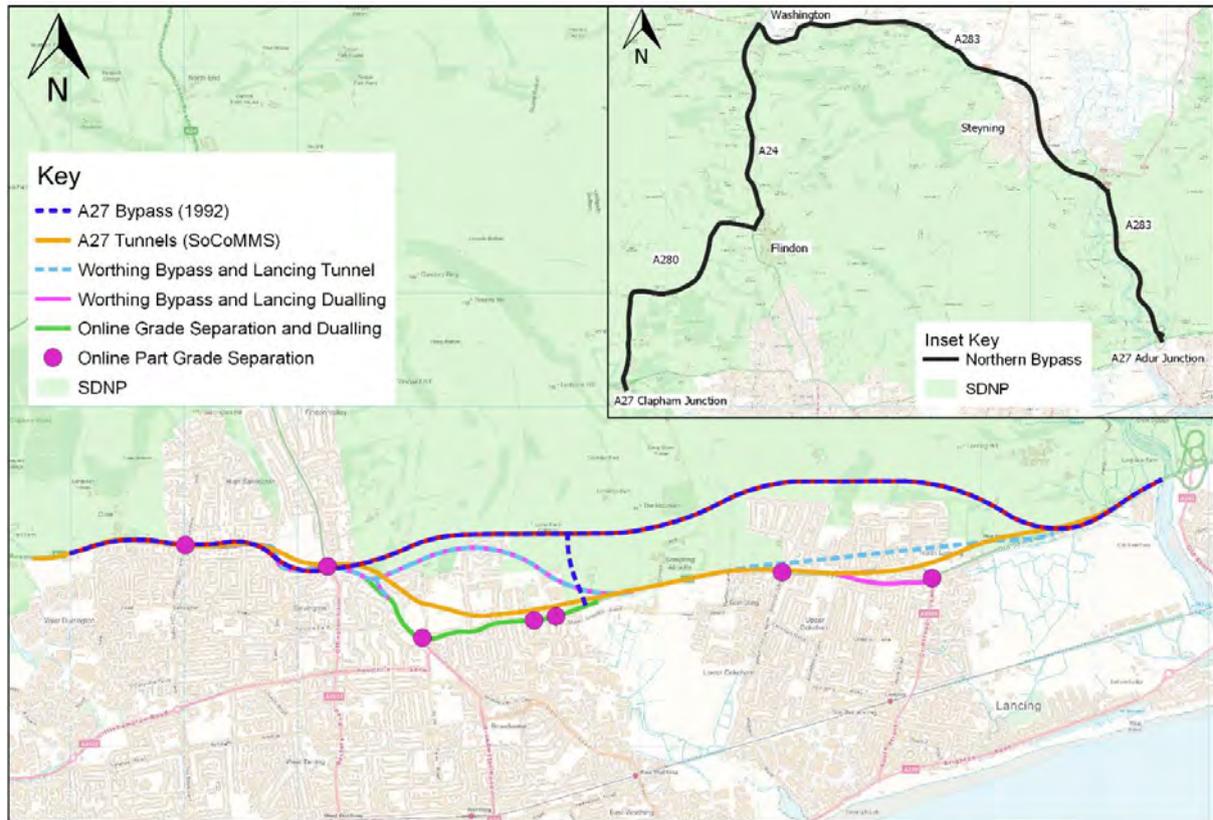
Table 2-1 – Overview of larger-scale options

Period	Study / Strategy	Option
1992 - 1996	A27 Worthing Bypass Inquiry	A27 Bypass (1992 Scheme)
2001 - 2003	South Coast Multi-Modal Study	A27 Tunnels (SoCoMMS scheme)
2013 - 2015	A27 Corridor Feasibility Study	Worthing Bypass and Lancing Tunnel Worthing Bypass and Lancing Dualling
2015 - 2020	Road Investment Strategy (RIS1)	Online Grade Separation and Dualling Online Part Grade Separation (Hybrid) Northern Bypass Dualling

For the purposes of this report, the literature review has identified a set of larger-scale options that are representative of the complete range of major highway infrastructure options and variants considered during these four phases of study. The specific options shown in Figure 2-1 capture the broad alignments and forms of major highway infrastructure associated with key decisions since the 1990s. The options that have been identified as 'larger-scale' are those that comprise full dualling, grade separation and are larger in scale than the online junction improvement proposals that National Highways presented as part of the RIS1 public consultation¹⁵. All the options are of a scale and alignment that would require extensive acquisition of land outside of the existing highway boundary, the demolition of property along the route and would impact upon the South Downs National Park (SDNP).

¹⁵ <https://highwaysengland.citizenspace.com/he/a27-worthing-and-lancing-improvement/>

Figure 2-1 – Larger-scale options considered historically at A27 Worthing and Lancing



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Road standards

The larger-scale options all include the provision of a dual carriageway standard to replace the existing single carriageway sections of road.

Road layout design standards set out in the Design Manual for Roads and Bridges (DMRB)¹⁶ include a set of road cross-sections recommended for roads in the United Kingdom (see Appendix B). Amongst these are cross-sections for both a rural all purpose dual carriageway (generally referred to as D2AP) and that for a rural all purpose single carriageway (generally referred to as S2). The minimum road width for a D2AP is 26.1m while that for an S2 is 14.3m, generating a difference in width of 11.8m between them.

The 26.1m minimum D2AP road width is influenced by a recommended 7.3m carriageway width for each direction of travel, a 1m hardstrip width on either side of the carriageway, a 2.5m central reserve width and a 2.5m verge width on either side of the carriageway. Similarly, the 14.3m minimum S2 road width is influenced by a recommended 7.3m carriageway width for both directions of travel, a 1m hardstrip width on either side of the carriageway and a 2.5m verge width on either side of the carriageway.

Provision of space for walking, cycling and horse-riding forms part of the design process. Additional considerations would include the volume of anticipated users, the need for segregated or unsegregated facilities, additional width requirements associated with fixed objects or vertical features, and the design speed of the road. A width of 3 – 7m for these users may typically be required.

¹⁶ Design Manual for Roads and Bridges, CD127 Cross-sections and headrooms version 1.0.1, Highways England et al, July 2021

For comparison to the 26.1m minimum road width for a rural D2AP and any further width requirements for walking, cycling and horse-riding, the existing single sections within highway boundary through Worthing vary from 15 – 20 metres in width.

A high-level description of the seven options is presented in the remainder of this section. Any locations and measurements that are described are approximate and for the purposes of illustrating the main features of each option.

2.3. A27 bypass (1992 scheme)

The A27 Worthing and Lancing Bypass that was subject to a public inquiry¹⁷ in the 1990s was a full dualling scheme from the existing A27 dual carriageway to the west of Worthing through to Shoreham Bypass to the east of Lancing. The full dualling scheme was 9.7km in length, with the majority of route in new offline sections that bypass the existing A27 mainline, including to the north of Lancing. The scheme is illustrated in Figure 2-2.

Figure 2-2 – A27 bypass (1992 scheme)



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Approximately 1.7km of the western part of the route through Worthing would be situated entirely within the existing corridor of the A27. This section would consist of a combination of ‘cut and cover’ tunnels and a viaduct. The dualling would start from the existing A27 (Arundel Road) dual carriageway near The Coach and Horses hotel at the western end. The route remains online and below the existing ground level through the urban section of Worthing. Approximately 1km east of the start of the dualling, near Durrington Lane, the route would be accommodated through a

¹⁷ PSE/A27/5/65/11/1 (A27 Inquiry Conclusions)

proposed tunnel (approximately 580m in length) underneath the residential area between Salvington Hill / Durrington Hill and Uplands Avenue.

A new single carriageway running between Cote Street and Mill Lane was proposed to maintain accessibility for the local area and to the new dual carriageway route via various new slip roads. This single carriageway would be approximately 1.4km long and consist of three new roundabouts at Salvington Hill, Uplands Avenue and Mill Lane. It would run parallel to the new dual carriageway route, on and off the existing A27 corridor alignment, above and across the proposed route.

Since the scheme at this location would be a combination of cut and cover tunnel and new link roads, properties above and in close proximity would be affected, particularly to the west of Offington Corner Roundabout.

The dual carriageway route continues from the eastern portal of the tunnel for another 600m in cutting and then continues as the new Offington Corner viaduct (approximately 280m long) which would rise to approximately 6m above the existing ground. The existing Offington Corner junction would be relocated to the south and would form a new grade-separated junction, with only three arms which connect with the A24, Warren Road and Offington Lane.

The route proceeds offline further east beyond the viaduct section. It deviates north from the existing A27 and cuts through the south of the Worthing Golf Club and the Hill Barn Golf Club. At this point, the new dual carriageway would be in cutting and new overbridges above the offline dual carriageway route would accommodate Hill Barn Lane and Charmandean Lane.

The route continues east with a new grade-separated dumbbell junction, approximately 2km east of the Offington Corner viaduct, sited underneath the offline dual carriageway route. A Sompting link road, running north and south parallel to Lambleys Lane, would connect the new junction with the existing A27 approximately 650m further south.

Two new overbridges and one new underpass were proposed further east of the Sompting Junction carrying Lambleys Lane, Titch Hill and Dankton Lane respectively across the route. The route would then pass to the north of Lancing. There would be another new overbridge accommodating Halewick Lane at the north of the residential area. The dual carriageway route would continue east in the form of a second twin-bored tunnel at Lancing, approximately 580m long. It would be located underneath the Lancing Ring, which is a 29.4-hectare Local Nature Reserve.

The route would then pass to the south beyond the proposed eastern portal of the Lancing Tunnel. A new East Lancing Junction would be located at the north of Brighton City Airport. This would be a grade-separated dumbbell junction. The East Lancing Junction would provide connections to the surrounding area including the exiting A27 and Brighton City Airport. Approximately 960m east of the new East Lancing Junction, the route ties into the existing A27 dual carriageway section at Shoreham Bypass.

2.4. A27 tunnels (SoCoMMS scheme)

The scheme was originally developed as part of the South Coast Multi-Modal Study (SoCoMMS)¹⁸. Two specific variations to the scheme were considered; separate short sections of tunnel and a single full length tunnel that would connect the A27 at Cote with the junction of A27 / Mash Barn Lane¹⁹. The SoCoMMS scheme was subsequently refined as part of the A27 Corridor Feasibility Study²⁰.

The scheme was a full dualling of the A27 from the existing dual carriageway to the west of Worthing through to Shoreham Bypass to the east of Lancing. The full route would be approximately 9.7km, a similar length to the A27 Worthing and Lancing Bypass scheme that was

¹⁸ Final Report, South Coast Corridor Multi-Modal Study, Prepared for Government Office for the South East, Halcrow et al, August 2002

¹⁹ Review of SoCoMMS Schemes in West Sussex, A27 Worthing Junction Improvements Feasibility Report, Bullen Consultants Limited (BCL), July 2004

²⁰ A27 corridor feasibility study – (comprising) – stage 1 evidence report, stage 2 option assessment report, stage 3 investment cases report, Parsons Brinckerhoff for Highways Agency, February 2015

considered in the 1990s, but with an alignment closer to and largely beneath the existing urban area.

Figure 2-3 – A27 tunnels (SoCoMMS scheme)



Approximately 4.3km of the route would be underneath ground level on the alignment of the existing A27. The remaining 5.4km would be situated in close proximity (300m or less) north of the existing A27. The majority of the existing A27 carriageway would be retained and adopted as a local access road. This option includes three separate bored tunnel sections approximately 6km long in total throughout the route.

The dualling proposal starts from the existing A27 (Arundel Road) dual carriageway approximately 300m west of The Coach and Horses hotel at the western end. The route would follow the existing A27 corridor through the western part of Worthing and would be constructed below the existing ground level as it heads east. The first bored tunnel section starts at approximately 580m from the western end of the route. There would be a new limited movement interchange prior to the first tunnel linking with the existing A27 above.

The first bored tunnel would be approximately 3.2km in length from 90m west of Cote Street to 40m east of Hill Barn Link. The route would be directly underneath the existing A27 up to Crockhurst Hill and would then deviate to the north across the Durrington Cemetery, cut through the centre of the existing Offington Corner roundabout junction and then deviate again to the north of the A27 underneath Hillside Avenue at the south of the golf courses. The eastern tunnel portal would be located within the Hill Barn Recreation Ground.

There would be a new roundabout junction established at Hill Barn Lane approximately 200m north of the existing Grove Lodge Roundabout junction. This junction would become a new interchange with the 320m long dual carriageway section located between the first and second tunnels. It incorporates a single merging link onto the new dual carriageway eastbound approaching the second bored tunnel and a single diverge link off the route westbound exiting the second bored

tunnel. The second tunnel would be approximately 800m long. The western tunnel portal would be approximately 160m north of the A27, being about 70m west of First Avenue. The tunnel alignment would be relatively straight and pass underneath Third Avenue, Charmandean Lane, Beeches Avenue, Pines Avenue and Sompting Road. The eastern tunnel portal would be approximately 20m east of Lyons Way.

The route retains the straight alignment heading east and lines up with the existing A27 dual carriageway section between Lambleys Lane and Church Lane. A new grade-separated dumbbell junction was proposed above the route, approximately 100m east of Church Lane. By incorporating two exit slips, two entry slips and two new link roads into the new junction, this would provide connectivity between the new dualling route, Church Lane and the existing A27 west of Lambleys Lane. There would be a new overbridge carrying Dankton Lane approximately 400m further east of the new grade-separated dumbbell junction.

The third tunnel would be approximately 1.9km in length. Its western portal would be located approximately 330m east of the new Dankton Lane overbridge. The alignment of the tunnel deviates north away from the existing A27, following closely the alignment of Manor Road and underneath the greenfield to the south of Lancing Manor. The eastern tunnel portal would be located near the Lancing Manor leisure centre outdoor artificial grass pitch, east of the building. The route would then deviate towards the existing A27 alignment as it heads east beyond the tunnel.

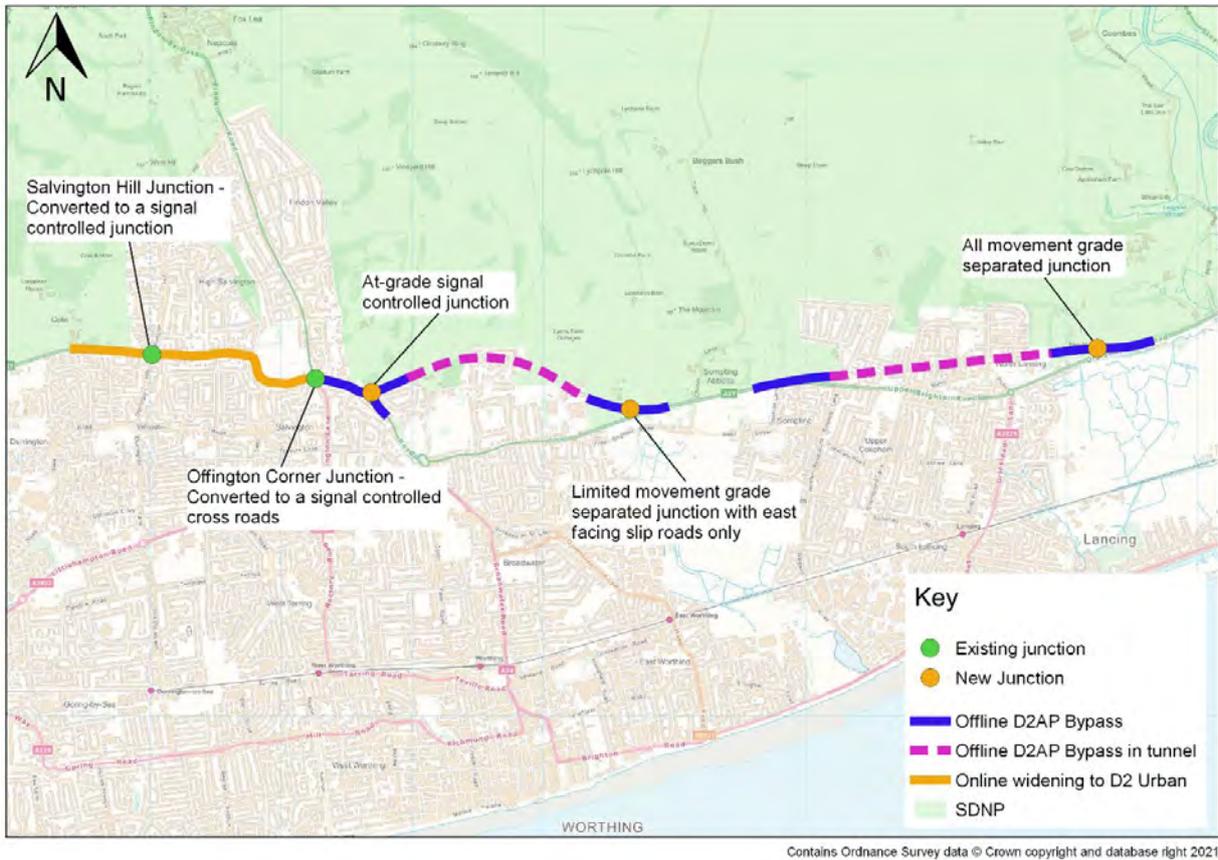
Another new grade-separated dumbbell junction was proposed above the route, approximately 320m east of the eastern tunnel portal. The southern dumbbell roundabout would be positioned along the existing A27 near Hoe Court. It would provide full connectivity with the area with the layout similar to the proposed dumbbell junction near Church Lane. The route passes close to the existing A27 heading further east beyond the new grade-separated dumbbell junction. Approximately 700m east of the new junction, the route ties into the existing A27 dual carriageway section at 200m east of the existing signalised T-junction, with access to Brighton City Airport.

2.5. Worthing bypass and Lancing tunnel scheme

The bypass and tunnel scheme was developed as part of the A27 Corridor Feasibility Study. This scheme would replace the existing single carriageway sections of the A27 with two lanes in each direction through a combination of online widening through north-west Worthing at High Salvington and two short offline bypasses with tunnels located to the north of the existing A27.

This scheme would widen the existing 2km section of A27 single carriageway between Cote Street and Offington Corner junction to a two-lane dual carriageway with associated land take from frontage residential properties along this section. Local side roads would be converted to left in left out arrangements or closed completely. Direct access to properties fronting the road would be retained. The carriageway standard proposed would not meet DMRB standards for a D2AP carriageway and would be an urban all purpose road with a speed limit. The junction with Salvington Hill would be converted from a staggered crossroads to a signal-controlled junction. The existing roundabout at Offington Corner junction would be converted to a signal-controlled crossroads.

Figure 2-4 – Worthing bypass and Lancing tunnel scheme



From the Offington Corner junction, heading east, approximately 350m of the existing A27 would be dualled and widened to two lanes in each direction. The route would then bypass to the north of the remaining single carriageway section of the existing A27 at Grove Lodge roundabout and the Lyons Farm Junction. Approximately 1.5km of the bypass would be in a tunnel. Both tunnel portals would be located within the SDNP.

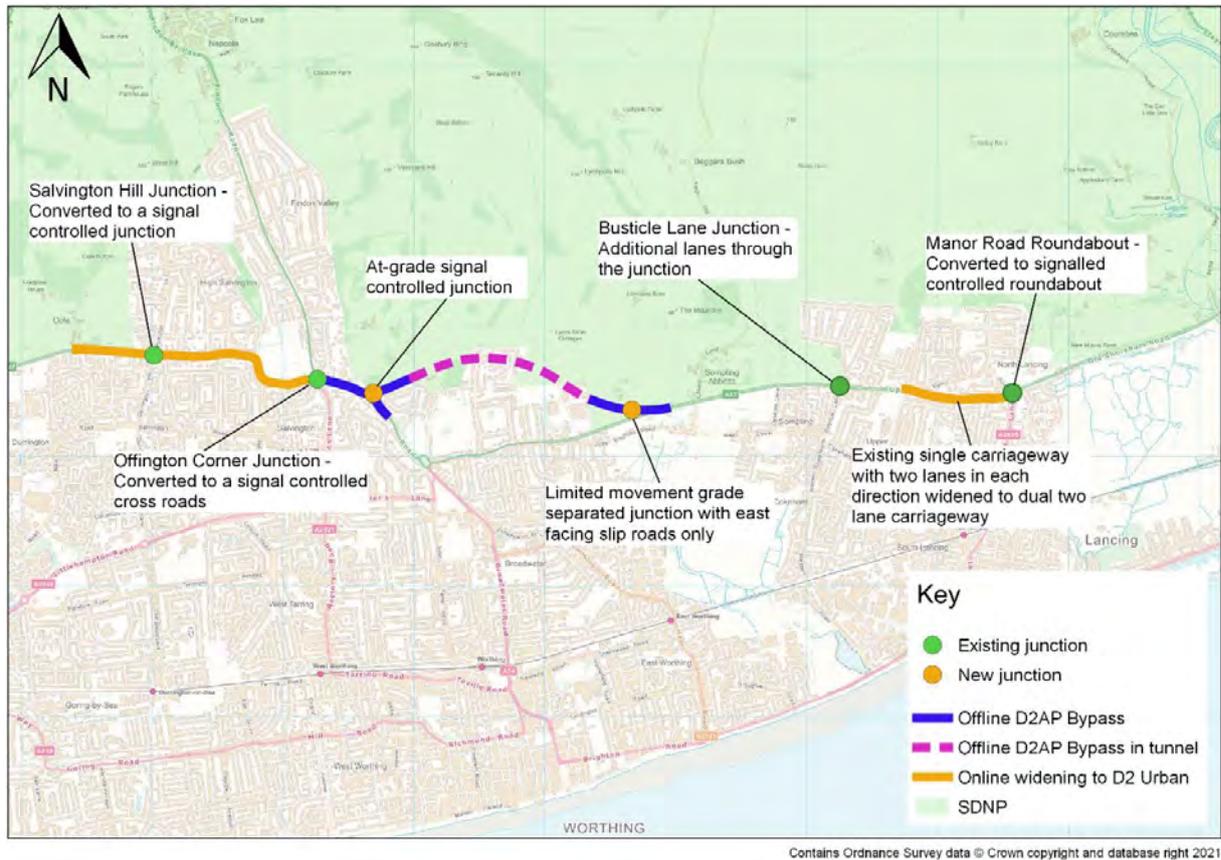
The scheme would include a new at-grade signal-controlled junction at the western end of the bypass and a limited movement grade-separated junction at the eastern end, located near Lambleys Lane. There would be multiple residential properties requiring demolition at both ends of the bypass section, in particular at the western end where the route connects to the existing A27.

The route would then be configured as per the Lancing Tunnel section of the SoCoMMS scheme, with a 1.7km route to the north of the existing A27 and most of the bypass located in a tunnel. An all-movements grade-separated junction would be provided where the route connects with the existing A27 Old Shoreham Road east of Hoe Court.

2.6. Worthing bypass and Lancing dualling scheme

The bypass and dualling scheme was developed as part of the A27 Corridor Feasibility Study. At Worthing, the option follows the same route as the Bypass and Tunnel scheme described above, connecting the existing dual 2 lane carriageway sections located either side of Worthing with a combination of online widening and a bypass including a section of tunnel.

Figure 2-5 – Worthing bypass and Lancing dualling scheme



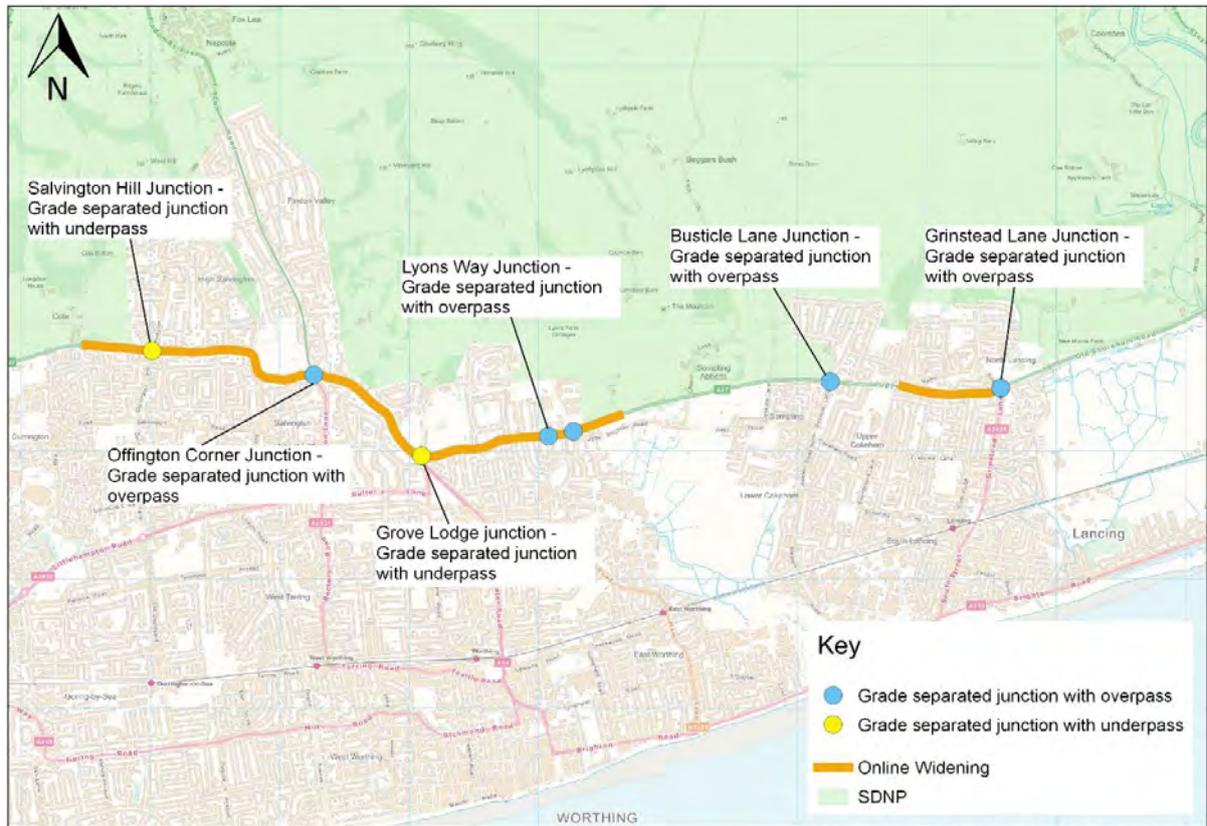
At Lancing, this scheme would include smaller-scale online improvements at the Busticle Lane and Grinstead Lane junctions with the existing 2+2 lane carriageway section between Manor Road and Grinstead Lane dualled. Existing side road junctions would be converted to left in left out and direct access to residential properties retained.

The Busticle Lane junction improvement would include additional lanes for straight ahead movements and additional turning lane capacity and would remain at-grade. The Grinstead Lane junction improvement would comprise the conversion of the existing roundabout to signalled control and would also remain at-grade.

2.7. Online grade separation and dualling scheme

This scheme was developed during RIS1 alongside similar options that would widen the A27 on its existing alignment to dual carriageway standard and introduce grade separation at key junctions throughout the route. Whilst all existing direct access points to the A27 would be retained, local roads would have their access restricted (left in / left out only) or removed.

Figure 2-6 – Online grade separation and dualling scheme



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The proposal for Durrington Hill / Salvington Hill Junction would be for an underpass underneath the existing junction. To accommodate the portals and service roads required, approximately 19m of road width would be required, with impacts on adjacent properties. The entrance to the Meadowfield Hospital would be closed and relocated to an alternate access point on Salvington Hill or incorporated into a service road as a left in left out junction. To the east, the location of the portal would be located at Chute Way, which would be incorporated into the service road as a left in left out junction. Swandean Close would be incorporated into the service roads as a left in left out junction. The northern and southern arms of the junction would be retained, and any alterations to the junction would be kept to within the highway boundary at this point.

The proposal for Offington Corner Junction was for an overpass above the existing roundabout junction. To accommodate the required structures and service roads, land would be required from sections to the south of the A27.

At Grove Lodge Junction, the A27 would be carried by an underpass beneath the existing junction. Land may be required from Worthing College for the construction and alignment of the western portals and property would be affected by the construction of the eastern portals.

At the Lyons Farm Retail Park junctions with Sompting Road and Lyons Way, the A27 would be carried by an overpass across the existing junction. To accommodate this, it would be necessary for several properties to be demolished on the western approach, and for land to be taken from the SDNP on the eastern approach.

The proposal for Busticle Lane / Halewick Lane Junction would be for the A27 to be carried by an overpass across the existing junction, with land taken from the SDNP on the eastbound carriageway. Westbound movements would be served via slip roads which would have implications for adjacent land.

The A27 at Grinstead Lane / Manor Road would be carried by an overpass across the existing junction. Eastbound movements would be carried via a junction that would utilise land from Lancing Manor Leisure Centre. Westbound movements however would need to be served via slip roads, requiring the redesign of access for houses on the western side of the junction as the service road would be replaced by a slip road. Properties on the eastern side would be impacted by the slip road provision.

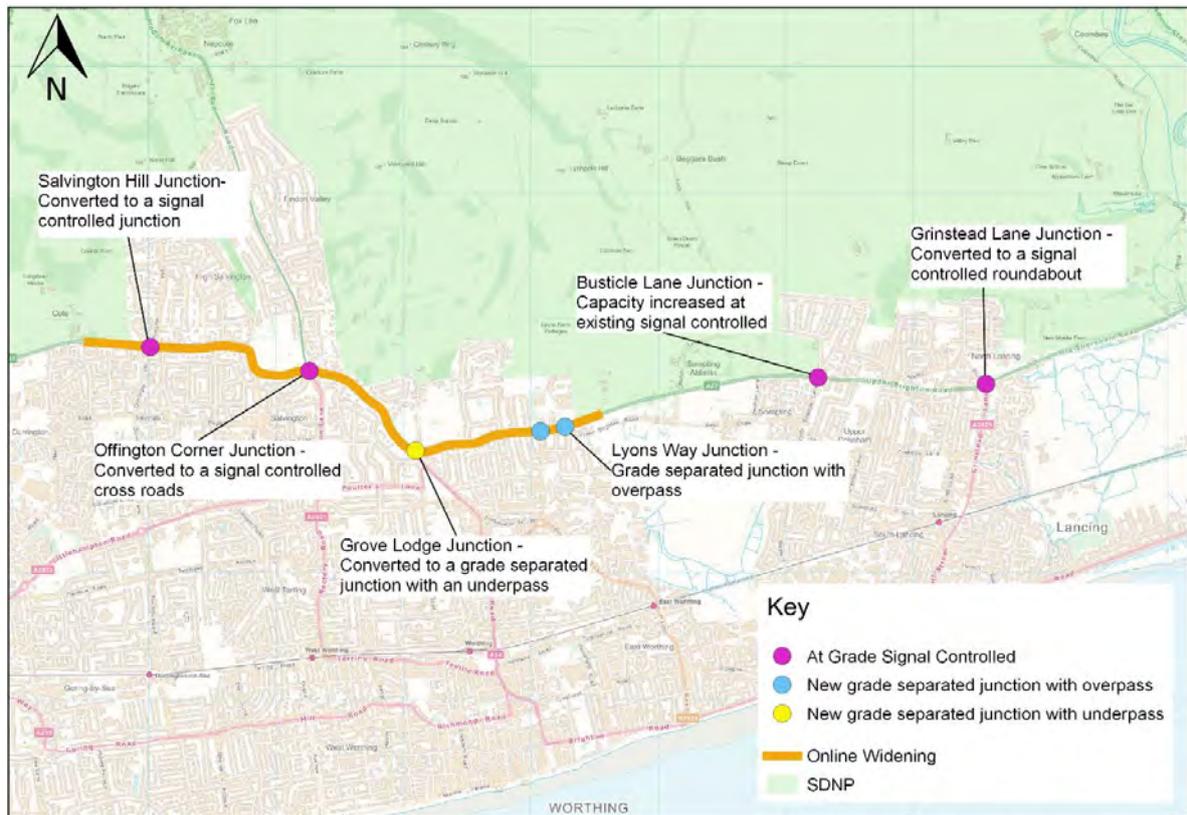
2.8. Online part grade separation (hybrid) scheme

This option was developed during RIS1 as a hybrid of the scheme that was proposed as part of the RIS1 consultation (at-grade junction improvements) with online widening and the provision of grade-separated junctions at some locations along the route.

The scheme would widen the existing 2km section of A27 single carriageway between Cote Street and Offington Corner Junction to a two-lane dual carriageway with associated land take from frontage residential properties along this section. Local side roads would be converted to left in left out arrangements or stopped up completely. Direct access to properties fronting the road would be retained. The carriageway standard proposed would not meet DMRB standards for D2AP carriageway and would be an urban dual carriageway with a speed limit. The junction with Salvington Hill would be converted from a staggered crossroads to a signal-controlled junction. The existing roundabout at Offington Corner Junction would be converted to a signal-controlled crossroads.

The A27 Warren Road between Offington Corner Junction and Grove Lodge would be widened to a two-lane dual carriageway with direct property access and local side roads either converted to left in left out arrangements or stopped up. This would involve land take from the frontage properties.

Figure 2-7 – Online part grade separation (hybrid) scheme



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Grove Lodge junction would be converted to a grade-separated junction with the A27 in an underpass underneath the existing signalised roundabout with slip roads providing access to Grove Lodge roundabout, which would be largely retained. To provide the underpass, additional land would be required from Worthing College and from the properties to the south of the existing road. Several properties would need to be demolished along the A27 Upper Brighton Road. Some local side roads and residential properties would have direct access onto the slip roads at the junction. The junction arrangement would not meet DMRB standards.

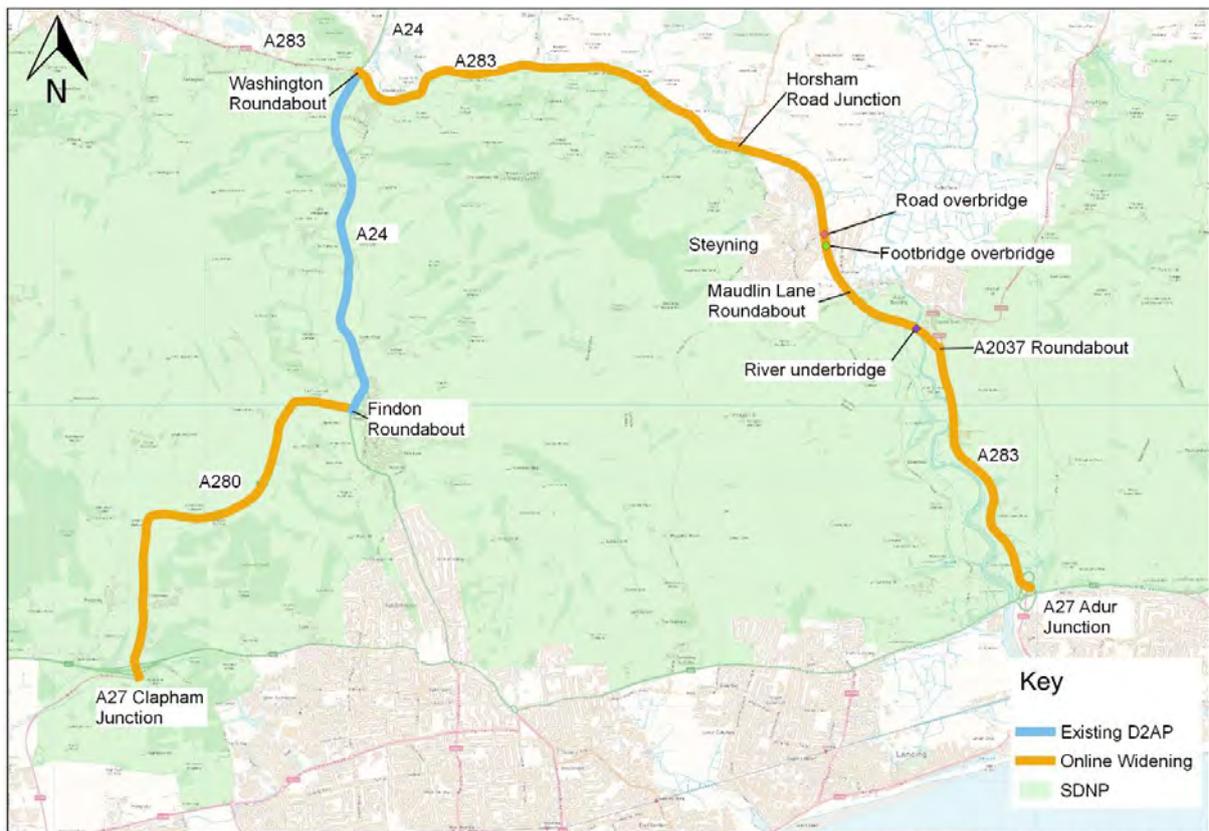
The existing single carriageway between Grove Lodge and Lyons Way would be converted to a dual 2 lane carriageway. The A27 would be elevated to provide a grade-separated junction at Lyons Way. The west facing slip roads would start in close proximity to the east facing slip roads for the grade-separated junction at Grove Lodge. Slip roads would provide access to one-way connector roads linking the A27 to a signal-controlled junction at Sompting Road and Lyons Way. Local side roads would have access onto the connector roads or would be closed. Some private residences would have direct access onto the one-way connector roads. The elevated section of the A27 would extend over 800m from Third Avenue to the junction with Lambleys Lane and many properties would need to be demolished on the south side of the existing A27.

The scheme then ties into the existing dual carriageway section at Lancing east of the Lambleys Lane junction. Busticle Lane Junction would be improved with additional lanes on the approach. The existing A27 between Busticle Lane and Grinstead Lane is a mix of dual 2-lane carriageway with physical central reserve separation and 2-lane plus 2-lane single carriageway separated by road markings. This section would be retained and Grinstead Lane junction would be converted to a signalised roundabout.

2.9. Northern bypass dualling scheme

This scheme was promoted by a local action group as an alternative to National Highways RIS1 scheme proposal. The route would be approximately 19.5km in length with extensive sections within the SDNP. The option would involve the dualling of 13.2km of existing single carriageway, including the A280 and the A283 via Steyning.

Figure 2-8 – Northern bypass dualling scheme



The route would dual the existing 5.5km single carriageway route along the A280 Long Furlong from the A27 Clapham Junction to Findon. Access arrangements for adjacent properties would be revised to a left in left out arrangement, diverted or closed and would impact residential land use at Clapham.

The route then travels north along the existing dual carriageway section of the A24 to Washington to join the A283. The dualling of the A283 would require the conversion of local access roads to left in left out arrangements or their diversion or closure. The route passes through the town of Steyning where the scheme would require the replacement of road and foot bridges and would impact on adjacent residential land on the 500m section near Kings Barn Lane and Castle Lane.

The A283 route would continue through the SDNP and would join with the existing A27 at the Shoreham Junction.

Option appraisal and decision-making

3. Option appraisal and decision-making

3.1. Introduction

Since the 1990s, the key milestones associated with the appraisal and decision-making on the seven specific larger-scale infrastructure options can be associated within four periods of study as described in section 2.2 and repeated below.

- 1992 – 1996 – A27 Worthing Bypass Public Inquiry
- 2001 – 2003 – South Coast Multi-Modal Study
- 2013 – 2015 – A27 Corridor Feasibility Study
- 2015 – 2020 – Road Investment Strategy (Roads Period 1)

3.2. 1992–1996 - A27 Worthing bypass public inquiry²¹

A planning application for the A27 Worthing Bypass “published scheme” was made under the Highways Act 1980, Acquisition of Land Act 1981 and the Town and Country Planning Act 1984 in 1992. This was subject to a Public Inquiry that took place between September 1993 and August 1994.

The published scheme comprised a dual carriageway road with “*twin bored tunnels of 580 metres in length under Lancing Ring and a ‘cut and cover’ tunnel under the built-up area of Worthing²² and “a northern bypass of Lancing comprising extensive cuttings / embankments and a single bored tunnel²³”. The scheme also included “*a grade-separated junction at the eastern end to enable connections to the existing A27 route and Shoreham Airport²⁴*”.*

A large number of alternatives were considered during the Inquiry, many of them were entirely new routes and others were modifications of the published scheme. Different routes were assessed as part of the Environmental Statement and in total 64 alternatives were considered during the Public Inquiry, including variations proposed by stakeholders and the public. The Inquiry process resulted in the Inspector’s recommendation to accept two modifications to the published scheme.

The inspector’s conclusions were “*to note that this confirms the policy of comprehensive upgrading of the A27/A259. There is widespread support for the view that conditions on the A27 are bad and that new road building is needed to improve those conditions. I conclude that there is a need for an improvement of the A27 in Worthing and Lancing*”.

In reviewing the justification for the scheme, the inspector noted that Government and Local Policy supported the delivery of a scheme on the A27 through Worthing and Lancing. It was the inspector’s opinion that where there is an impact, the Department of Transport (DoT) has sought to minimise any issues or provide appropriate mitigation with the “*disbenefits of the scheme ... weighed against the benefits*” and recommended it proceed.

Following the Public Inquiry, the SoS for Transport rejected the scheme in 1996 due to “*local disagreement on the route²⁵*”. This is reflected in the broad range of alternatives proposed and

²¹ PSE/A27/5/65/11/1 (A27 Inquiry Conclusions)

²² Worthing Area Strategy Development Plan, South Coast Multi-Modal Study, prepared for Government Office for the South East, Halcrow et al, August 2002

²³ A27 corridor feasibility study – (comprising) – stage 1 evidence report, stage 2 option assessment report, stage 3 investment cases report, Parsons Brinckerhoff for Highways Agency, February 2015

²⁴ Worthing Area Strategy Development Plan, South Coast Multi-Modal Study, prepared for Government Office for the South East, Halcrow et al, August 2002

²⁵ A27 Worthing and Lancing improvements scheme, Public Consultation, Highways England

considered during the Public Inquiry and some “*strong opposition to the published scheme*”²⁶. The issues centred on “*the environmental implications of the bypasses, particularly in terms of their impact on the physical environment*”²⁷, reflecting an adverse visual effect on 600 or more properties.

3.3. South Coast Multi-Modal Study (SoCoMMS)²⁸

SoCoMMS was prepared for the Government Office for the South East and published in 2002. The purpose of SoCoMMS was to identify and investigate congestion, safety and environment-related transport problems and propose suitable mitigation measures to resolve these issues. The study covered the region between Thanet and Southampton and was part of a wider review of transport provision across the country.

The study was overseen by a steering group, comprising of 17 organisations including the Highways Agency, DfT and Local Highway Authorities.

SoCoMMS considered a broad range of alternative measures that were “*appraised in accordance with the Government’s guidelines for the multi-modal studies*”²⁹. The appraisal of measures followed the Guidance on the Methodology for Multi-Modal Studies (GOMMMS) methodology. The outcomes of the appraisal process were used to formulate the SoCoMMS strategy that was then developed further in nine Strategic Development Plans (SDP³⁰). The purpose of the SDPs was to “*... investigate the performance of multi-modal measures at the local level. The plans will provide a feedback to the strategy development process by confirming the inclusion of key measures. The plans will provide greater detail on the measures and their appraisal*”.

The Worthing Area SDP references the previous options that were considered historically in the Worthing area including the 1992 published scheme. The SDP proposed a major highway scheme as a medium-term (2008 – 2012) solution, comprising a tunnel/series of tunnels, junction improvements, improved pedestrian/cycle facilities, new and enhanced bus and rail services and facilities, improved accessibility to transport services and traffic calming and complementary measures to address travel behaviour and encourage modal shift. The major highway scheme identified for the Worthing and Lancing section of the A27 included two tunnel concepts, the first “*a full length tunnel connects the A27 at Cote with the junction of A27 (T) Old Shoreham Road / Mash Barn Lane. The design of the tunnel ends was assumed to be cut and cover with 2 lanes in both directions*”. The second concept was “*an online improvement linking the existing dual carriageway with short sections of tunnel, 2 lanes in each direction. A link was assumed between the A27 and the A24 at Warren Road*”.

The SDP recommended “*that the tunnel options be included within the strategy, subject to further review and design, in addition to other elements which have been considered in other Strategy Development Plans*”. “*In regard to the longer term A27 improvements, the Highways Agency should develop options and conduct further public consultation before finalising the way forward*”.

The SoS for Transport responded to the recommendations in SoCoMMS in 2003, re-stating the Government’s commitment to its “*policy presumption against new or expanded transport infrastructure that will adversely affect environmentally sensitive areas and sites, except where there is an overriding public interest in the development proceeding*”³¹.

²⁶ PSE/A27/5/65/11/1 (A27 Inquiry Conclusions)

²⁷ Worthing Area Strategy Development Plan, South Coast Multi-Modal Study, prepared for Government Office for the South East, Halcrow et al, August 2002

²⁸ Final Report, South Coast Corridor Multi-Modal Study, Prepared for Government Office for the South East, Halcrow et al, August 2002

²⁹ Executive Summary, South Coast Corridor Multi-Modal Study, Prepared for Government Office for the South East, Halcrow et al, August 2002

³⁰ Worthing Area Strategy Development Plan, South Coast Multi-Modal Study, prepared for Government Office for the South East, Halcrow et al, August 2002

³¹ Secretary of State’s response to South Coast Multi-Modal Study, Department for Transport, July 2003

The SoS did not support a number of trunk road schemes which would impact on environmentally sensitive areas. These schemes included improvements through Worthing and Lancing in the form of a tunnel or tunnels as well as other major infrastructure proposals at Chichester and Arundel.

The SoS considered that *“a tunnel at Worthing was noted to impact on regionally important groundwater sources”* with the local hydrogeology vulnerable to transportation measures. The SDP had concluded there was *“little scope for mitigation. This has in itself a major impact and is sufficient (by accumulation of all local measures) to rate the impact of the core strategy as significant.”*³². The scheme was also noted to have a *“very high cost”*.

The SoS concluded that the Highways Agency should work with local authorities and statutory environmental bodies to identify less damaging options, including management measures which reduce the need for major road construction. In particular, the *“revised proposals for the Worthing – Lancing section of the A27 should take account of the effectiveness of the measures already being taken forward to improve key roundabouts, introduce traffic calming and improve public transport services”*. The SoS endorsed the recommendation of the study for the promotion of measures to reduce travel demand and encourage more sustainable travel choices.

A study³³ to identify and develop less environmentally damaging options was then undertaken. This study recommended a series of online junction measures including grade separation at Offington Corner and Grove Lodge junctions, with at-grade improvements at other locations along the route.

3.4. A27 Corridor Feasibility Study³⁴

The A27 Corridor Feasibility Study was one of six studies undertaken by the DfT to investigate problems and identify potential solutions to long-standing road ‘hot spots’ in the country. The feasibility studies were announced as part of the investment programme³⁵ which followed the 2013 Spending Review. The feasibility study was published in 2015 and comprised three reports; an Evidence Report (1 of 3), Option Assessment Report (2 of 3) and Investment Cases Report (3 of 3) which informed subsequent announcements in the RIS.

The purpose of the study was to identify *“the opportunities and understand the case for future investment solutions within the A27 corridor, particularly at Arundel and Worthing, which are deliverable, affordable and offer value for money”*. The scope of the study was *“to take a proportionate approach and to be completed in accordance with DfT’s Transport Analysis Guidance (January 2014)”*.

The Evidence Report presents a review of historical studies, including those associated with the 1992 Worthing Bypass and SoCoMMS schemes. The Evidence Report also describes a process of engagement managed through an A27 Study Reference Group with membership across local highway and planning authorities, local economic partnerships, statutory bodies, members of parliament and some other organisations. The process included four specific meetings, additional topic-specific meetings and direct correspondence with stakeholders.

The A27 Corridor Feasibility Study Option Assessment Report included a broad range of discrete interventions which at Worthing and Lancing comprised:

- tunnels throughout;
- combinations of tunnel, bypass and dualling;
- online dualling throughout;
- online junction improvements; and

³² Worthing Area Strategy Development Plan, South Coast Multi-Modal Study, Prepared for Government Office for the South East, Halcrow Group Limited et al (August 2002)

³³ Review of SoCoMMS Schemes in West Sussex, A27 Worthing Junction Improvements Feasibility Report, Bullen Consultants for Highways Agency, July 2004

³⁴ A27 corridor feasibility study – (comprising) – stage 1 evidence report, stage 2 option assessment report, stage 3 investment cases report, Parsons Brinckerhoff for Highways Agency, February 2015

³⁵ Investing in Britain’s future, HM Treasury, June 2013

- travel demand management and public transport.

A long list of options was created and was subject to an initial sift. The larger-scale options from the historic studies that were discounted during the initial sift are:

- 1992 Worthing Bypass scheme – *“Not deliverable in terms of impact on South Downs National (Park) and economic cost. Also has a significant visual impact as option includes elevated viaduct structure”*.
- 1992 Worthing Bypass (an alternative to the 1992 scheme study with lowered alignment to include cut and cover / bored tunnels throughout, developed during SoCoMMS³⁶) – *“Not deliverable in terms of impact on South Downs National Park and high economic cost”*.
- SoCoMMS scheme (separate bored tunnels) – *“Would not reduce travel time and improve journey time through Worthing and would not improve connectivity because of a long convoluted connection between the A24 and the tunnel. It is considered lower performing than other similar options considered”*.³⁷

The larger-scale options that were taken through the initial sifting process using DfT’s Early Assessment and Sifting Tool (EAST)³⁸ generally comprised combinations of options including particular sections of the SoCoMMS scheme to produce new complete schemes for appraisal. This included the following larger-scale interventions described in section 2:

- A – SoCoMMS scheme (variation) – Worthing and Lancing sections of SoCoMMS with additional junction connectivity to the existing A27 and improvements to cycling and walking north – south of the A27
- C – Bypass and Tunnel – Northern Bypass in Worthing plus Lancing section of SoCoMMS scheme
- D – Bypass and Dualling – Northern Bypass in Worthing with online dualling and at-grade improvements through Lancing

The EAST tool “does not make an overall recommendation as to whether an option should be progressed, instead, it is for the analyst to identify their own criteria or thresholds for determining which options ‘pass’ or ‘fail’ this stage of the process”³⁹. The approach involved ranking the score, from highest to lowest, for each package of options to reflect the scale of impact, practical feasibility, affordability and public acceptability. These options were all retained for further assessment following the application of DfT EAST alongside a set of smaller-scale interventions. The options were then considered further at a qualitative level in accordance with DfT’s Option Assessment Frameworks.

Of the larger-scale options, the Option Assessment Report concludes with taking forward Option A, the SoCoMMS scheme variation with the most extensive tunnelling, to the final stage of the A27 Corridor Feasibility Study. This was on the basis that this option “showed the highest initial benefits. It would most effectively reduce severance, air pollution and noise in both Worthing and Lancing whilst providing additional capacity”. Online dualling and low-cost localised improvements were also retained for consideration.

The third study report Stage 3: Investment Cases, sets out the strategic case, affordability, value for money and deliverability of the prioritised proposals from the Option Assessment Report.

³⁶ Review of SoCoMMS Schemes in West Sussex, A27 Worthing Junction Improvements Feasibility Report, Bullen Consultants for Highways Agency, July 2004

³⁷ A27 corridor feasibility study – (comprising) – stage 1 evidence report, stage 2 option assessment report, stage 3 investment cases report, Parsons Brinckerhoff for Highways Agency, February 2015

³⁸ EAST is a decision support tool that has been developed to quickly summarise and present evidence on options in a clear and consistent format. It provides decision makers with relevant, high-level information to help them form an early view of how options perform and compare

³⁹ Transport Analysis Guidance, The Transport Appraisal Process, Department for Transport, January 2014

The A27 Corridor Feasibility Study concludes “there are very clear policy aspirations at a local and regional level that support the concept of improvements to the single carriageway sections of the A27, in particular addressing at-grade junction capacity constraints”. The report qualifies the strategic policy fit that “road user benefits and wider economic benefits would have to be balanced against the impacts on the South Downs National Park and any other sites with special planning designations” (see also section 4.3).

The economic impacts of the SoCoMMS scheme variation (A) are identified as:

- significant benefits in terms of journey time savings, but not enough to offset the high scheme costs;
- beneficial impact on severance and noise by removing a large proportion of the A27 traffic from the town; and
- adverse impact on landscape and townscape, as existing open space in Worthing and small parts of the SDNP would be affected by tunnel portals and grade-separated junctions.

From the economic analysis, the A27 Corridor Feasibility Study shows the Benefit – Cost Ratio (BCR) calculations for each of the options. The SoCoMMC scheme variation (A) is shown to provide an adjusted BCR of 0.9 whereas the online options are shown to provide an adjusted BCR of 6.0 – 6.5. The study concludes “*there is an investment case for online improvements at Worthing and Lancing, which could provide VfM*”.

3.5. Road Investment Strategy (Roads Period 1)⁴⁰

The DfT’s RIS1 (2015/16 – 2019/20) was published in March 2015 as part of the long-term strategic planning and funding of the SRN. The commitments within the strategy were informed by six studies, including the A27 Corridor Feasibility Study. The RIS1 improvement at A27 Worthing and Lancing was identified as “*online improvements ... to the capacity of the road and junctions along the stretch of single carriageway in Worthing and narrow lane dual carriageway in Lancing. The extent and scale of improvements, including the option of full dualling, are to be agreed in consultation with West Sussex County Council and the public.*”

A series of options that met the RIS1 specification were identified and considered through a transport appraisal process. This included options with different configurations of junction improvement (grade-separated or at-grade) and the option of dualling. Larger-scale, fully grade-separated options were considered such as “Option 4” which is described as “*new flyovers / underpasses at junctions and upgrading to dual carriageway, with direct access to the A27. Widening of the A27 to dual carriageway. Junction improvements with new layouts incorporating flyovers / underpasses. All existing direct access points to the A27 retained, though restricted access to/from some local roads*”⁴¹. This scheme is the larger-scale option described in section 2.7.

Options that comprised full grade separation were considered to result in significant local impacts relating to land, property and impacts on the SDNP and were identified as unaffordable. These options were “*discarded early as well in excess of the upper budget*”⁴² for the scheme.

Prior to public consultation, a ‘hybrid’ option, which reflected part grade-separation and part at-grade junctions along the route (described in section 2.8) was also considered and developed. This option included “*grade separation at the Lyons Farm Junctions and the Grove Lodge junction as well as widening between all junctions within Worthing and Lancing*”⁴³. This option was developed as a response to the cost constraints associated with full grade separation but was also “*rejected*

⁴⁰ Road Investment Strategy: for the 2015/16 – 2019/20 Road Period, Department for Transport, March 2015

⁴¹ A27 Worthing and Lancing improvements scheme, Public Consultation, Highways England

⁴² A27 Worthing and Lancing improvements scheme, Public Consultation, Highways England

⁴³ A27 Worthing and Lancing improvements scheme, Public Consultation, Highways England

due to cost⁴⁴. Only options comprising at-grade junction improvements were taken forward for further consideration before a single option was taken forward to public consultation.

The A27 Worthing and Lancing public consultation took place between July and September 2017 from which the results of the consultation process and feedback were analysed and presented within a Report on Public Consultation⁴⁵. As a response to the consultation feedback, further studies were carried out on the hybrid option to consider further the economic case for larger-scale infrastructure prior to any decision on a preferred scheme. The study found the hybrid option would offer a low benefit-cost ratio⁴⁶ (see Table 3-2), implying poor value for money⁴⁷.

A further larger-scale option was considered prior to the public consultation in 2017 which can be referred to as a 'northern bypass dualling' scheme (described in section 2.9). The scheme proposal emerged from the Bypass Not A27 Through-pass Residents Action Group. *"The northern 'bypass' route is an alternative to any proposed in earlier studies and would make use of local roads, including the A280 Long Furlong, A24 and A283 Steyning Road / Washington Road"*⁴⁸. The distance of the proposed route from its eastern and western junctions with the A27 is 25.6km in comparison to the existing route of 13.4km.

The traffic performance and economic case for the northern bypass dualling scheme indicated reductions in travel time but an increase in the total vehicle distance travelled⁴⁹. The conclusion of the study was the potential costs of providing a dual carriageway would outweigh the benefits and would represent *"poor value for money"*.

The public consultation brochure⁵⁰ confirmed National Highways position on the proposal. *"The northern 'bypass' route is an alternative to any proposed in earlier studies and would make use of local roads, including the A280 Long Furlong, A24 and A283 Steyning Road / Washington Road. However, the route would require considerable upgrading to meet modern trunk road standards and given its length (25 kilometres), it would cost considerably more than the benefits that would be gained. The route is also within the South Downs National Park, which is a nationally designated protected landscape. We are required to explore whether any other options are viable before we take forward options affecting the National Park"*.

3.6. Summary of larger-scale option decision making

Table 3-1 illustrates the timeline of decision-making and a summary of the reasons why larger-scale infrastructure has not progressed at A27 Worthing and Lancing.

⁴⁴ A27 Worthing and Lancing improvements scheme, Public Consultation, Highways England

⁴⁵ A27 Worthing and Lancing improvements, PCF Stage 2 – Report on Public Consultation, Highways England, April 2018

⁴⁶ Benefit-cost ratio (BCR) – a ratio of the benefits of a project, expressed in monetary terms, relative to its costs

⁴⁷ Value for Money Framework, Department for Transport (2015)

⁴⁸ A27 Worthing and Lancing improvements scheme, Public Consultation, Highways England

⁴⁹ A27 Worthing and Lancing Improvements, PCF Stage 2 – Technical Note: Sensitivity Test, northern bypass, Highways England, June 2017

⁵⁰ A27 Worthing and Lancing improvements scheme, Public Consultation, Highways England

Table 3-1 – Timeline of decision-making on larger-scale options

Period	Study / Strategy	Option	Rationale
1992 - 1996	A27 Worthing Bypass Inquiry	A27 bypass (1992 scheme)	The SoS rejected the scheme due to local disagreement on the route. This centred on the environmental implications of the bypasses, particularly the impact on the physical environment. When re-considered ⁵¹ , the impact of the scheme upon the SDNP and its cost reinforced the original justification.
2001 - 2003	South Coast Multi-Modal Study	A27 tunnels (SoCoMMS scheme)	The SoS rejected the scheme due to the impact on environmentally sensitive areas, including on groundwater sources. The scheme was also noted to have a very high cost. When re-considered ⁵² , the lack of connectivity of the tunnel with the A24 was considered to limit the performance of the scheme.
2013 - 2015	A27 Corridor Feasibility Study	A27 tunnels (SoCoMMS variation)	The scheme was rejected during the study process due to implications associated with the environmentally sensitive location of the SDNP, with specific impacts in relation to groundwater sources and landscape / townscape. The scheme was also considered to have a high cost and provide poor value for money.
		Worthing bypass and Lancing tunnel	The scheme was rejected during the study process as it would not meet study objectives and was not likely to provide better value for money than a more extensive tunnel scheme.
		Worthing bypass and Lancing dualling	The scheme was rejected during the study process as it would not meet study objectives and was not likely to provide better value for money than a more extensive tunnel scheme.
2015 - 2020	Road Investment Strategy (RIS1)	Online grade separation and dualling	Significant local impacts including on landscape / townscape and the high cost relative to the scheme budget.
		Online part grade separation (hybrid)	The scheme was rejected during the study process on the basis of poor value for money and the high cost relative to the scheme budget.
		Northern bypass dualling	The scheme was rejected during the study process on the basis of poor value for money and the impact upon the SDNP.

In summary, the themes that repeat consistently throughout the decision-making process on larger-scale options are the environmental impact, specifically in relation to landscape/townscape,

⁵¹ A27 corridor feasibility study – (comprising) – stage 1 evidence report, stage 2 option assessment report, stage 3 investment cases report, Parsons Brinckerhoff for Highways Agency, February 2015

⁵² A27 corridor feasibility study – (comprising) – stage 1 evidence report, stage 2 option assessment report, stage 3 investment cases report, Parsons Brinckerhoff for Highways Agency, February 2015

groundwater and the impact upon the SDNP. These options are also cited to have a high cost and / or a low BCR or poor value for money when considered against the benefits of the scheme. A further factor of consideration reflecting the '*local disagreement on the route*' is the historical feedback from the public and stakeholders on the scheme. Most recently, this has led to proposed options for the A27 Worthing and Lancing, as well as schemes across the wider A27 corridor, being paused and then cancelled before subsequent re-consideration. Each of these key themes associated with historical appraisal and decision-making processes are articulated further below.

Environmental influences on decision making

Although the Inspector for the 1990s A27 Bypass recommended the scheme should proceed, particular aspects of the scheme would produce a "*harsh environment, dominated visually by the viaduct*" at Offington Corner Junction, and would "*completely change the character of the area*". The DoT accepted there would be "*significant change in the character of the western end of Warren Road*" and the Inspector commented that "*these impacts, and the construction of the Salvington tunnel, are some of the most serious physical impacts of the Scheme on the urban environment*".

The SoCoMMS tunnel scheme was developed, in part, to respond to and mitigate some of the visual and landscape issues that were associated with the 1990s scheme. However, when considered further as part of the A27 Corridor Feasibility Study, adverse impacts were also noted "*on landscape and townscape, as existing open space in Worthing and small parts of the SDNP adjacent to the route would be affected by tunnel portals and grade-separated all-access junctions*".

The larger-scale online options, such as the full grade separation and dualling of the route were identified as impacting upon landscape and townscape. "*This Option would open up previously screened views and cause an obvious deterioration to views from several highly sensitive receptors which could not be mitigated effectively*". This was considered to have a large adverse visual impact in terms of views from residential properties.

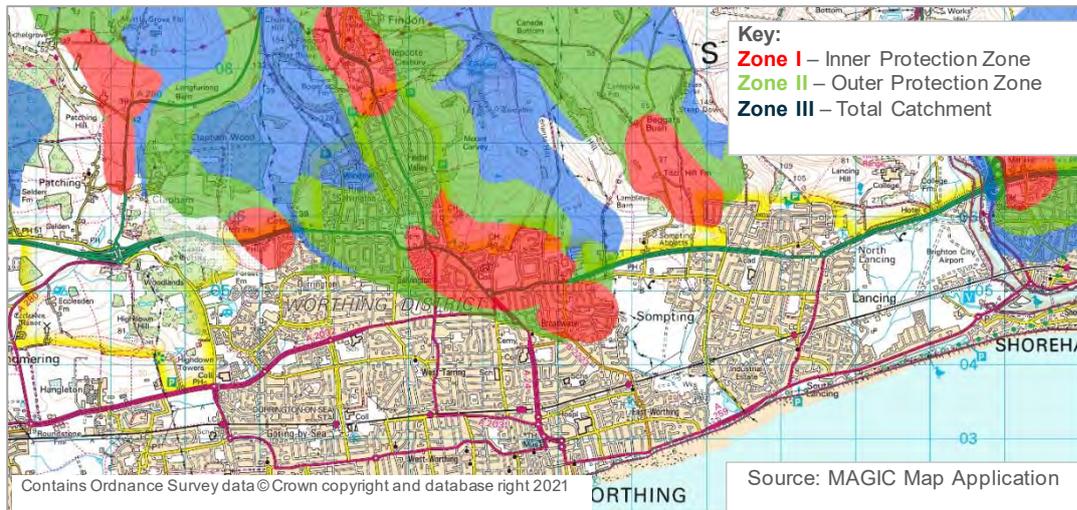
A consequential impact of the more extensive tunnelling proposals in the SoCoMMS tunnel scheme was a "*significant negative impact*" on the water environment and in particular, regionally important groundwater sources. The SoCoMMS appraisal process concluded this was sufficient by accumulation of all local measures to rate the impact of the core strategy as significant.

The hydrogeological conditions in the areas where the tunnels were proposed were found to present substantial risks to the groundwater environment. One of the main reasons was the presence of the Chalk aquifer, which is classified as a Principal Aquifer, and which represents a strategic public water resource by local water companies (e.g. Southern Water) and other commercial users.

In the case of Worthing, the town is underlain by the Chalk Group, which is considered one of the most strategically important aquifers (in terms of its value as a supply of potable water) in the UK. The Chalk Group is classified by the Environment Agency (EA) as a Principal Aquifer and has historically been heavily utilised as a productive supply of good quality potable water, generally requiring relatively little treatment before being distributed to end users (the public).

The level of risk to the groundwater environment is reflected within Groundwater Source Protection Zones (SPZs) as defined by the EA, as shown in Figure 3-1.

Figure 3-1 – Groundwater Protection Zones



The historical tunnelling options would present substantial risks to the Chalk Principal Aquifer and the various sources which abstract from it. This risk would be particularly pronounced due to the groundwater flow type of the Chalk aquifer, which is principally through fractures. This fracture flow regime results in high velocity groundwater flow rates through the aquifer, which subsequently results in very fast pollutant transport travel times also. Tunnel boring works, especially if undertaken in the saturated part of the aquifer (i.e. below the water table), would likely result in the generation of a large volume of fine particles (turbidity). These would directly enter the Chalk aquifer, which when combined with the SPZs and very fast pollutant travel times would result in a substantial turbidity risk to local groundwater sources. These risks are significant and there is considered to be a lack of effective mitigation options.

Cost and value for money influences on decision-making

A summary of the costs estimated historically for each of the larger-scale options is presented in Table 3-2 including the source of the information. These reflect a cost base year of 2010. Cost or value for money have been cited as part of decision-making on all larger-scale options. The BCR which implies the likely level of value for money is presented in Table 3-2.

The process for the estimation of cost requires the creation of an expenditure profile, which reflects when the costs would be incurred for preparation, supervision, works and land, prior to an estimated year of opening of the scheme. Costs are prepared in current year prices and then expressed as a forecast of out-turn costs using projected construction-related inflation.

The implication of costs being estimated in the past, and at different times, is they are not comparable nor are they a current estimate of the costs of each scheme. Over time, scheme costs will be impacted by both general cost inflation and construction cost inflation (construction cost inflation is often different to general cost inflation). The assumptions relating to inflation have changed over time. Furthermore, the estimates of scheme cost would also be influenced by assumptions relating to the timescale for development, delivery and year of opening of the scheme as well as changes in guidance and assumptions relating to cost risk and optimism bias over time.

An updated cost estimate is also provided for each option in Table 3-2, expressed as a year 2021 present day cost⁵³. Any re-consideration of larger-scale options would require a review of the

⁵³ Information from the DfT's TAG Data Book was used to indicate the scheme costs as a year 2021 present day value. To bring the costs to a present-day value, DfT's TAG Data Book provides annual parameters in a form of a Gross Domestic Product (GDP) deflator per year from 1990 to 2100. A ratio of the GDP deflator in 2021 against that of the GDP deflator in the base year was then multiplied with the available total expenditure forecasts of the historical larger-scale options generating a present-day cost.

design, reconsideration of delivery programme and the re-estimation of scheme and operation / maintenance costs.

For the reasons stated above, the original and updated cost estimates presented within Table 3-2 for each larger-scale option should not be directly compared.

Table 3-2 – Summary of larger-scale option scheme costs and benefit-cost ratio

Option	Source of Cost	Expenditure Profile (Years)	Original Cost (£m)	Updated Cost (£m)	Original BCR
A27 Tunnels (SoCoMMS Scheme) (Option A)	Economic Output Document	2014-2022	£1,314m	£1,652m	0.90
Worthing Bypass and Lancing Tunnel (Option C)	Economic Output Document	2014-2021	£952m	£1,197m	n/a
Worthing Bypass and Lancing Dualling (Option D)	Economic Output Document	2014-2021	£549m	£690m	n/a
Online Grade Separation and Dualling	Options Review Report, Dec 17	n/a	>£500m	£563m	n/a
Online Part Grade Separation (Hybrid)	Economic Output Document	2017-2025	£276m	£347m	0.94
Northern Bypass Dualling	Technical Note: Sensitivity Test, northern bypass, June 2017	2016-2023	£499m	£627m	0.30

Note 1: Cost and BCR for the 1992 Worthing Bypass scheme are not presented due to the availability of the information.

Note 2: BCR is listed as 'n/a' where the option was discounted on the basis of a qualitative assessment.

The BCR's associated with the options in Table 3-2, where available, are within the range 0 – 1. This indicates that the economic benefit associated with the scheme is less than its cost which implies that value for money would be considered as “poor”⁵⁴. An increase of the scheme cost would impact on both the financial affordability and the economic case (BCR and value for money) for individual schemes. Given cost and value for money have been cited as reasons for the historical decision-making on all larger-scale options at A27 Worthing and Lancing, costs would be an important factor in any re-consideration of these larger-scale options.

Stakeholders and public influences on decision-making

All transport investment projects start with sound policy and thorough appraisal followed by the development of a Business Case consistent with DfT's 5-case model⁵⁵. One dimension to the 5-case model is the 'strategic case' which sets out the need for intervention as informed by stakeholder views and requirements, to which the proposed scheme responds. The lack of consensus on a solution is a factor that has constrained, to date, the delivery of interventions on the A27.

⁵⁴ Value for Money Framework, Department for Transport, 2015

⁵⁵ <https://www.gov.uk/government/publications/transport-business-case/transport-business-case-guidance>

Stakeholder engagement and consultation is an essential part of the scheme development and appraisal process and has featured consistently during the four periods of study. “*An appropriate level of public and stakeholder participation and engagement at suitable points in the process*”⁵⁶ is a key principle of transport analysis guidance. The outputs of engagement and consultation “*inform the evidence-base which establishes the ‘need’ for intervention, guides the option generation, sifting and assessment steps*”⁵⁷.

Since the 1990s, there has been broad public and stakeholder agreement on the need for intervention but limited consensus on the solution. Views are typically polarised between support for larger-scale infrastructure such as tunnels and bypasses and smaller-scale interventions including those focused on walking, cycling and demand management. The results of a review of opinion highlights the contrasting position of a diverse number of stakeholders on larger-scale interventions:

- substantial levels of support from key groups on the basis of anticipated benefits relating to journey times, resilience, reduction of incidents, and the potential to facilitate economic growth.
- conversely, a likelihood of strong opposition “*from key groups to most proposals, but particularly those that involve new carriageway construction in the national park*”.

The most recent public consultation on improvements at A27 Worthing and Lancing took place as part of RIS1 in summer 2017. The findings are presented in a Report on Public Consultation⁵⁸ and can be considered representative of the feedback on schemes proposed since the 1990s.

The results showed that 86% of public respondents agreed there is a need for the scheme. However, the proposed RIS1 scheme (online junction improvements referred to as “Option 1”) received a low level of support with only 15% of respondents supporting it to some degree and 76% opposing it to some degree. The most frequent response for those opposing the scheme was that a more significant intervention was needed to improve transport conditions.

The position of stakeholders was similar to public respondents, with results demonstrating support for the need for the scheme but opposition to the RIS1 option. However, the most frequently mentioned suggestion from stakeholders was that more should be done to improve facilities for non-motorised users, mentioned by 32% of stakeholders. This was followed by 25% of stakeholders expressing the need for a bypass / underpass / flyover and 19% feeling that measures to encourage sustainable transport was required. There were also specific aspects of the RIS1 option that attracted negative feedback, in particular the introduction of signalisation and the potential restrictions to some local roads.

A further illustration of stakeholder and public views on the A27 in West Sussex is presented in recent surveys undertaken by WSCC as part of the development of their next transport plan⁵⁹. The conclusion to this survey summarised the following points:

- “*Comments in support of road capacity improvements, including improved road links and improvements to the A27*”.
- “*Contrasting comments, which outweighed supportive comments, opposed to the construction of more road capacity*”.

A summary of the polarisation of view between larger-scale and smaller-scale interventions is captured below, based on a sample of comments from stakeholders in response to the summer 2017 RIS1 consultation.

⁵⁶ Transport Analysis Guidance, The Transport Appraisal Process, Department for Transport, January 2014

⁵⁷ Transport Analysis Guidance, The Transport Appraisal Process, Department for Transport, January 2014

⁵⁸ A27 Worthing and Lancing improvements, PCF Stage 2 – Report on Public Consultation, Highways England, April 2018

⁵⁹ West Sussex Transport Plan Review Survey Autumn 2020, Feedback Summary, West Sussex County Council, March 2021

Supporting larger-scale options

“the proposals are inadequate and would only make matters worse”, suggest “flyovers, single lane in each direction, over the roundabout and junctions.” Adur District Councillor

“improvements will have very little impact on traffic flow. . . . the best answer is a bypass from the Shoreham flyover to the A27 west of Worthing.” Lancing Parish Councillor

“the only solution to Lyons Farm is to put in a tunnel for through traffic” West Sussex County Councillor (Cissbury)

“alternative scheme that have the inclusion of flyovers, a relief road or a bypass” Lancing Parish Council

“the scheme is too little to make a difference” Adur and Worthing Business Partnership

“consideration for a bypass with tunnels along the edge of the South Downs National Park” Federation of Small Businesses

“reject outright the proposal” and suggests “tunnelling under the Downs (and) grade separation”. Lancing Business Park

“a proper bypass is the only long-term solution” Broadwater Medical Centre

“... preferred option is a new dual carriageway along the A283 and A280, wide widening of the A24 in between” Adur and Worthing Residents’ Alliance

“the only solution is a bypass or relief road that takes through traffic out of the area” Lancing Manor Residents Network

Supporting smaller-scale options

“local authorities should consider measures such as traffic restraint policies, improvements to public transport, increased walking and cycling to deal with capacity issues in the longer term” Littlehampton Town Council

“completely opposed to consideration of other routes to take traffic off the A27 by bypassing of any sort” and would like to see further investment for “improving sustainable and low carbon transport options for this route.” Adur Green Party

“against relentless focus on road building which will only serve to increase traffic and pollution and contribute to climate change.” European Parliament, MEP for the South East of England

“improvements to public transport to reduce that amount of local travel” Sussex Wildlife Trust

“support the option in the fact that it is online improvements, rather than offline” and “more thought to sustainable transport measures” needed. Sompting Estate

“welcome proposed option as not large scale or damaging” and wants to see “a holistic approach, as road building alone is not a long-term solution and should be done also by reducing the need for travel” Campaign for Better Transport

“welcome the fact that Highways England is only proposing modest road proposals and not more damaging schemes for the Worthing-Lancing area. Large road building in the area would cause significant impact on communities and the environment, whether in or out of town.” Campaign for Better Transport

“funds would be far better allocated to traffic reduction methods through improving active travel and access” Arundel SCATE

“support the option not having flyovers and underpasses, as this would impact on viewpoints from the national park” South Downs Society

Current and future scheme development

4. Current and future scheme development

4.1. Current scheme development

The DfT's strategy for RIS2 (2020/21 to 2024/25)⁶⁰ includes the development of a “*package of enhancements between Worthing and Lancing to improve the capacity and flow of traffic*” with an allocated budget of £20m. The strategy is to develop and consult on the scheme during RIS2, with delivery anticipated to start in 2024/25.

The RIS sets out the investment plan for the second five-year cycle of funding for operations, maintenance, renewals and enhancements. Each RIS is informed by a research phase which includes strategic and corridor studies and route strategies before decision-making and mobilisation of subsequent RIS phases. Alongside the research phase, National Highways continue to develop the broader policy and strategy, such as the roadmap to net zero⁶¹ and for digital roads⁶².

National Highways work with other stakeholders on plans and strategies that relate to the strategic road network. For the A27 this includes the emerging Sub-National Transport Body, TfSE's Transport Strategy work which aims to determine what investment is needed to transform the region's transport system. TfSE are developing a number of area studies which will identify specific schemes and policy initiatives and a strategic investment plan for government review and approval.

National Highways develop the major schemes in RIS in accordance with a Project Control Framework (PCF), which is a joint DfT and National Highways approach to managing major projects comprising a standard project lifecycle and set of products. The lifecycle includes a number of specific stages which for optioneering and decision-making include PCF Stage 1 (option identification) and PCF Stage 2 (option selection).

Planning for RIS3 (2026-2030) has commenced, and a pipeline of possible future schemes has been identified which includes Chichester and Lewes to Polegate on the A27. Further studies will confirm the issues and need for improvement⁶³ and a new South Coast Central route strategy will be developed. It can be anticipated that future phases of study and investment are likely to follow a similar structure of investment cycles.

4.2. Scheme objectives and need for intervention

During the previous four phases of study (see section 2.2.1), policies, issues and opportunities have been re-examined in order to set objectives for the scheme, against which the case for identified options has been appraised. The need for intervention reflects the objectives set for the scheme and these have remained broadly consistent over time.

During the inquiry into the Worthing Bypass (1992 scheme), the focus of the scheme objectives was on supporting economic growth, the environment and road safety. The environmental objectives were focused on the removal of traffic from unsuitable roads and included air quality as “*one of the principal issues that emerged*”. The SoCoMMS study in 2003 set objectives for the region consistent with the New Approach to Appraisal (NATA) of economy, safety, environment, accessibility, and integration with a broader multi-modal emphasis.

During the A27 Corridor Feasibility Study, the number of objectives were expanded and were developed further. The economy-related objectives were linked to travel time and reliability. Themes around severance along the route were stated explicitly and the impacts of adverse weather were

⁶⁰ Road Investment Strategy 2: 2020-2025, Department for Transport, March 2020

⁶¹ Net zero highways: our 2030 / 2040 / 2050 plan, National Highways, 2021

⁶² Digital Roads, Introduction to Digital Roads, National Highways, August 2021

⁶³ Vision for route strategies – Planning for the future of our roads, Highways England, 2021

cited in relation to safety. Environmental objectives focused upon minimising impacts on the natural environmental, opportunities for improvement and mitigation.

The objectives set as part of RIS1 remained broadly consistent with the A27 Corridor Feasibility Study, with capacity, connectivity and resilience identified within the context of economic objectives, with environmental impacts specifically referencing air quality, planning for climate change and the special qualities of the SDNP. Safety remained a key objective for the scheme. As part of RIS2, the objectives and need for the scheme have continued to develop and are now summarised as:

- Improve road safety for all on the A27 and alternative local road network in the Worthing and Lancing areas.
- Reduce delays and improve journey times for the Worthing and Lancing areas and not impede future enhancements to transport in the scheme area.
- Not impede future enhancements to transport in the scheme area.
- Provide for alternative travel modes along the A27 and crossing the A27 in the Worthing and Lancing areas.
- Ensure that the scheme does not result in any significant adverse environmental effects, and seek opportunities for enhancements.

The scheme objectives have evolved since the 1990s and reflect the changing needs case and policy context for the scheme. Four key broad objectives and areas of influence on the scope, development and appraisal of schemes at A27 Worthing and Lancing are described below.

Objective: Improve road safety for all

The improved safety of the route is a consistent objective for the A27 and Worthing and Lancing improvements since the 1990s. There has been a continued development of policy context in relation to safety. This is set out in the RIS performance specification and documents including Digital Roads⁶⁴ which aims to realise National Highways objectives for road worker and road user safety with interventions that would support the target for zero injuries or deaths on the SRN by 2040. The South Coast Central Route Strategy⁶⁵ cites the route as having “*some of the worst performing links for safety issues in the country*”, with the A27 between Lancing and the A24 identified as one of the links with a poor safety record.

The strengthening of policy context is set against a continuing safety problem at Worthing and Lancing. The case for the A27 Worthing and Lancing bypass of the early 1990s reflected an accident rate at the time of between 30 and 68 accidents⁶⁶ per 100 million vehicle kilometres (100mvkm) in comparison to the national average at the time for an all-purpose dual carriageway of 19 accidents per 100mvkm. The SoCoMMS study in 2003 reported an accident rate of 50 per 100mvkm, exceeding the national average. The A27 Corridor Feasibility Study also noted casualty rates greater than the national average.

During RIS1, data for the period 2010 - 2015 showed a rate of between 75 and 120 collisions per 100mvkm, higher than the national average of approximately 55 during the same period⁶⁷. This was reflected in the public consultation of 2017 as “*an above average number of accidents on the A27 through Worthing and Lancing*”

In PCF Stage 2, data for the period 2012 - 2016 was considered. It was noted that the A27 has a slightly lower level of ‘killed and seriously injured’ accidents than the urban A road category nationally. However, the collision rate per 100mvkm is higher than the national average for urban A roads. The collision rate per 100 million vehicle kilometres over the four periods of study is summarised in Table 4-1.

⁶⁴ Digital Roads, Introduction to Digital Roads, National Highways, August 2021

⁶⁵ South Coast Central Route Strategy, Highways England, March 2017

⁶⁶ PSE/A27/5/65/11/1 (A27 Inquiry Conclusions)

⁶⁷ A27 Worthing-Lancing Improvements, PCF Stage 1 - Technical Appraisal Report, Highways England, April 2017

Table 4-1 – Summary of historical collision rates

Study / Stage	Geographic Extent	Collisions per 100 million vehicle kilometres	
		Study Extent	National Average
Worthing Bypass	A27 between Cote Street (Worthing) and Coombes Road (Lancing)	30 to 68	19
SoCoMMS	A27 “through Worthing”	>50	50
A27 Corridor Feasibility Study	“West Sussex portion” of A27	Greater than national average	Unknown
RIS1	A27 between Cote Street (Worthing) and River Adur crossing	75-120	~55
	A27 between the A27 / Grinstead Lane roundabout junction and the A27 / Durrington Hill junction	99-247	47-54

Note 1: The national average for the Worthing Bypass study / stage was based on all-purpose dual carriageways. The national average for the SoCoMMS study / stage was based on all A roads. All other national averages are based on all urban A roads.

Although the extents of the sections of road considered vary, it can be concluded that the collision rate remains consistently above the national average. It could also be concluded that the collision rate has continued to increase over time. This would indicate that safety continues to be a critical objective. Any improvement scheme would respond to and address this challenge.

Objective: Reduce delays and improve journey times

As part of each of the previous periods of study, changes in traffic volumes have been forecast in order to understand future transport conditions. These forecasts are an important part of the evidence that impacts upon the performance of the route in terms of delays and journey times which in turn informs the case for the scheme.

All historical studies have concluded that transport issues at the time would be exacerbated by continued growth in traffic volume. For example, as part of SoCoMMS, the growth in car trips across the regional study area was estimated at 28% over a 15-year period up to the year 2016. Transport modelling also forecast a 38% growth in east - west traffic movements within the study area between 1999 and 2016 within the Worthing area. It was noted that “*much of the growth is on the parallel routes to the A27. There is little growth on the A27 itself*”⁶⁸, due to the capacity constraints on the route. Longer-term forecasts suggested further growth, with estimates for a growth in car trips of 44% (between the years 2000 and 2030) across the wider south-coast region.

DfT traffic count data⁶⁹ illustrates the growth in traffic volume has not materialised as previously estimated. Data for a similar period of time (2001 – 2018) as the SoCoMMS forecasts is presented in Figure 4-1 which shows Annual Average Daily Flow (AADF). Red lines indicate traffic volumes at locations on the A27 and blue lines indicate locations on the local A road network. The bold red and blue lines represent the average of those individual count points.

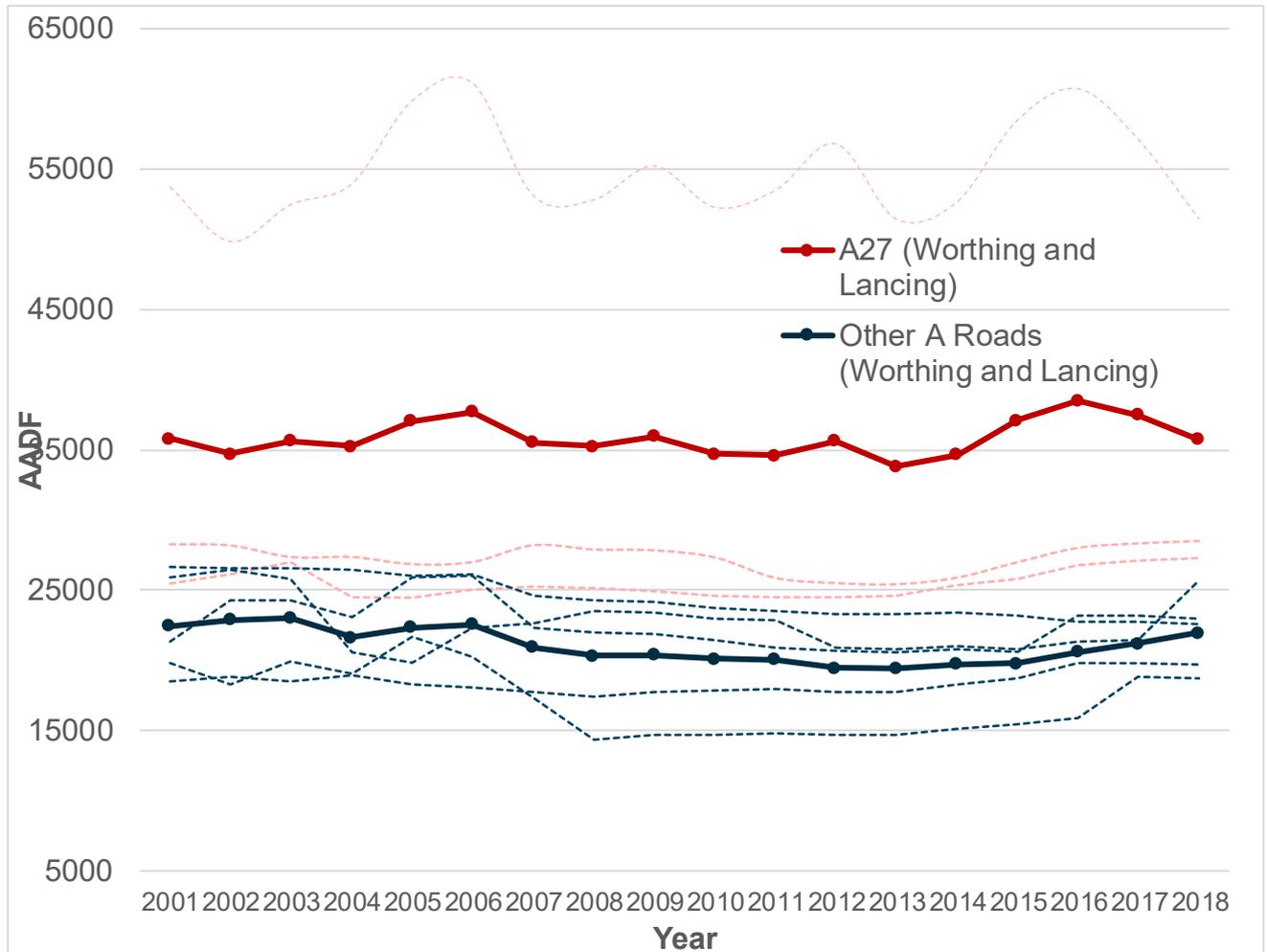
Traffic volumes on the A27 have increased by up to 10% at some locations but has decreased at others along the route during this period. Data for local roads within the Worthing and Lancing urban area also show that traffic growth has been limited, with increases of no more than 10% and a reduction in traffic volume at many locations across the local road network. The level of actual growth in traffic volume is markedly less than had been forecast in previous studies. The average traffic growth is close to 0% for both the A27 and the local A road network during this period. Comparatively, average traffic growth at other locations on the A27 such as at Chichester and

⁶⁸ Worthing Area Strategy Development Plan, South Coast Multi-Modal Study, prepared for Government Office for the South East, Halcrow et al, August 2002

⁶⁹ <https://data.gov.uk/dataset/208c0e7b-353f-4e2d-8b7a-1a7118467acc/gb-road-traffic-counts>

Arundel and on the alternative A283 / A29 route through the SDNP has been in the order of 10% on average. Nationally, DfT data⁷⁰ indicates that total vehicle miles on A roads has increased by 11%.

Figure 4-1 – Historical average daily traffic volumes



The implication of the lower levels of traffic growth is, whilst traffic issues remain significant on the A27 at Worthing and Lancing, the issues have not been exacerbated by traffic growth in the same way as forecast in historical studies. This may suggest that the level of additional road capacity needed to address the problem could be less than would be provided by the historical larger-scale options.

Objective: Provide for alternative travel modes

A feature of local traffic conditions that forms part of the case for the scheme is the proportion of longer-distance through traffic that is estimated to use the route through Worthing. As part of the A27 Worthing Bypass Inquiry in the early 1990s, the Inspector noted “the published scheme carries 45% of through traffic east of the A24 and 58% west of the A24”. At the time, the removal of through traffic from unsuitable roads was a specific and noted objective which has contributed to the previous rationale for larger-scale infrastructure in the form of tunnels and bypasses. However,

⁷⁰ <https://roadtraffic.dft.gov.uk/summary>

analysis associated with SoCoMMS⁷¹ set out that about 30% of vehicles travelling along the corridor is thought to be through traffic.

More recent data⁷² shows the pattern of trip-making in Worthing which shows around three quarters of traffic as local journeys, and the remaining quarter as through traffic. Through traffic is defined as a journey that travels along the A27 from east of Grinstead Lane to west of Durrington Hill junctions. The current average proportion of through traffic at the A27 Worthing and Lancing is 22% and this is forecast to reduce to 16% by 2041 without intervention as a result of continuing local land use development and the diversion of some trips to alternative routes due to congestion.

The through traffic data is consistent with other data⁷³ that shows that around 70% of journeys within the south coast area has a trip length of less than 15km and could be considered as 'local'. Census data (2011) for Worthing shows that around two thirds of journeys to work have a trip length of less than 20km.

In summary, the data shows that a high proportion of traffic movements within the Worthing and Lancing area are shorter distance. The estimated proportion of through traffic has reduced over time and is now around a quarter of the traffic that uses the A27. This information is considered in option development and selection and also has an impact on the economic case for the scheme.

Objective: No significant adverse environmental effects

Section 3.6 of this report notes some of the key environmental effects that have informed decision making on historical schemes. These include visual landscape and townscape effects and groundwater. The improvement of air quality along the A27 continues to form a key environmental objective for the transport intervention at Worthing and Lancing.

In 2010, Grove Lodge (A27 Upper Brighton Road) was declared an Air Quality Management Area (AQMA) as levels of Nitrogen Dioxide (NO₂) above the national annual mean objective of 40µg/m³ were measured in the area⁷⁴, with road traffic the primary source of pollutants. The area was enlarged in 2014 along the Upper Brighton Road and Warren Road (A27) to Lyons Farm. In 2010, Worthing Borough Council implemented an Action Plan⁷⁵ which sets out measures devised to try to deliver improvements to air quality by reducing pollution emitted from vehicles and the amount of traffic passing through the AQMA.

In 2015, NO₂ concentrations exceeded the annual objective at one location along the A27 close to the Grove Lodge roundabout. Elsewhere levels within the AQMA had *"tended to decrease and were typically the lowest measured over the five year period 2010-15"*. However, the continued exceedance at one location within the AQMA remained a cause for concern and the A27 Worthing and Lancing scheme objectives have continued to reflect this.

Continued monitoring in 2019⁷⁶ has shown the majority of locations registered a downward trend in measured levels of NO₂. The monitoring at Grove Lodge recorded a decrease in the ratified annual mean from 36.8µg/m³ in 2018 to 32.9µg/m³ in 2019. As with previous years, the hourly mean objective of 200µg/m³ was not exceeded at any time during 2019.

Only one monitoring site exceeded the annual mean objective of 40µg/m³ during 2019; N30A Grove Lodge Cottages. WBC carried out a consultation on declaring the AQMA for an exceedance of the 1-hour mean objective of 200µg/m³ and decided not to progress with the re-designation of the AQMA. The AQMA remains in place reflecting the annual objectives only.

⁷¹ Review of SoCoMMS Schemes in West Sussex, A27 Worthing Junction Improvements Feasibility Report, Bullen for Highways Agency, July 2004

⁷² A27 Worthing and Lancing improvements, PCF Stage 2 – Scheme Assessment Report, Highways England, June 2018

⁷³ A27 Worthing and Lancing Improvements, PCF Stage 2 – Combined Modelling and Appraisal Report (ComMA), Highways England, March 2018

⁷⁴ 2016 Air Quality Annual Status Report (ASR), Worthing Borough Council, January 2017

⁷⁵ Air Quality Action Plan for Worthing Air Quality Management Area No 2, Worthing Borough Council, November 2015

⁷⁶ 2019 Air Quality Annual Status Report (ASR), Worthing Borough Council, September 2020

Future monitoring will continue to illustrate the effect of the Action Plan and wider national trends towards a cleaner vehicle fleet. Should this continue to have a positive impact upon air quality, the significance of the problem and therefore the level of benefit that any specific transport scheme would provide would be reduced. Equally the level of enhancement needed to resolve the problem may be less than previously considered.

4.3. Implications of changes in policy

The policies associated with the development of transport schemes have changed over time. There have been significant developments in the policy context that guides the appraisal and consenting process for schemes within the Worthing and Lancing area.

The case for the 1990s Worthing Bypass scheme was considered against the objectives and policies at the time, including those associated with the Sussex Downs Area of Outstanding Natural Beauty (AONB) designation. Subsequent phases of study carried out as part of SoCoMMS in the early 2000s also considered the impact of a wide range of transport options on the AONB.

In 2010, the Sussex Downs AONB designation was revoked and the SDNP was established. This designation was made under The National Parks and Access to the Countryside Act 1949 with the purpose of ensuring *“our most beautiful and unique landscapes have been, and will continued to be, protected in the future”*⁷⁷. The South Downs National Park Authority (SDNPA) subsequently became planning authority for the national park in 2011.

There are legal duties for National Highways to consider regarding the statutory purposes of these designations. Decision-makers must give *“great weight . . . to conserving and enhancing landscape and scenic beauty in National Parks . . . which have the highest status of protection”*⁷⁸. Furthermore, the National Planning Policy Framework (NPPF, 2021) sets out *“the scale and extent of development within all these designated areas should be limited, whilst development within their setting should be sensitively located and designed to avoid or minimise adverse impacts on the designated areas”*.

The National Policy Statement for National Networks (NPSNN) was published in 2014 and *“sets out the need for, and Government policies to deliver, development of nationally significant infrastructure projects (NSIP’s)”* (paragraph 1.1). NPSNN reflects the continued compelling need for development of national networks. The SoS uses the NPSNN as the primary basis for making decisions on development consent applications for NSIPs in England. Both the NPPF and NPSNN seek to achieve sustainable development and recognise that different approaches and measures will be necessary to achieve this but the proposals must not *“result in adverse impacts of the development outweighing its benefits”* (paragraph 1.2).

NPSNN recognises that strategic road infrastructure schemes within national parks may sometimes be necessary if they are in the public interest, although there is a *“strong presumption”* against doing so and it needs to be demonstrated that alternatives are not possible. *“The SoS should refuse development consent in these areas except in exceptional circumstances and where it can be demonstrated that it is in the public interest. Consideration of such applications should include an assessment of:*

- *“the need for the development, including in terms of any national considerations, and the impact of consenting, or not consenting it, upon the local economy;*
- *the cost of, and scope for, developing elsewhere, outside the designated area, or meeting the need for it in some other way; and*
- *any detrimental effect on the environment, the landscape and recreational opportunities, and the extent to which that could be moderated.”* (paragraph 5.151)

⁷⁷ English National Parks and the Broads, UK Government Vision and Circular 2010, DEFRA, March 2010

⁷⁸ paragraph 176, National Planning Policy Framework, Ministry of Housing, Communities & Local Government, 2021

The SDNPA sets out⁷⁹ that any schemes which are ultimately proposed will:

- “demonstrate that there is no alternative which would have avoided or had a lesser impact on the seven Special Qualities for which the National Park is nationally designated
- set out clearly, based on robust evidence, the nature and scale of these impacts
- demonstrate how these impacts would be mitigated or compensated for, bearing in mind that a National Park landscape is of national importance.”

In summary, there is a strong presumption against major infrastructure development in National Parks and the policy position has continued to strengthen since the A27 Worthing Bypass Public Inquiry during the 1990s. Previous decision-making on historical larger-scale options has consistently cited environmental or SDNP-specific impacts.

Whilst there are clear and demonstrable benefits for larger-scale options, any such option that is situated within the National Park would unlikely be considered the “*least environmentally harmful option reasonably available*”⁸⁰. It is anticipated that any new environmental impact assessment reporting undertaken now, for the same of similar larger-scale scheme options, would identify a greater number of significant landscape, townscape and visual effects. It is possible that further new significant effects may also be identified. As a result, in today’s context, there are expected to be greater challenges in seeking to avoid, reduce, mitigate and compensate for the potential significant landscape, townscape and visual effects of the larger-scale options. Accordingly, the position set out in RIS2 reflects the potential to meet scheme objectives through improvements along the existing route with a lesser impact on the special qualities of the SDNP.

A further key area of policy development is the Climate Change Act (2008). This established a legally binding target to reduce the UK’s greenhouse gas emissions by at least 80% in 2050 from 1990 levels. This was amended in 2019 to commit the UK to achieving net zero emissions⁸¹ by 2050. The Climate Change Act established the context for Government action and incorporated the requirement to undertake Climate Change Risk Assessments, and to develop a National Adaptation Programme (NAP) to address opportunities and risks from climate change.

The NPPF sets out that the planning system should support the transition to a low carbon future in a changing climate, and new development should be planned for in ways that can help to reduce greenhouse gas emissions, such as through its location, orientation and design. However, NSIP’s are determined in accordance with the Planning Act 2008 and, in this case, the NPSNN which anticipates it being “*very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets*”.

The National Climate Change Risk Assessment (CCRA), first reported in 2012, provides a basis for assessing the likely future environment which Environmental Impact Assessments (EIA)s need to consider. The third CCRA⁸² highlights that more action is needed in terms of risk or opportunity to infrastructure networks (and assets) from cascading failures, pluvial and fluvial flooding, slope and embankment failures, subsidence as a result of climate change and risk from temperature variability, extremes, winds and lightning.

The adequacy of the necessary mitigation associated with the design and construction will be a material consideration for the SoS and the implications of this for the consideration of larger-scale infrastructure is described further below.

⁷⁹ Position Statement on the A27 route corridor, South Downs National Park Authority, 2010

⁸⁰ South Downs Local Plan, Adopted 2 July 019 (2014-33), South Downs National Park, 2019

⁸¹ Any emissions would be balanced by schemes to offset an equivalent amount of greenhouse gases from the atmosphere, such as planting trees or using technology like carbon capture and storage

⁸² Independent Assessment of UK Climate Risk, Advice to Government, For the UK’s third Climate Change Risk Assessment (CCRA3), Climate Change Committee, June 2021

4.4. Implications of changes in guidance and standards

As with changes in policy, the guidance associated with the development and appraisal of transport schemes has changed over time. These changes respond to the continuing development of national policy and legislation and can influence the case for a scheme and how it compares to other options. In the remainder of this section, implications are illustrated for key changes in environmental and economic guidance.

Environmental guidance

These changes can be illustrated through consideration of how policies associated with the climate and carbon impact of transport schemes has developed since the 1990's. The New Approach to Appraisal (NATA) was a multi-criteria decision framework for road projects that was introduced in 1999 in response to criticism that appraisal methods were biased to economic impacts at the expense of other measures, such as the environment. NATA required the development of an Appraisal Summary Table (AST) summarising the impacts of the project against five criteria, including the environment. The environmental impact appraisal was required to include the changes in carbon dioxide (CO₂) emissions as a result of the project. However, no assessment of this impact was required.

Greenhouse gas (GHG) emissions were previously not assessed in detail as part of the appraisal of larger-scale infrastructure projects. However, there has been an increased focus on GHG emissions associated with these projects, and over time guidance for the appraisal of GHG of larger-scale infrastructure has become more robust. As a significant emitter of GHG emissions, this is a particular challenge for the appraisal of road schemes.

Between 2006 and 2009, the NATA guidance was reviewed and updated, and appraisals were required to monetise GHG emissions and assess their impact to better inform the decision-making process. NATA guidance was then incorporated within TAG, the DfT's guidance for the appraisal of transport schemes, in 2013.

DMRB⁸³ included CO₂ under the regional air quality assessment as, whilst CO₂ was considered as a pollutant due to its GHG effect, its effect on the environment was considered to be global. Prior to 2007, the regional air quality assessment was not required until later stages of the appraisal process, once a preferred option had been selected. Guidance⁸⁴ was subsequently updated to include a greater consideration of GHG at each stage of the appraisal process. However, the regional air quality assessment was only required to consider changes in emissions as a result of the operation of a project.

In line with amendments to EU Directive⁸⁵, DMRB guidance was updated in 2019 to separate air quality from climate guidance, with the requirement for assessment to report on GHG emissions across the whole project life cycle, excluding decommissioning. The guidance also advises reporting significant effects where increases in GHG emissions have a material impact on the ability of Government to meet its carbon reduction targets (although guidance anticipates this is highly unlikely).

There has been an increased focus on GHG emissions associated with highways projects, and over time guidance for the appraisal of GHG has become more robust. Carbon prices set out in the TAG databook for use in scheme appraisal have increased significantly compared to previous versions. GHG emissions are also now assessed at earlier stages of the appraisal process and therefore is a factor in the assessment of smaller and larger-scale infrastructure options and selection of a preferred transport scheme.

Guidance has also developed to consider the effects of climate on highways (climate change resilience and adaptation). DMRB LA114 was introduced in 2019, stating that "*assessments must, as required by the EIA Directive, describe the likely significant effects of proposed projects on the environment resulting from the vulnerability of the project to climate change (adaptation)*". Through

⁸³ <https://www.standardsforhighways.co.uk/dmr/>

⁸⁴ <https://www.standardsforhighways.co.uk/dmr/HA20707>

⁸⁵ 2011/92/EU was amended in 2014 by EIA Directive 2014/92/EU

this assessment, projects are required to minimise their vulnerability against the negative effects of projected climate change through appropriate design and mitigation measures. In accordance with IEMA 2020, this should take place at all stages of design development – from optioneering through to detailed design.

A risk assessment shall identify how the project can be adapted to protect it from future climate scenarios and where an effect has been concluded to be significant, the significance of impacts needs to be reduced to an acceptable level (not significant).

This guidance and assessment process is a response to the increasing risk that climate presents for the operation of transport schemes. With appropriate design and mitigation, this is most likely to add cost to the delivery of a scheme. This then becomes a factor in decision-making associated with the economic and financial cases for a scheme.

Other notable changes in guidance that are likely to influence the appraisal, decision-making and potentially the cost of a scheme include:

- Drainage design – the assessment and design must allow for higher increases in rainfall in future than in previous guidance. The outcome is to forecast worsening effects associated with rainfall and therefore larger-scale mitigation requirements. This may lead to additional costs both in terms of infrastructure and additional land requirements.
- Material assets and waste – guidance has developed to strengthen the assessment of the effects associated with the use of materials, and the generation and management of waste. The significance and quantification of effects associated with scheme construction are now considered, with larger-scale infrastructure more likely to be associated with significant impacts.
- Biodiversity - in RIS2, the biodiversity Key Performance Indicator (KPI) goes further by requiring National Highways to deliver no net loss of biodiversity across its land. Guidance ensures that the development is delivered in a way which helps to restore any biodiversity loss. It is this restoration that is likely to require additional works, to enhance new and retained habitats and continue to maintain them in an improved condition. The UK Government's pending Environment Bill will require major infrastructure projects to deliver a biodiversity net gain.
- National Park – guidance produced by the SDNPA includes technical advice including on lighting design and dark sky protection.

Economic guidance

A further dimension to the 5-case model is the 'economic case'. The economic case for a transport scheme identifies all of the benefits of the scheme and compares them with the costs of delivering and operating the scheme. The range of impacts to be assessed is contained in TAG⁸⁶ and how these are used to determine Benefit to Cost Ratios (BCR) and value of money is outlined in the Value for Money Framework⁸⁷. Value for money is cited during the A27 Corridor Feasibility Study and RIS1 as a key reason why larger-scale options have not progressed.

During the four phases of study since the 1990s, there have been significant changes to guidance and the associated inputs that feed into the economic appraisal. These changes impact upon the calculation of economic benefits and the value for money assessment of scheme options. These changes can be grouped into three key areas of change:

- Traffic growth and forecasts.
- Monetary valuation in economic appraisal.
- Transport modelling guidance and appraisal framework.

The transport economic benefits of scheme options are calculated based on outputs from traffic modelling. Traffic modelling is underpinned by a set of future traffic growth forecasts sourced from

⁸⁶ <https://www.gov.uk/guidance/transport-analysis-guidance-tag>

⁸⁷ <https://www.gov.uk/government/publications/dft-value-for-money-framework>

the DfT National Trip End Model⁸⁸ (NTEM) and from DfT Road Traffic Forecasts (RTF) for goods vehicles. The traffic forecasts take account of changes in population, employment, housing, car ownership and trip rates. Local development is also taken into account in developing traffic forecasts.

In transport modelling, the current (baseline) traffic volume and the level of traffic growth is a factor in the level of congestion and delay predicted in the future. A higher forecast of traffic growth typically results in a transport model predicting higher levels of congestion and consequently a higher level of economic benefit can be estimated for a scheme.

Traffic growth has not out-turned at levels predicted by historical forecasts and therefore current traffic volumes are lower than estimated in previous economic appraisals. This is illustrated by analysis presented earlier in this report which shows:

- no overall change in traffic volumes between 2001 and 2018 at Worthing and Lancing on the A27 and local A road network
- a typical growth in traffic volume of around 10% between 2001 and 2018 at other locations on the A27 and on alternative routes such as the A283 / A29.

This observed data can be compared with previous study forecasts which include the SoCoMMS forecast growth in car trips of 44% (between 2000 and 2030) across the wider south-coast region. Historical NTEM forecasts previously indicated growth of 9 – 10% for the period 2010 to 2020. Furthermore, the latest future forecasts in NTEM now indicate a lower level of traffic growth during morning and afternoon peak periods, compared to historical predictions. Forecasts used in the A27 Corridor Feasibility Study, produced in 2015, indicated traffic growth between the years 2010 and 2035 of between 15% and 19%. In all years and time periods, with the exception of the year 2035 inter peak, current NTEM growth⁸⁹ forecasts are lower than that used in the traffic modelling for the A27 Corridor Feasibility Study.

A lower traffic baseline and lower traffic forecasts typically result in a reduction in scheme benefits in economic appraisal, which in turn leads to a reduction in the BCR and impacts on the value for money of each scheme option.

Monetary valuation in economic appraisal

Journey time savings, vehicle operating cost savings and accident savings are all calculated using transport modelling forecasts and monetised to determine the transport benefits of a scheme. Values of time are used to monetise the changes in journey time, and monetary valuations are provided for vehicle operating cost and accident savings. The values are updated regularly to reflect changes in economic growth, latest research and factors that impact on vehicle operating costs e.g. fuel costs and non-fuel operating costs.

A comparison of the values of time in the current (2021) Transport Analysis Guidance (TAG) databook with values in the 2014 release of TAG indicates that the current average value of time for a car on an average weekday is approximately 15% lower than in 2014. The current growth indices used to calculate values of time are also lower than the indices from 2014. The combined impact of a lower initial value of time and lower growth indices results in a much greater difference in the forecast values of time. For example, by 2061, forecast values of time using the current TAG databook are some 35% lower than those forecasts using the 2014 release of TAG.

In summary, lower values of time would result in lower monetised scheme benefits with a consequential impact upon the BCR and a potential change in value for money category. To illustrate this, the monetary valuation of the online part grade separation (hybrid) scheme has been

⁸⁸ <https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-nTEM>

⁸⁹ <https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-nTEM>

considered further. An economic assessment⁹⁰ has shown that the impact of these changes in values of time is a reduction in the level of monetary benefit of around 15%.

Transport modelling guidance and appraisal framework

Over time there has been a number of changes to the guidance on traffic modelling for scheme appraisal. The key change was introduced in the late 1990s and early 2000s, in response to the Standing Advisory Committee on Trunk Road Assessment (SACTRA) report. This report highlighted that the construction of new highways schemes resulted in induced traffic (for example new car trips, people changing mode or people changing destination), which was not captured by highway assignment models. The report led to changes in guidance and the need to include variable demand modelling (VDM) in traffic modelling and scheme assessment.

The impact of variable demand is generally a reduction in transport user benefits as a result of the additional traffic induced by the scheme. This means that any scheme appraisal carried out that does not include variable demand potentially overestimates benefits. This includes all options assessed prior to the year 2000 and analysis that was undertaken using fixed demand models, including the modelling supporting the A27 Corridor Feasibility Study.

The economic appraisal framework that underpins the economic case for a transport scheme has been updated over time to reflect the wider impact transport investment has on society. These impacts are typical of the economic impacts of many larger-scale transport options and contribute either positively or negatively to the economic case for a scheme. The degree to which each of these impacts would be applicable or significant would depend upon the context and scope of the particular scheme.

- Wider economic Impacts - the impact of transport improvements transmitted into the wider economy is a beneficial impact and typically contributes 20 - 30% of user benefits.
- Reliability - the variation in journey times that individuals are unable to predict. This is a benefit typically in the order of 10% of transport user benefits.
- Greenhouse gases - the total change in carbon emissions and is largely dependent on the total change in vehicle kilometres as a result of a transport scheme and are typically a dis-benefit due to induced traffic. Recent changes in TAG have placed higher monetary values on carbon compared to previous versions although this may be offset by an update to the fleet mix to account for an increase in electric vehicle uptake.
- Noise and air quality - the level of benefits or disbenefits is dependent on the change in noise and air quality and the population exposed, so is dependent on the change in traffic on individual roads and the alignment of scheme options. Those schemes that overall take traffic away from properties, for example a bypass, are likely to result in benefits where those that do not for, example online improvements, are likely to result in disbenefits.
- Landscape - an estimate of the public valuation of landscape impacts and is included in the estimate of value for money but is not included in the adjusted quantification of economic impacts (such as BCR)⁹¹. The valuation of loss of landscape could be a significant factor for those schemes that impact on the rural landscape, particularly if the land has a designated status.

Table 4-2 summarises the changes described in this section and their potential impact on the value for money assessment of larger-scale options such as tunnels, bypasses and grade separation.

⁹⁰ A Transport User Benefits Appraisal (TUBA) assessment was undertaken on the scheme using versions 1.9.8 (Dec-16), 1.9.9 (Feb-18) and 1.9.15 (Jul-21). A comparison of the monetary valuation of the scheme showed that the economic benefits reduce by around 15% between versions 1.9.8 and 1.9.15.

⁹¹ Value for Money – Supplementary Guidance on Landscape, Department for Transport, 2021

Table 4-2 – Impact of economic appraisal changes on value for money

Category	Input to economic appraisal	Impact on value for money
Scheme Cost Calculation	An increase in scheme construction and maintenance costs associated with inflation	-
	General cost inflation including that associated with a later scheme opening year*	-
Traffic growth and forecasts	A reduction in traffic volume baseline	-
	A reduction in traffic growth forecasts	-
Monetary valuation in economic appraisals	Changes to values of time and operating costs	-
	Impact of variable demand (induced traffic)	-
Transport modelling guidance and appraisal framework	Wider economic impacts	+
	Journey time reliability	+
	Greenhouse gas impacts	-
	Air and noise impacts	+
	Landscape impacts	-
	Future maintenance vehicle delays	+

* Note 1: changes in scheme opening year would also positively or negatively influence the benefits within an economic appraisal

The impact of these changes to economic appraisal will vary and would be dependent on the particular option. It is likely that the aggregate impact of these changes for the appraisal of larger-scale highway schemes is the forecast economic benefits for a scheme may reduce over time.

Value for money is cited as a reason that historical larger-scale options have not progressed. The impact of reducing economic benefits and increasing scheme cost estimates would further suggest that making the economic case for larger-scale options would be increasingly challenging in future.

4.5. Future larger-scale option identification

Future scheme development processes would need to be specified in accordance with the applicable policy, guidance and standards at the time. For A27 Worthing and Lancing, the context and findings of previous phases of study and decision-making should inform any future scheme development or appraisal process.

Schemes would be developed in line with the applicable DMRB design standards that have been updated and revised over time. Scheme development would also follow good design principles⁹² and reflect the recommendations of National Highways Strategic Design Panel.⁹³

A range of larger-scale options that involve tunnels have been considered since the 1990s, with different tunnel lengths, alignments and connectivity to the wider road network. The 1992 Worthing Bypass scheme included two sections of route with bored and cut and cover tunnels, each of

⁹² The road to good design, Highways England, 2018

⁹³ <https://nationalhighways.co.uk/our-work/environment/sustainable-development-and-design/good-design/>

approximately 600m in length. Variations to this scheme that were developed included tunnels of up to approximately 2.1km in length and as part of the SoCoMMS study bored tunnels of almost 3.3km in length were proposed.

Given that the existing A27 largely comprises dual carriageway / dual lane layouts it is assumed that, as for much of the road tunnel stock in the UK, the proposed tunnel works would be dual bore where one bore would carry a dual carriageway in one direction and the other bore would carry traffic in the other direction. In this way traffic can be carried at up to 70mph speeds in safety.

As described earlier in this report, the 1992 Worthing Bypass and SoCoMMS tunnel schemes were not taken forward due to different environmental impacts and scheme cost, with value for money then becoming a key issue for the SoCoMMS scheme.

One area that the previous phases of study has not considered is the scope for a reduced specification tunnel which would aim to balance the operational requirements, environmental impacts and reduce the cost of the scheme. Of the limited tunnel stock in the UK, there are few tunnels that contain bi-directional traffic in a single bore and of these tunnels they are limited to a 30mph vehicle speed. Examples include Ramsgate Harbour Approach, Rotherhithe Tunnel and Saltash Tunnel (three lanes with tidal flow). At a number of locations, tunnels that were originally single-bore have been expanded to twin-bore including Blackwall and Tyne tunnels.

In the UK, the Mersey Queensway tunnel, at 3.2km long, is significantly longer than other road tunnels in the UK such as the A3 Hindhead tunnel, which is 1.8km long. The longest length of tunnel proposed as part of the SoCoMMS scheme would therefore be consistent with the longest UK road tunnel at the time of writing. The A303 Stonehenge tunnel is proposed to be around 3.3km long and the proposed Lower Thames Crossing, at just over 4km in length will eventually be the longest road tunnel in the UK.

The basic per metre cost of any tunnel directly relates to the area of the excavation required as the cost of transporting and disposal of excavated material is one of the costliest elements of the tunnelling process. Based on DMRB⁹⁴, the internal diameter of a typical twin bore road tunnel for a twin lane configuration may be 11.75m for each direction, in comparison to a single bore tunnel containing three lanes operating as a tidal flow of 15.0m internal diameter. The single bore tunnel in this scenario would have an excavation area of 176m³/m and a dual bore tunnel 216m³/m. This indicates a single bore would require around 20-25% less excavation and this would provide a cost reduction relative to the dual bore tunnel.

Although a tunnel with bi-directional traffic in a single bore may provide a cost saving relative to a dual carriageway tunnel in a dual bore, and future innovative and faster construction techniques may provide further efficiencies⁹⁵. Cost savings would be considered against the safety and operational compromises that a single tunnel requires. A scheme development and appraisal process would identify whether such a scheme would be feasible and deliverable and the extent to which the benefits of the scheme would outweigh the costs.

⁹⁴ CD352 Design of road tunnels, Design Manual for Roads and Bridges, Highways England et al, March 2020

⁹⁵ Digital Roads, Introduction to Digital Roads, National Highways, August 2021

Summary and conclusions

5. Summary and conclusions

This report has set out the various historical larger-scale improvement options considered for the A27 at Worthing and Lancing, including tunnels, bypasses and grade-separated junctions and the decision-making rationale for why these options have not progressed.

Background and historical larger-scale options

There are many longstanding and extensively studied challenges at A27 Worthing and Lancing around capacity, delays, journey time and reliability, safety and environment.

There is a strong and consistent policy context for improvements to the A27 at Worthing and Lancing set out within National Highways RIS with current plans to identify and deliver a package of potential improvements to *'improve the capacity and flow of traffic on the A27 from Worthing to Lancing'*. The need for improvement to the A27 is also supported by TfSE, WSCC and Adur & Worthing in various plans and strategies.

Whilst there is broad agreement regarding the need for intervention there is limited consensus to date on the right transport solution. This is articulated clearly in the response to the 2017 RIS1 A27 Worthing and Lancing public consultation where views were polarised between support for larger-scale infrastructure such as tunnels and bypasses and smaller-scale interventions including those focused on walking, cycling and demand management.

This report has described a set of larger-scale options that are representative of the complete range of major dual carriageway highway infrastructure options and variants considered since the 1990s. These schemes are:

- **A27 Bypass (1992 Scheme)** – a bypass to the north of Worthing and Lancing with sections of 'cut and cover' tunnel
- **A27 Tunnels (SoCoMMS Scheme)** – extensive tunnelling on an alignment closer to the existing A27 than the 1992 scheme
- **Bypass and Tunnel** – a short, tunnelled bypass at Worthing and tunnel at Lancing
- **Bypass and Dualling** – a short, tunnelled bypass at Worthing and dualling
- **Online Grade Separation and Dualling** – the widening and grade-separation of all main intersections along the route
- **Online Part Grade Separation (Hybrid)** – widening of the existing A27 with grade separation limited to the Grove Lodge Roundabout and Lyons Farm junctions
- **Northern Bypass Dualling** – a scheme that would dual an alternative route through the SDNP to the north of the A27, via the A280, A24 and A283

Previous decision-making

None of the historical larger-scale improvement options have progressed to delivery. The reasons focus consistently upon the evidence associated with environmental impact (and planning policy compliance), cost and the value for money associated with these options.

The adverse environmental impacts cited in decision-making include visual impact (landscape and townscape), impacts upon groundwater sources and more recently (since its formation in 2010) impacts upon the policies associated with the SDNP. These impacts have been judged to be so significant that the proposals have been rejected, either by the SoS or as part of the appraisal process at the time the scheme was developed. Alternative smaller-scale solutions which meet objectives but with a lesser environmental impact have typically been taken forward to further stages of scheme development but sufficient consensus around the right solution has not been achieved.

The financial and economic case for the larger-scale options has proven increasingly challenging to make, with the BCR shown in recent phases of study to imply poor value for money. Alongside this,

the comparatively high cost associated with larger-scale options has made the financial case for these interventions more challenging.

Future scheme development

National Highways current plans for investment in the A27 Worthing and Lancing are set out in RIS2 which are subject to further engagement and consultation before delivery by 2025. The scope of RIS3 is being developed, and improvements along the A27 are being considered at Chichester and between Lewes and Polegate.

Any future consideration of transport improvement options on the A27 at Worthing and Lancing would need to reflect the updated and evolving strategy and policy context, including that emerging from current studies by TfSE and in local authority plans. The process for scheme development would be undertaken in accordance with the changing appraisal requirements that are set out in guidance at the time and would consider deliverability.

The key changes in environmental policy and guidance since the 1990s include the formation of the SDNP and its associated policies, the NPPF, and the NNNPS; all of which guide decision-makers toward schemes that meet their objectives but are the least environmentally harmful option reasonably available. A future scheme must also respond to evolving climate change policy, support the transition to a low carbon future and deliver improved environmental outcomes including biodiversity net gain requirements.

Future schemes will also need to respond to value for money requirements and a changing appraisal framework which, in recent years, has reduced the level of 'traditional' economic benefit associated with journey time and vehicle operating cost savings. Although traffic volume is still forecast to increase in future, there remains uncertainty in relation to future forecasts and data has demonstrated that growth has not materialised as previously predicted at Worthing and Lancing and across the wider area.

This report has summarised the extensive multi-modal studies and scheme development that has been undertaken historically for different scales and alignments of highway intervention. The context and findings of previous phases of study and decision-making should inform any future scheme development or appraisal process.

Appendix A

List of Larger-Scale Options

List of Larger-Scale Options

This list includes the seven specific larger-scale options and a number of other variations, where referred to within this report.

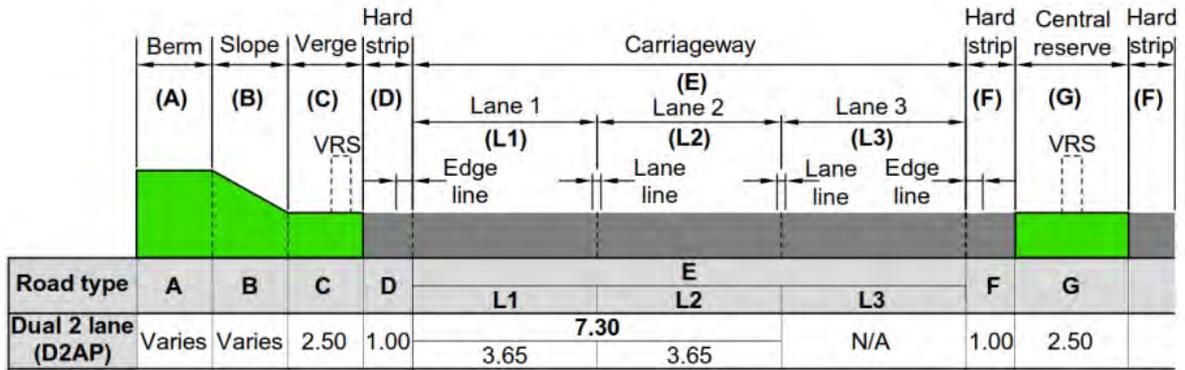
Option Name	Option Description
A27 Bypass (1992 Scheme)	A bypass to the north of A27 Worthing and Lancing with sections of 'cut and cover' tunnel
A27 Bypass (1992 Scheme BCL variation)	A bypass to the north of A27 Worthing and Lancing on a lowered alignment with extensive sections of tunnel
A27 Tunnels (SoCoMMS Scheme)	Extensive tunnelling on an alignment closer to the existing A27 than the 1992 scheme
A27 Tunnel (SoCoMMS scheme BCL variation)	A single extensive tunnel on an alignment closer to the existing A27 than the 1992 scheme
Bypass and Tunnel	A short, tunnelled bypass at Worthing and tunnel at Lancing
Bypass and Dualling	A short, tunnelled bypass at Worthing and dualling at Lancing
Online Grade Separation and Dualling	The widening and grade separation of all main intersections along the route
Online Part Grade Separation (Hybrid Scheme)	Widening of the existing A27 with grade separation limited to the Grove Lodge Roundabout and Lyons Farms junctions
Northern Bypass	A scheme that would dual an alternative route through the SDNP to the north of the A27, via the A280, A24 and A283

Appendix B

Road Layout Design Profiles

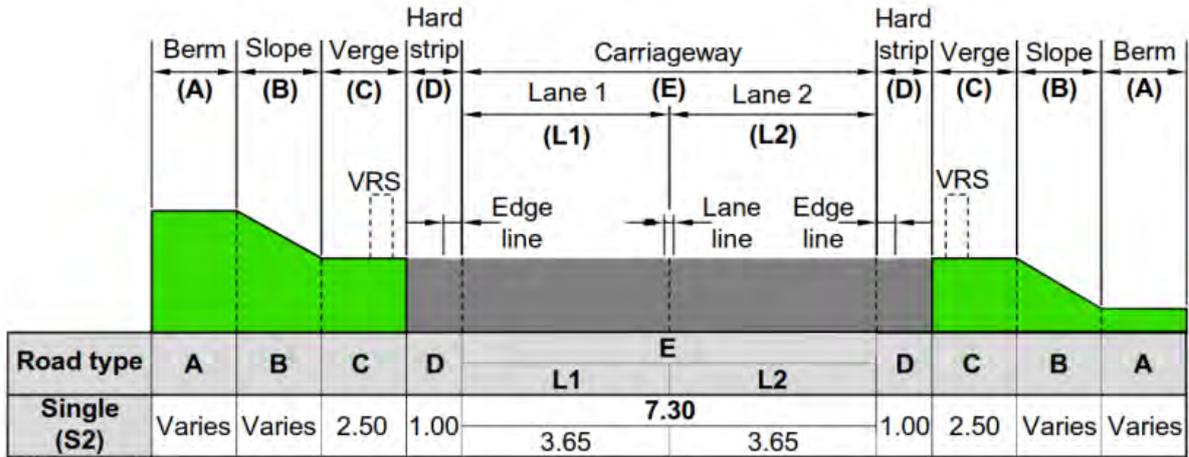
Dual 2 lane All Purpose (D2AP) Diagram

Source: CD 127 Cross-sections and headrooms, Figure 2.1.1N1e Dimensions of cross-section components for rural all-purpose roads mainline



Single 2 lane (S2) Diagram

Source: CD 127 Cross-sections and headrooms, Figure 2.1.1N1e Dimensions of cross-section components for rural all-purpose roads mainline



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