

A417 Missing Link

Preliminary Environmental Information Report

Chapter 3 Assessment of Alternatives - Appendices

28 September 2020

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Appendix 3.1 Scheme Assessment Report Appraisal Summary Tables

Appendix 3.2 Option 30 Alternatives Technical Note

A417 Missing Link

Preliminary Environmental Information Report

Appendix 3.1
Scheme Assessment Report Appraisal Summary Tables

28 September 2020

Name of scheme:		A417 Missing Link (PCF Stage 2) - Option 12				Name	Michael Goddard											
Description of scheme:		The scheme comprises an approximately 6.4 kilometre dual carriageway surface route (historically known as the Modified Brown Route), with a mixture of on-line widening and off-line construction. It follows the existing A417 alignment on Crickley Hill and near Birdlip, with off-line sections to the northeast of Barrow Wake and to the north of Nettleton, before re-joining the existing A417 carriageway south of the location of the existing Cowley Roundabout. There would be a new grade separated junction located at the B4070 (Birdlip) and north-facing slip roads, which would connect the mainline dual carriageway to the existing route at Barrow Wake. A minor junction would also be provided on the A417 near the location of the existing Cowley Roundabout to provide local access.				Organisation	Highways England											
		Role		Promoter/Official														
Impacts	Summary of key impacts	Assessment																
		Quantitative		Qualitative	Monetary £(NPV)	Distributional 7-pt scale/vulnerable grp												
Economy	Business users & transport providers	<table border="1"> <tr> <td colspan="2">Value of journey time changes (£m)</td> <td>146.4</td> </tr> <tr> <td colspan="3">Net journey time changes (£m)</td> </tr> <tr> <td>0 to 2min</td> <td>2 to 5min</td> <td>> 5min</td> </tr> <tr> <td>-1.0</td> <td>128.8</td> <td>18.6</td> </tr> </table>		Value of journey time changes (£m)		146.4	Net journey time changes (£m)			0 to 2min	2 to 5min	> 5min	-1.0	128.8	18.6	Not applicable	£111.4 million	Not applicable
	Value of journey time changes (£m)		146.4															
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0 to 2min	2 to 5min	> 5min																
-1.0	128.8	18.6																
Reliability impact on Business users	Reliability impacts have been estimated based on existing journey time variability along single and dual-carriageway sections of the A417. This scheme will provide significant reliability benefits due to the removal of the single-carriageway section of the A417 which experiences high levels of travel time variability.	£35.2 million		Beneficial	£35.2 million													
Regeneration	The scheme is not in close proximity to a regeneration area.	Not applicable		Not applicable	N/A													
Wider Impacts	The wider impacts of the scheme have been assessed using the DIT's Wider Impacts in Transport Appraisal (WITA version 1.2.1.2 beta) software. N.B. The WITA analysis of agglomeration and labour supply impacts has been limited to the detailed model area where confidence in the model results is highest. The scheme removes a significant bottleneck from the A417 corridor, leading to reductions in travel costs for journeys that make use of the route. The WITA analysis shows benefits primarily resulting from agglomeration impacts and to a lesser extent from benefits associated with output changes in imperfectly competitive markets. Wider benefits also arise from labour supply impacts.	Agglomeration benefits £38.9 million Labour supply benefits £0.7 million Output change in imperfectly competitive markets £11.1 million		Not applicable	£50.7 million													
Environmental	Noise	Results indicate an overall benefit due to a reduction of traffic using the bypassed section of A417 and some minor roads. Attenuation from alignment changes at some receptors and the relatively unpopulated area adjacent to the scheme would result in an overall benefit. Results do not include the effects of mitigation in the form of noise barriers or bunds which has not been specified at this stage. In the opening year, there are 2 receptors that are assessed to experience significant adverse effects due to noise.	Households experiencing increased daytime noise in forecast year: 17 Households experiencing reduced daytime noise in forecast year: 142 Households experiencing increased night time noise in forecast year: 11 Households experiencing reduced night time noise in forecast year: 101		Not applicable	£1.0 million	Distributional impacts across income groups would be unevenly spread with a Neutral effect on people in quintiles 1 (most deprived) and 3, a Slight Beneficial effect in quintile 5 (least deprived), Moderate Beneficial effect on people in quintile 2 and a Large Beneficial effect in quintile 4.											
	Air Quality	Overall there is a net worsening in local and regional air quality as a result of the scheme. This is because of the rerouting of vehicles on to the A417 and M5 away from the M40 and A34 which results in a longer route with a greater number of properties along it. There would be no new exceedances as a result. The scheme is predicted to improve air quality at properties within the Birdlip AQMA near the affected road network. Overall, the total change in NPV is negative, indicating a net deterioration in air quality when considering both local and regional effects. For the purpose of this assessment, it was assumed that one property would be demolished for the scheme ("Woodside House" on Crickley Hill).	Local Air Quality Assessment Score in Year of Opening: 2024: NO2: +225.4 PM10: +80.4 Regional Emissions (Over 60 year appraisal period) NOx: +830 tonnes		Not applicable	PM10 NPV: -£0.2 million NOx NPV: -£0.4 million Total value of change in air quality: -£0.6 million	NO2 and PM10: Distributional impacts across income groups would be unevenly spread with a Neutral effect on people in quintile 1 (most deprived), Slight Adverse effect on people in quintile 4, Moderate Adverse effect on people in quintiles 2 and 5 (least deprived) and Large Adverse effect on people in quintile 3.											
	Greenhouse gases	The scheme would result in an increase in both non-traded carbon and traded carbon over the 60 year appraisal period.	<table border="1"> <tr> <td>Change in non-traded carbon over 60y (CO2e)</td> <td>822,194</td> </tr> <tr> <td>Change in traded carbon over 60y (CO2e)</td> <td>10,109</td> </tr> </table>		Change in non-traded carbon over 60y (CO2e)	822,194	Change in traded carbon over 60y (CO2e)	10,109	Not applicable	-£36.5 million								
	Change in non-traded carbon over 60y (CO2e)	822,194																
	Change in traded carbon over 60y (CO2e)	10,109																
	Landscape	The scheme lies within the Cotswolds AONB, designated for its high landscape value. The area around the existing A417 is typical of National Character Area 107 Cotswolds, within which it lies. A dramatic limestone scarp, lined by ancient beech hangers on the upper slopes, rises above rural lowlands to the west. The high wold lies on the dip slope to the east, and is dominated by arable farming on thin soils, with blocks of woodland and plantation. Pasture and woodland occur in the valleys. There is limited settlement in the landscape, which contains accessible land, Public Rights of Way (PRoW), ecological assets and historical features. The scheme runs entirely at surface. The western half of the scheme runs on-line and adjacent with the existing A417, deepening the Crickley Hill cutting and affecting existing vegetation and Horsbere Brook. Elevated views from the top of the escarpment, including at Barrow Wake, look west over falling ground into the neighbouring vale and would likely be affected by this part of the scheme. East and south of Air Balloon, the scheme runs in part off-line, and in part on-line and adjacent with the existing A417, through an undulating rural landscape. The scheme would affect woodland at Emma's Grove and open farmland, with 2 new grade-separated junctions created at Barrow Wake and Birdlip. The new road and associated junctions and infrastructure would give rise to additional fragmentation of the local landscape pattern, an increased level of disturbance of the area and impacts on views from isolated settlement and PRoW.	Not applicable		Large Adverse	Not applicable												
Townscape	Given the highly rural nature of the route, the scheme would not pass through any developed settlements greater than individual farmsteads. No village settlements would be directly affected by the route. A townscape appraisal is not considered necessary due to the lack of urban features. Instead, the landscape appraisal should be referenced with regard to this route.	Not applicable		Not applicable	Not applicable													
Historic Environment	The scheme would result in moderate and large adverse impacts to the settings of two highly significant heritage assets, as well as to the rural setting of a heritage asset of medium significance. The scheme would also have a large adverse impact on an asset of low, local significance. Additionally, there would be large adverse impacts to archaeological remains across the entire road corridor during the construction phase of the scheme. In light of the surrounding heritage assets, buried archaeological remains have the potential to be of high, national significance. The detouring of the existing A417 would, however, improve the setting of some assets of medium significance. Overall, it is considered that the beneficial effects do not balance out the large number of adverse effects that the construction and operation of the scheme would have on the historic environment, particularly buried archaeological remains.	Not applicable		Large Adverse	Not applicable													

	Biodiversity	There is a potential for Large adverse effects on bats. To date, the rare Annex II species greater horseshoe, lesser horseshoe and barbastelle have been recorded foraging and commuting within the footprint of the scheme and lesser horseshoe have been recorded roosting within the zone of influence of the scheme. Ongoing surveys will provide more details on the importance of populations affected. The proposals could potentially directly impact on populations of these species, reduce available habitat, result in habitat fragmentation and the mortality of bats in relation to traffic. Large Adverse effects are identified for Bushey Muzzard SSSI due to potential groundwater impacts as the option may intersect the aquifer that is supplying the SSSI. There is a potential for Moderate Adverse effects on Ancient Woodland due to potential loss and fragmentation of habitats at Emma's Grove. Standard mitigation has been included in the assessment of likely impacts. There are considerable opportunities for additional ecological enhancement measures along the scheme corridor, including the provision of a green bridge in the vicinity of Crickley Hill and Barrow Wake. These benefits have not been included in the assessment of impacts due to their current uncertainty. On balance, the overall assessment is Large Adverse as there are no compensatory effects which could balance out the large adverse effects.	Not applicable	Large Adverse	Not applicable														
	Water Environment	Potentially adverse effects on direct groundwater receptors (groundwater bodies) and indirect groundwater receptors (springs, streams, wetland and abstractions) during construction and operation. A mainline cutting and embankment foundations / piles would intersect the Great Oolite aquifer upgradient of Bushey Muzzard SSSI, potentially leading to a reduction of water supply to this spring-fed wetland and associated habitat loss. Mainline cutting close to Air Balloon would potentially divert groundwater from one catchment to another. Therefore, adopting the precautionary principle, in the absence of ground investigation baseline data, and detailed design and mitigation measures, the assessment score for potential impacts on groundwater receptors would be Very Large Adverse. The potential impacts on surface water receptors would be mainly insignificant due to standard mitigation measures implemented through the CEMP and design. There is a potentially low significant adverse effect during construction on Horsbere Brook, as an indirect receptor, from change in groundwater heads and groundwater flow regime.	Not applicable	Very Large Adverse	Not applicable														
Social	Commuting and Other users	Journey time benefits arise from the conversion of the existing single carriageway section of the A417 to a modern dual carriageway, with associated junction improvements. Net journey time changes are the net of positive and negatives in a given time band. The majority of journey time benefits are accrued from time savings of between 2 and 5 minutes. Monetary (NPV) includes benefits from journey time savings, vehicle operating cost impacts and changes in user charges. User benefits are distributed evenly between income quintiles leading to a moderate beneficial impact.	<table border="1"> <thead> <tr> <th colspan="3">Value of journey time changes (£m)</th> </tr> <tr> <th colspan="3">Net journey time changes (£m)</th> </tr> <tr> <th>0 to 2min</th> <th>2 to 5min</th> <th>> 5min</th> </tr> </thead> <tbody> <tr> <td>4.0</td> <td>103.7</td> <td>12.4</td> </tr> </tbody> </table>	Value of journey time changes (£m)			Net journey time changes (£m)			0 to 2min	2 to 5min	> 5min	4.0	103.7	12.4	120.0	Not applicable	£48.6 million	Moderate beneficial
	Value of journey time changes (£m)																		
	Net journey time changes (£m)																		
	0 to 2min	2 to 5min	> 5min																
	4.0	103.7	12.4																
	Reliability impact on Commuting and Other users	Reliability impacts have been estimated based on existing journey time variability along single and dual-carriageway sections of the A417. This scheme will provide significant reliability benefits due to the removal of the single-carriageway section of the A417 which experiences high levels of travel time variability.	£28.9 million	Beneficial	£28.9 million														
	Physical activity	The scheme would result in the severance of some walkers, cyclists and horse-riders (WCH) routes, however the provision of diversions for affected routes and new crossings would reduce changes to journey times and lengths for WCHs. New crossings could potentially improve amenity and would be safer for WCHs. The installation of new and improved facilities for WCHs has the potential to encourage people to make more journeys using non-motorised forms of transport rather than motorised transport modes. Without specific details for where mitigation would be provided at this stage, it is assumed that there would be some journey length increases for WCHs. Although this could affect the usage of routes, there may also be some health benefits as a result of WCH travelling further to reach their destinations and on amenity with new safer crossings.	Not applicable	Neutral	Not applicable														
	Journey quality	Journey quality is anticipated to improve for travellers utilising the road between Cowley Roundabout and Crickley Hill once the scheme is in operation. A slight beneficial impact has been predicted to traveller care through the anticipated provision of new signage, reduced congestion and improved road surface. The impacts upon traveller views are anticipated to be neutral once the scheme is operational. Traveller stress is generally anticipated to reduce once the scheme is operational due to improvements in driver frustration, route uncertainty and fear of potential accidents, although the route would be slightly longer for those wishing to travel along the A436 which may increase frustration for them. The reduced congestion is likely to result in reduced frustration whilst the installation of new signage would result in a slight improvement to route uncertainty. The new safety provisions, particularly the new suitable vehicle restraint system along the central reserve, would lead to a slight reduction in the fear of potential accidents.	Not applicable	Slight Beneficial	Not applicable														
Accidents	A reduction in the number of fatal and serious casualties results from the conversion of the existing single carriageway section of the A417 to a modern dual carriageway, with associated junction improvements. There is an increase in the number of accidents and slight casualties due to increases in traffic in the A417 corridor, however the net result is beneficial. A distributional impact assessment of accident benefits has shown that the impact of the scheme on vulnerable groups is neutral.	Reduction in PIAs: -23.6 Reduction in casualties Fatal: 77.9 Serious: 101.5 Slight: -33.9	Not applicable	£67.9 million	Neutral														
Security	Impacts on security as a result of the scheme are likely to be neutral as scores for each security indicator identified within Table 4.1 of TAG Unit A4.1, are predicted to be the same with or without the scheme in place. There are not anticipated to be any changes to public transport waiting facilities / interchange facilities or to informal surveillance as a result of the scheme. However, CCTV and other route monitoring infrastructure would be installed provided to a level which is consistent with the wider A417 / A419 corridor which would be beneficial. There is potential for WCH routes to be affected, and consideration of measures such as footbridges and underpasses has been given to retain connectivity and access for WCHs along the network. The potential provision of underpasses may adversely affect the personal security of pedestrians, should they be provided. There is the potential for the scheme to result in some changes to lighting at the Air Balloon junction, although no lighting is likely to be required at Cowley roundabout, with this feature removed with the scheme in place. The scheme would also result in changes to landscaping with new screening planting and cuttings provided as appropriate, although this is not anticipated to affect personal security.	Not applicable	Neutral	Not applicable	Not applicable														
Access to services	The scheme is not anticipated to affect access to services within the vicinity of the scheme and effects on public transport accessibility would be Neutral.	Not applicable	Neutral	Not applicable	Not applicable														
Affordability	There is a forecast to be an overall increase in vehicle operating costs as a result of the scheme, leading to a moderate adverse affordability assessment. The increase in vehicle operating costs however, is driven to an extent by the redistributional impacts of the highway improvement (i.e. people choose to travel further, and incur greater vehicle operating costs, due to the reductions in travel time that the scheme brings). For the majority of existing trips the scheme will reduce vehicle operating costs as the new alignment is more direct and less congested than the current route. Some local movements, particularly traffic travelling between the A417 and A436, will experience increases in journey distance, and therefore costs, as a result of the scheme. A distributional impact assessment has shown that the affordability impacts of the scheme are evenly distributed between income quintiles.	N/A	Moderate Adverse	N/A	Moderate adverse														

Public Account	Severance	The scheme is predicted to result in a slight increase in severance for walkers, cyclists and horse riders (WCH) wishing to access the 3 community facilities within the study area. A total of 1472 WCHs, of which 814 would be classed as pedestrians, were counted at 31 different locations within the vicinity of the scheme in September 2017 during the summer holidays. Counts were undertaken for a 14-hour period (8am to 6pm) on Saturday 2 September, with an additional survey undertaken at 3 of the sites on Saturday 10 September due to access difficulties for the previous survey. A slight negative impact on severance has been predicted for pedestrians travelling to: 417 Bike Park from Little Witcombe or Brockworth; Ullenwood Bharat Cricket Club from Birdlip, Barrow Wake car park, Little Witcombe or Brockworth, Coberley, Cowley and Ullenwood; Walking milestone from Barrow Wake car park. This is because the scheme is likely to sever WCH routes used to access the community facilities from the nearby communities outlined above. A slight negative impact is predicted on severance for cyclists and horse-riders wishing to access the community facilities within the study area, with some hindrance to movements likely. The scheme is predicted to result in a slight relief in severance for local communities such as Birdlip, Cowley, Coberley, Little Witcombe and Brockworth 15 years after opening, with traffic rerouted onto the scheme alignment. With consideration of mitigation measures which are likely to be applied, including the development of an WCH strategy; which would ensure that permanent diversions and structures comprising footbridges and underpasses are provided at appropriate locations, potential increases in journey lengths for WCHs and also the positive impacts on some local communities with a relief in severance, a Neutral effect is predicted for the scheme on severance.	Not applicable	Neutral	Not applicable	To be assessed at a later stage
	Option and non-use values	The scheme does not include measures that will substantially change the availability of transport services in the study area.	Not applicable	Neutral	Not applicable	
	Cost to Broad Transport Budget	The scheme will be funded through Central Government Funds	Central Govt funding: £295.1 million	Not applicable	£295.1 million	
Indirect Tax Revenues	There would be some increase in the tax being paid to the Exchequer	Central Govt funding: Wider Public Finances = -£72.8 million	Not applicable	-£72.8 million		

Name of scheme:		A417 Missing Link (PCF Stage 2) - Option 30				Name	Michael Goddard		
Description of scheme:		The scheme comprises approximately 5.6 kilometre of dual carriageway surface route, with the majority constructed off-line and to the east of the existing A417 alignment. At its northern end, it follows the alignment of the existing A417 on Crickley Hill before entering the proposed off-line section near the location of the existing Air Balloon roundabout. It continues in a broadly southbound direction before re-joining the existing A417 carriageway south of the location of the existing Cowley Roundabout. A grade separated junction would be provided near Shab Hill, with a single carriageway link road proposed to connect the new dual carriageway to the existing A417 near the B4070 at Birdlip. A minor junction would also be provided on the A417 near the location of the existing Cowley Roundabout to provide local access.				Organisation	Highways England		
						Role	Promoter/Official		
Impacts		Summary of key impacts		Assessment					
				Quantitative		Qualitative	Monetary £(NPV)	Distributional 7-pt scale/vulnerable grp	
Economy	Business users & transport providers	Journey time benefits arise from the conversion of the existing single carriageway section of the A417 to a modern dual carriageway, with associated junction improvements. Net journey time changes are the net of positive and negatives in a given time band. The majority of journey time benefits are accrued from time savings of between 2 and 5 minutes. Monetary (NPV) includes benefits from journey time savings, vehicle operating cost impacts and changes in user charges.		Value of journey time changes (£m) 170.4		Not applicable	£158.7 million	Not applicable	
		Net journey time changes (£m)							
		0 to 2min	2 to 5min	> 5min					
		-7.2	138.3	39.2					
Environmental	Reliability impact on Business users	Reliability impacts have been estimated based on existing journey time variability along single and dual-carriageway sections of the A417. This scheme will provide significant reliability benefits due to the removal of the single-carriageway section of the A417 which experiences high levels of travel time variability.		£38.9 million		Beneficial	£38.9 million		
	Regeneration	The scheme is not in close proximity to a regeneration area.		Not applicable		Not applicable	N/A		
	Wider Impacts	The wider impacts of the scheme have been assessed using the DfT's Wider Impacts in Transport Appraisal (WITA version 1.2.1.2 beta) software. N.B. The WITA analysis of agglomeration and labour supply impacts has been limited to the detailed model area where confidence in the model results is highest. The scheme removes a significant bottleneck from the A417 corridor, leading to reductions in travel costs for journeys that make use of the route. The WITA analysis shows benefits primarily resulting from agglomeration impacts and to a lesser extent from benefits associated with output changes in imperfectly competitive markets. Wider benefits also arise from labour supply impacts.		Agglomeration benefits £46.9 million Labour supply benefits £0.8 million Output change in imperfectly competitive markets £15.9 million		Not applicable	£63.6 million		
	Noise	Results indicate an overall benefit due to reduction of traffic using bypassed section of A417 and on some minor roads. Attenuation from alignment changes at some receptors and the relatively unpopulated area adjacent to the scheme results in an overall benefit. Results do not include effects of mitigation in the form of noise barriers or bunds which has not been specified at this stage. In the opening year, there are 4 receptors that are assessed to experience significant adverse effects due to noise.		Households experiencing increased daytime noise in forecast year: 23 Households experiencing reduced daytime noise in forecast year: 185 Households experiencing increased night time noise in forecast year: 18 Households experiencing reduced night time noise in forecast year: 121		Not applicable	£1.2 million	Distributional impacts would be unevenly spread across income groups with a Neutral effect on people in quintiles 1 (most deprived), 2 and 3, a Slight Beneficial effect on people in quintile 4 and Large Beneficial effect on people in quintile 5 (least deprived).	
Air Quality	Overall there is a net worsening in local and regional air quality as a result of the scheme. This is because of the rerouting of vehicles on to the A417 and M5 away from the M40 and A34 which results in a longer route with a greater number of properties along it. There would be no new exceedances as a result. The scheme is predicted to improve air quality at properties within the Birdlip AQMA and Oxford AQMA near the affected road network. Overall the net change in NPV is negative, indicating a net deterioration in air quality when considering both local and regional effects. For the purpose of this assessment, it was assumed that one property would be demolished for the scheme ("Woodside House" on Crickley Hill).		Local Air Quality Assessment Score in Year of Opening: 2024: NO2: +591.0 PM10: +218.5 Regional Emissions (Over 60 year appraisal period) NOx: +898 tonnes		Not applicable	PM10 NPV: -£0.5 million NOx NPV: -£0.4 million Total value of change in air quality: -£1.0 million	NO2: Distributional impacts across income groups would be unevenly spread with a Slight Adverse effect on people in quintiles 4 and 5 (least deprived), Moderate Adverse effect on people in quintiles 1 and 2, and Large Adverse effect on people in quintile 3. PM10: Distributional impacts would be relatively evenly spread across income groups with a Neutral effect on people in quintile 1 (most deprived) and a Moderate Adverse effect on people in quintiles 2, 3, 4 and 5 (least deprived).		
Greenhouse gases	The scheme would result in an increase in both non-traded carbon and traded carbon over the 60 year appraisal period.		Change in non-traded carbon over 60y (CO2e) 835,792 Change in traded carbon over 60y (CO2e) 11,316		Not applicable	-£37.1 million			
Landscape	The scheme lies within the Cotswolds AONB, designated for its high landscape value. The area around the existing A417 is typical of National Character Area 107 Cotswolds, within which it lies. A dramatic limestone scarp, lined by ancient beech hangers on the upper slopes, rises above rural lowlands to the west. The high wold lies on the dip slope to the east, and is dominated by arable farming on thin soils, with blocks of woodland and plantation. Pasture and woodland occur in the valleys. There is limited settlement in the landscape, which contains accessible land, Public Rights of Way (PRoW), ecological assets and historical features. The scheme runs entirely at surface. The western section runs on-line and adjacent with the existing A417, deepening the Crickley Hill cutting and affecting existing vegetation and Horsbere Brook. Elevated views from the top of the escarpment, including at Barrow Wake, look west over falling ground into the neighbouring vale and would likely be affected by this part of the scheme. East and southeast of Air Balloon, the scheme runs off-line through an undulating rural landscape, affecting open farmland, woodland at Emma's Grove and a wooded valley at Shab Hill where a substantial new grade separated junction is proposed. The new road and associated junctions and infrastructure would give rise to fragmentation of the local landscape pattern, an increased level of disturbance of the area and impacts on views from isolated settlement and PRoW.		Not applicable		Large Adverse	Not applicable			
Townscape	Given the highly rural nature of the route, the scheme would not pass through any developed settlements greater than individual farmsteads. No village settlements would be directly affected by the route. A townscape appraisal is not considered necessary due to the lack of urban features. Instead, the landscape appraisal should be referenced with regard to this route.		Not applicable		Not applicable	Not applicable			
Historic Environment	The scheme would result in a moderate adverse impact to the settings of two highly significant heritage assets, as well as to the rural setting of heritage assets of medium significance. The scheme would also have a large adverse impact on an asset of low, local significance. Additionally, there would be large adverse impacts to archaeological remains across the entire road corridor during the construction phase of the scheme. In light of the surrounding heritage assets, buried archaeological remains have the potential to be of high, national significance. The detouring of the existing A417 would, however, improve the setting of some assets of medium significance. Overall, it is considered that the beneficial effects do not balance out the large number of adverse effects that the construction and operation of the scheme would have on the historic environment, particularly buried archaeological remains.		Not applicable		Large Adverse	Not applicable			

	Biodiversity	There is a potential for Large adverse effects on bats. To date, the rare Annex II species greater horseshoe, lesser horseshoe and barbastelle have been recorded foraging and commuting within the footprint of the scheme and lesser horseshoe have been recorded roosting within the zone of influence of the scheme. Ongoing surveys will provide more details on the importance of populations affected. The proposals could potentially directly impact on populations of these species, reduce available habitat, result in habitat fragmentation and the mortality of bats in relation to traffic. There is a potential for Moderate Adverse effects on Ancient Woodland due to potential loss and fragmentation of habitats at Emma's Grove. Standard mitigation has been included in the assessment of likely impacts. There are considerable opportunities for ecological enhancement measures along the scheme corridor, including the provision of a green bridge in the vicinity of Crickley Hill and Barrow Wake. These benefits have not been included in the assessment of impacts due to the uncertainty of these measures. On balance, the overall assessment is Large Adverse as there are no compensatory effects which could balance out the large adverse effects.	Not applicable	Large Adverse	Not applicable														
	Water Environment	Potentially adverse effects on direct groundwater receptors (groundwater bodies) and indirect groundwater receptors (springs, streams, wetland and abstractions) during construction and operation. A mainline cutting and embankment foundations / piles would intersect the Great Oolite aquifer upgradient of Bushley Muzzard SSSI, potentially leading to a reduction of water supply to this spring-fed wetland and associated habitat loss. Mainline cutting close to Air Balloon would potentially divert groundwater from one catchment to another. Therefore, adopting the precautionary principle in the absence of ground investigation baseline data, and detailed design and mitigation measures, the assessment score for potential impacts on groundwater receptors would be Very Large Adverse. The potential impacts on surface water receptors would be insignificant due to standard mitigation measures implemented through the CEMP and design.	Not applicable	Very Large Adverse	Not applicable														
Social	Commuting and Other users	Journey time benefits arise from the conversion of the existing single carriageway section of the A417 to a modern dual carriageway, with associated junction improvements. Net journey time changes are the net of positive and negatives in a given time band. The majority of journey time benefits are accrued from time savings of between 2 and 5 minutes. Monetary (NPV) includes benefits from journey time savings, vehicle operating cost impacts and changes in user charges. User benefits are distributed evenly between income quintiles leading to a moderate beneficial impact.	<table border="1"> <thead> <tr> <th colspan="3">Value of journey time changes(£m)</th> </tr> <tr> <th colspan="3">Net journey time changes (£m)</th> </tr> <tr> <th>0 to 2min</th> <th>2 to 5min</th> <th>> 5min</th> </tr> </thead> <tbody> <tr> <td>-13.6</td> <td>114.6</td> <td>29.8</td> </tr> </tbody> </table>	Value of journey time changes(£m)			Net journey time changes (£m)			0 to 2min	2 to 5min	> 5min	-13.6	114.6	29.8	130.8	Not applicable	£56.2 million	Moderate beneficial
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	Reliability impact on Commuting and Other users	Reliability impacts have been estimated based on existing journey time variability along single and dual-carriageway sections of the A417. This scheme will provide significant reliability benefits due to the removal of the single-carriageway section of the A417 which experiences high levels of travel time variability.	£29.8 million	Beneficial	£29.8 million														
	Physical activity	The scheme would result in the severance of some walkers, cyclists and horse-riders (WCH) routes, however the provision of diversions for affected routes and new crossings would reduce changes to journey times and lengths for WCHs. New crossings could potentially improve amenity and would be safer for WCHs. The installation of new and improved facilities for WCHs has the potential to encourage people to make more journeys using non-motorised forms of transport rather than motorised transport modes. Without specific details for where mitigation would be provided at this stage, it is assumed that there would be some journey length increases for WCHs. Although this could affect the usage of routes, there may also be some health benefits as a result of WCH travelling further to reach their destinations and on amenity with new safer crossings.	Not applicable	Neutral	Not applicable														
Journey quality	Journey quality is anticipated to improve for travellers utilising the road between Cowley Roundabout and Crickley Hill once the scheme is in operation. A slight beneficial impact has been predicted to traveller care through the anticipated provision of new signage, reduced congestion and improved road surface. The impacts upon traveller views are anticipated to be neutral once the scheme is operational. Traveller stress is generally anticipated to reduce once the scheme is operational due to improvements in driver frustration, route uncertainty and fear of potential accidents, although the route would be slightly longer for those wishing to travel along the A436 which may increase frustration for them. The reduced congestion is likely to result in reduced frustration whilst the installation of new signage would result in a slight improvement to route uncertainty. The new safety provisions, particularly the new suitable vehicle restraint system along the central reserve, would lead to a slight reduction in the fear of potential accidents.	Not applicable	Slight Beneficial	Not applicable															
Accidents	A reduction in the number of fatal and serious casualties results from the conversion of the existing single carriageway section of the A417 to a modern dual carriageway, with associated junction improvements. There is an increase in the number of accidents and slight casualties due to increases in traffic in the A417 corridor, however the net result is beneficial. A distributional impact assessment of accident benefits has shown that the impact of the scheme on vulnerable groups is neutral.	Reduction in PIAs: -101.8 Reduction in casualties Fatal: 77.8 Serious: 95.6 Slight: -129.2	Not applicable	£65.3 million	Neutral														
Security	Impacts on security as a result of the scheme are likely to be neutral as scores for each security indicator identified within Table 4.1 of TAG Unit A4.1, are predicted to be the same with or without the scheme in place. There are not anticipated to be any changes to public transport waiting facilities / interchange facilities or to informal surveillance as a result of the scheme. However, CCTV and other route monitoring infrastructure will be installed provided to a level which is consistent with the wider A417 / A419 corridor which would be beneficial. There is potential for WCH routes to be affected, and consideration of measures such as footbridges and underpasses has been given to retain connectivity and access for WCHs along the network. The potential provision of underpasses may adversely affect the personal security of pedestrians, should they be provided. There is the potential for the scheme to result in some changes to lighting at the Air Balloon junction, although no lighting is likely to be required at Cowley roundabout, with this feature removed with the scheme in place. The scheme would also result in changes to landscaping with new screening planting and cuttings provided as appropriate, although this is not anticipated to affect personal security.	Not applicable	Neutral	Not applicable	Not applicable														
Access to services	The scheme is not anticipated to affect access to services within the vicinity of the scheme and effects on public transport accessibility would be Neutral.	Not applicable	Neutral	Not applicable	Not applicable														
Affordability	There is a forecast to be an overall increase in vehicle operating costs as a result of the scheme, leading to a moderate adverse affordability assessment. The increase in vehicle operating costs however, is driven to an extent by the redistributional impacts of the highway improvement (i.e. people choose to travel further, and incur greater vehicle operating costs, due to the reductions in travel time that the scheme brings). For the majority of existing trips the scheme will reduce vehicle operating costs as the new alignment is more direct and less congested than the current route. Some local movements, particularly traffic travelling between the A417 and A436, will experience increases in journey distance, and therefore costs, as a result of the scheme. A distributional impact assessment has shown that the affordability impacts of the scheme are evenly distributed between income quintiles.	N/A	Moderate Adverse	N/A	Moderate adverse														
Severance	The scheme is predicted to result in a slight increase in severance for walkers, cyclists and horse riders (WCH) wishing to access 2 of the 3 community facilities within the study area. A total of 1472 WCHs, of which 814 would be classed as pedestrians, were counted at 31 different locations within the vicinity of the scheme in September 2017 during the summer holidays. Counts were undertaken for a 14-hour period (6am to 8pm) on Saturday 2 September, with an additional survey undertaken at 3 of the sites on Saturday 10 September due to access difficulties for the previous survey. A slight negative impact on severance has been predicted for pedestrians travelling to: 417 Bike Park from Little Witcombe or Brockworth; Ullenwood Bharat Club from Birdlip, Barrow Wake car park, Little Witcombe or Brockworth, Coberley, Cowley and Ullenwood. No severance impacts are predicted for pedestrians travelling to St John Chrysostom Greek Orthodox Church. The scheme is likely to sever WCH routes used to access the 417 Bike Park and Ullenwood Bharat Cricket Club community facilities from the nearby communities outlined above. A slight negative impact is predicted on severance for cyclists and horse-riders wishing to access the community facilities within the study area, with some hindrance to movements likely. The scheme is predicted to result in a slight relief in severance for local communities such as Birdlip, Cowley, Coberley, Little Witcombe and Brockworth in the opening year and 15 years after opening, with traffic rerouted onto the scheme alignment. With consideration of mitigation measures which are likely to be applied, including the development of a WCH strategy; which would ensure that permanent diversions and structures comprising footbridges and underpasses are provided at appropriate locations, potential increases in journey lengths for WCHs and also the positive impacts on some local communities with a relief in severance, a Neutral effect is predicted for the scheme on severance.	Not applicable	Neutral	Not applicable	To be assessed at a later stage														
Option and non-use values	The scheme does not include measures that will substantially change the availability of transport services in the study area.	Not applicable	Neutral	Not applicable															
Public Account	Cost to Broad Transport Budget	The scheme will be funded through Central Government Funds	Central Govt funding: £272.5 million	Not applicable	£272.5 million														
	Indirect Tax Revenues	There would be some increase in the tax being paid to the Exchequer	Central Govt funding: Wider Public Finances = -£73.8 million	Not applicable	-£73.8 million														

A417 Missing Link

Preliminary Environmental Information Report

Appendix 3.2
Option 30 Alternatives Technical Note

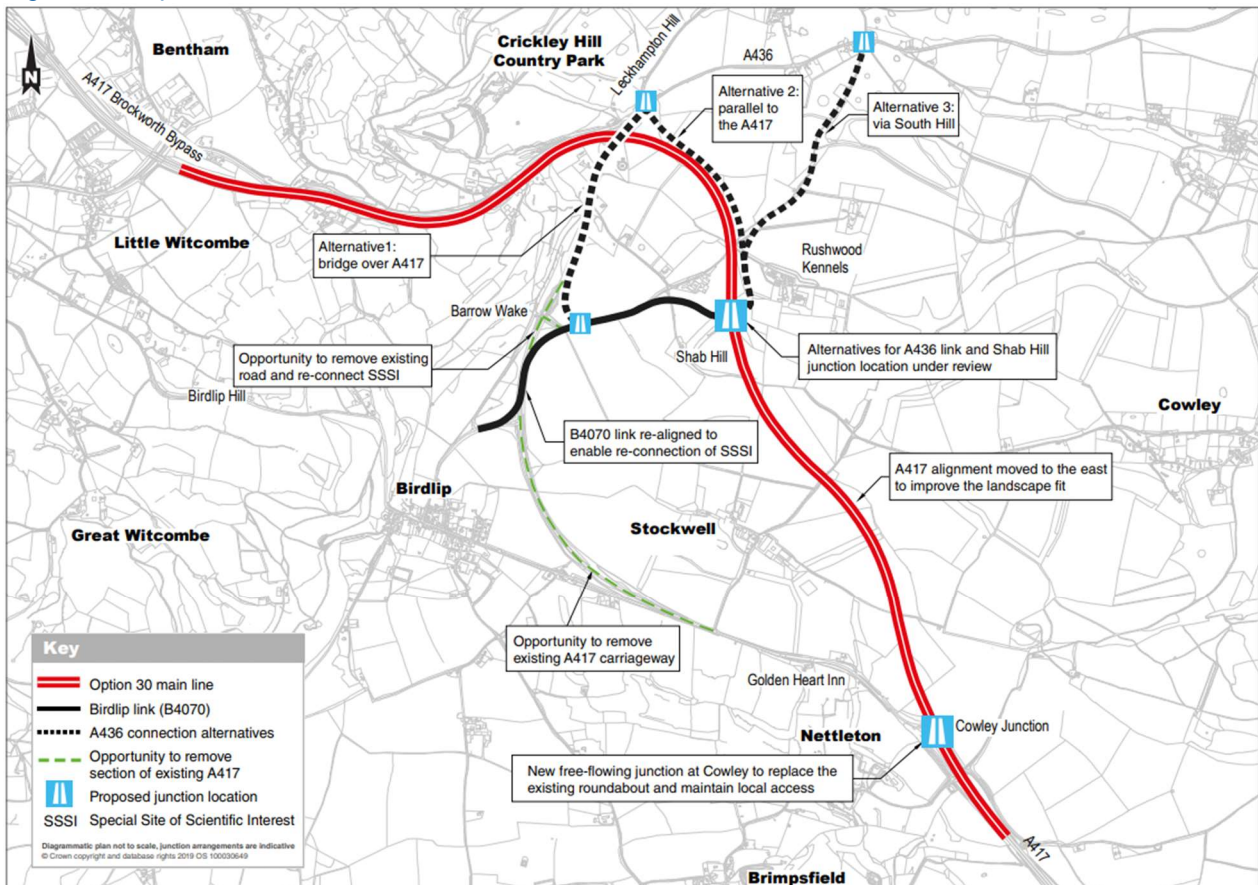
28 September 2020

Project:	A417 Missing Link – PCF Stage 2		
Project Number	HE551505		
Prepared by:	Removed for Sensitivity	Date:	August 2019
Approved by:	Removed for Sensitivity	Checked by:	Removed for Sensitivity
Subject:	Option 30 Alternatives Technical Note		

Executive summary

In March 2019 Highways England announced Option 30 as the preferred route for improving the A417 Missing Link. Three alternative versions of Option 30 were presented in the Preferred Route Announcement (PRA), each differing in the way a connection between the A417 and A436 is provided. The three alternatives are shown in Figure 0.1.

Figure 0.1: Option 30 alternatives



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Preliminary assessment was undertaken on the three alternatives in order for a recommendation to be made. Traffic flow models were used to assess the journey times and reliability of each option. The alternatives were also assessed for their environmental opportunities and their compliance with the National Policy Statement for National Networks (NPSNN). Furthermore, a WebTAG assessment and appraisal was undertaken and the three options were reviewed regarding their engineering and buildability benefits. Lastly, an economic assessment was undertaken to estimate the monetised benefits of each using scheme costs prepared by Highways England.

The results of the assessment are summarised in the form of a comparison matrix below in Table 0.1.

Table 0.1: Alternatives summary matrix (ranked from 1, comparative best performing, to 3 comparative lowest performing)

	Alternative 1	Alternative 2	Alternative 3
Traffic assessment	3	2	1
Environmental opportunities	3	1	2
NPSNN compliance	3	1	2
Engineering and buildability	3	1	2
Benefit cost ratios (ranked)	3	2	1



It is recommended that Alternative 2 is progressed as the preferred option for the A417 Missing Link scheme.

Alternative 1 provides the fewest benefits and therefore it is recommended that it is discounted. While Alternative 3 has benefits above that of Alternative 2 regarding traffic, it performs worse under environmental opportunities and compliance with NPSNN, particularly for landscape which is an important factor in the AONB. Alternative 2 has a number of advantages as a result of running alongside the A417 mainline, particularly regarding the environmental opportunities this presents. It also poses the lesser risk of non-compliance with the relevant tests set out in NPSNN, particularly as it would cause significantly less disruption to the local environment, landscape and ecology during construction. One of the key aims of the A417 Missing Link scheme is to be landscape led, and the selection of Alternative 2 matches this objective.

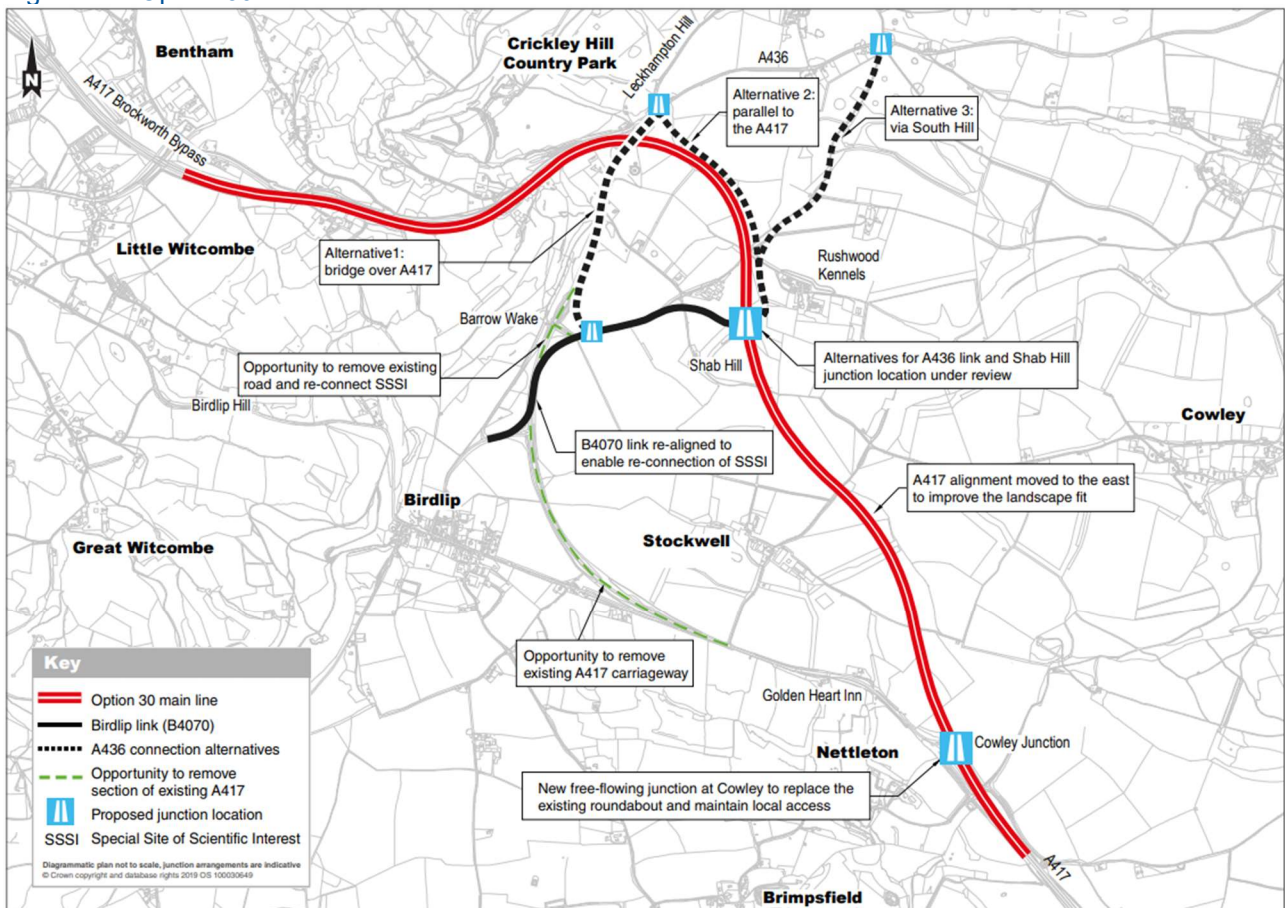
1 Introduction

In March 2019 Highways England announced Option 30 as the preferred route for improving the A417 Missing Link. Three alternative versions of Option 30 were presented in the Preferred Route Announcement (PRA), each differing in the way a connection between the A417 and A436 is provided.

This Technical Note provides a high-level summary of the benefits and opportunities associated with the three Option 30 alternatives, in regard to traffic, environment, engineering & buildability, and economics. The three alternatives, which are shown in Figure 1.1, are as follows:

- Alternative 1: bridge over A417;
- Alternative 2: parallel to the A417; and
- Alternative 3: via South Hill.

Figure 1.1: Option 30 alternatives



2 Traffic

2.1 Traffic flows

Forecast Annual Average Daily Traffic (AADT) flows at key locations around the scheme have been taken and Table 2.1 below shows a comparison of the AADT flows across the alternatives. The traffic assessment showed that each option would cause different changes to local flow rates as a result of the forecast reassignment of traffic

Table 2.1: Forecast AADT Flows on A417

Location	Forecast differences vs Do Minimum in design year (2039)		
	Alternative 1	Alternative 2	Alternative 3
A417 (Crickley Hill)	+ 10,900	+ 13,000	+ 14,900
A417 (south of Highwayman junction)	+ 12,300	+ 14,400	+ 12,800
Birdlip Hill	- 4,600	- 6,100	- 5,900
A436 (between Air Balloon and A435 junction)	- 3,700	- 2,900	+ 2,200
B4070	+ 1,800	+ 1,100	+ 700
Leckhampton Hill	+ 1,000	+ 3,400	- 2,100
A435 (north of A536 junction)	- 2,100	- 3,800	+ 100
Through Elkstone	- 1,700	- 2,900	- 2,400
Cowley Lane	+ 900	+ 900	+ 200
A46 (through Painswick)	- 500	- 200	+ 100

Alternative 1 would see a reduction in traffic on the A46 route through Painswick and on the A435 as traffic reassigns onto the B4070 / Leckhampton Hill route between Stroud and Cheltenham. Additionally, traffic routing between the A436 and the A417 is forecast to take alternative routes, resulting in increases in traffic in various locations including Cheltenham town centre, Cowley village and the B4425 through Bibury. Increases in traffic would also occur on Leckhampton Hill and on the B4070 between Stroud and Birdlip as a result of the removal of delays at the Air Balloon roundabout.

In comparison to Alternative 1, Alternative 2 would better alleviate rat running traffic through Elkstone and Birdlip, resulting in decreased traffic flow there. However, as a result of the more direct connection from the A417, it would see larger increases on Leckhampton Hill over Alternative 1.

Alternative 3 would also decrease traffic flow through Elkstone in Birdlip in comparison to Alternative 1. Unlike the other two alternatives, it would decrease traffic on Leckhampton Hill, as traffic would reassign onto the A436/A435 route between A417 south and Cheltenham. However, the impacts on routes to Stroud (A46 and B4070) are less pronounced than the other alternatives, and there would be an increase in traffic on the A436 between Ullenwood and Seven Springs due to reassignment onto the A436/A435 route between A417 south and Cheltenham.

2.2 Journey times and reliability

All three alternatives showed similar improvements to travel time and journey reliability on the mainline A417 following the replacement of the existing single carriageway section with a new dual carriageway. However, there were some comparable differences between the options when looking at the local road network.

On Alternative 1, journey times for traffic routing to/from Cheltenham via Leckhampton Hill would be improved by the removal of delays at the Air Balloon roundabout. Additionally, journey times on the westbound A436 approach to the Air Balloon roundabout during the evening peak would also improve. However, due to the proposal forming a less direct connection between the A436 and the A417, journey times compared with alternatives 2 and 3 would be longer along this corridor throughout most of the day. Alternative 1 would still see significant economic benefits over the existing situation as a result of the generally shorter journey times and improved reliability.

Alternative 2 would also see an improvement to journey times on the westbound A436 approach to the Air Balloon roundabout during the evening peak, as with Alternative 1, but would only incur a slight increase in journey times between the A436 and the A417. This means that Alternative 2 would provide improved economic benefits over Alternative 1 in regard to journey times and reliability.

Alternative 3 would provide the most direct connection between the A436 and the A417/M5 and therefore it would see the smallest increase in journey times along this corridor. As such, from the three options Alternative 3 would provide the largest economic benefits related to journey times and reliability. This is reflected in Table 2.2.

2.3 Accidents and wider impacts

The assessment shows that a reduction in the number of fatal and serious casualties would occur in all alternatives as a result of the conversion of the existing single carriageway section of the A417 to a modern dual carriageway, with associated junction improvements. There would be an increase in the number of accidents and slight casualties due to increases in traffic in the A417 corridor, however the net result is beneficial. The economic benefits for the alternatives are all similar, with insignificant monetary differences between them.

The wider impacts of the scheme have been assessed using the DfT's Wider Impacts in Transport Appraisal (WITA version 1.2.1.2 beta) software. The WITA analysis shows benefits primarily resulting from agglomeration of impacts and to a lesser extent from benefits associated with output changes in imperfectly competitive markets. Wider benefits also arise from labour supply impacts. The economic benefits for all three alternatives would be significant in comparison to the existing arrangement, with the largest benefits for Alternative 3, followed by Alternative 2, with Alternative 1 having the smallest.

2.4 Summary matrix

Table 2.2 below is a matrix which compares the alternatives under each category discussed in this section, with the exception of traffic flows.

Table 2.2: Traffic benefits summary matrix (ranked from 1, comparative best performing, to 3 comparative lowest performing)

	Alternative 1	Alternative 2	Alternative 3
Journey times and reliability	3	2	1
Accidents	-	-	-
Wider impacts	3	2	1
Overall (Traffic and economics)	3	2	1



The matrix demonstrates that Alternative 3 would be the best option from a traffic and economics perspective, followed by Alternative 2 and lastly Alternative 1.

3 Environment

3.1 Environmental opportunities

A high-level review was undertaken of the potential environmental opportunities of three alternatives. The methodology applied does not follow a standard approach to environmental appraisal or assessment based on published guidance, and the review should therefore not be read as a formal appraisal or assessment. Instead, it allows comparison between the potential environmental opportunities of each alternative against the environmental baseline.

Biodiversity

Alternative 3 performs the worst of the three options, as it would result in additional severance of habitats compared to Alternatives 1 and 2. Alternative 2 would result in the least amount of severance of bat and potential dormouse habitats when compared to Alternative 1 and 3 while also presenting more opportunities for biodiversity where the existing A417 is removed.

Landscape and visual

Of the three alternatives, Alternative 2 provides the most landscape opportunities due to it running alongside the mainline A417. It also allows for potential de-trunking of a much longer length of the A417 around Barrow Wake when compared to Alternatives 1 and 3, together with associated restoration and enhancement of landscape, ecology and access routes. It also has more opportunities compared to Alternative 3 given the potential for less extensive impacts on existing vegetation/woodland within the High Wold landscape, and on NMU routes and visual receptors. An advantage of Alternatives 2 and 3 is that they remove the need for the A436 overbridge, which could be an intrusive structure across the cutting at the top of the scarp slope. Due to this feature, Alternative 1 performs the worst of the three for landscape opportunities.

Population and health

While Alternative 1 would result in the least adverse impacts in journey lengths for walkers, cyclists and horse riders using public rights of way, Alternative 2 would have the most opportunities for community land and facilities, private property, and associated land take. Alternatives 2 and 3 also allow for the de-trunking of the A417 between Birdlip and the Air Balloon, which would result in more opportunities in terms of amenity benefits for walkers, cyclists and horse riders when compared to Alternative 1.

Cultural heritage

In regard to cultural heritage, Alternative 2 provides the most opportunities in comparison to the other options, as it concentrates the archaeological impact on an area already impacted by the Option 30 route alignment. Alternative 3 provides more opportunities for heritage when compared to Alternative 1, but not as many when compared to Alternative 2, as it includes an additional area of land outside of what would already be archaeologically impacted by the Option 30 route alignment.

Water

Alternative 2 currently has the most water related opportunities when compared to Alternatives 1 and 3 as it involves only one major cutting (mainline). Alternative 3 has the least opportunities as it involves an additional, long cutting through South Hill, which may intersect groundwater flow.

Summary matrix

Table 3.1 contains a matrix which allows comparison between the potential environmental opportunities of each alternative against the baseline.

Table 3.1: Environmental opportunities summary matrix (ranked from 1, comparative best performing, to 3 comparative lowest performing)

	Alternative 1	Alternative 2	Alternative 3
Biodiversity	3	1	2
Landscape and visual	3	1	2
Population and health	3	1	2
Cultural heritage	3	1	2
Water	2	1	3
Overall	3	1	2



The environmental review showed that overall, the option that would offer the most environmental opportunities is Alternative 2. This is due to it outperforming the other alternatives across all categories, particularly for landscape due to its alignment alongside the proposed mainline A417.

3.2 NPSNN Compliance

The following section will discuss the accordence of each alternative with the National Policy Statement for National Networks (NPSNN).

Air quality

The three alternatives contain no locations where predicted annual mean NO₂ concentrations are above the air quality objective of 40µg/m³, which means that they are all fully compliant with the requirements of the NPSNN. At this stage no alternative design option is considered to perform better than the others in terms of compliance with the requirements of the NPSNN.

Biodiversity

For their effects on the nearby SSSIs, Alternatives 2 and 3 would contain slightly less risk of non-compliance with NPSNN. Furthermore, Alternative 2 also poses the lesser risk of non-compliance relevant to the protection of other habitats and species than the other two options. Lastly, all three alternatives would have similar adverse effects on woodland and veteran trees. This means that Alternative 2 performs best for NPSNN compliance under biodiversity.

Landscape and visual

All three options carry a risk of non-compliance with NPSNN, however Alternative 2 includes additional enhancement opportunities over the other options. Alternative 3 performs the worst of the three due to the significant predicted effects it would have on the High Wold AONB landscape.

Population and health

Alternative 1 represents the greatest risk of non-compliance against NPSNN due to adverse effects predicted for a number of receptors in relation to land use. Alternative 3 is also predicted to have potential impacts on community and residential receptors, which means that it falls behind Alternative 2 in regard to compliance against NPSNN. While Alternative 2 does contain risks of non-compliance, the potential benefits outweigh the potential risks.

Cultural heritage

Alternative 2 presents the greatest probability of meeting the relevant tests contained within the NPSNN, as enhancements to the significance of a number of heritage assets have been identified. Alternative 1 poses the greatest risk of non-compliance against NPSNN due to potential adverse effects to the setting of two designated heritage assets during the construction and operation stage. Alternative 3 contains features that pose a greater risk of non-compliance with the relevant tests set out within the NPSNN in comparison to Alternative 2, although this alternative is considered more likely to meet the relevant tests than Alternative 1.

Noise

At this stage it is considered that all alternative design options present equivalent risk of non-compliance in meeting the relevant tests set out within the NPSNN. However, appropriate design of mitigation and enhancement measures would be considered at Preliminary Design to ensure impacts on receptors are reduced.

Water

In relation to flood risk and water quality it is not currently possible to differentiate between the alternative design options as they currently present equal probability of non-compliance with the relevant tests set out within the NPSNN.

Summary matrix

Table 3.2 contains a summary matrix that compares the performance of the three alternatives against the relevant tests set out within the NPSNN.

Table 3.2: NPSNN compliance summary matrix (ranked from 1, comparative best performing, to 3 comparative lowest performing)

	Alternative 1	Alternative 2	Alternative 3
Air Quality	-	-	-
Biodiversity	3	1	2
Landscape and visual	2	1	3
Population and health	3	1	2
Cultural heritage	3	1	2
Noise	-	-	-
Water	-	-	-
Overall	3	1	2



Under the relevant tests set out in the NPSNN, Alternative 2 poses the lesser risk of non-compliance of the three options. Alternatives 1 and 3 are predicted to both incur impacts that would significantly affect their chances of compliance, with Alternative 1 performing poorly regarding biodiversity, population, human health and cultural heritage impacts and Alternative 3 performing poorly regarding landscape impacts.

4 Engineering and buildability

4.1 Comparison of options

One of the main differentiators between the options is that Alternative 3 would provide a better earthworks balance with less surplus material for the overall scheme, however assessment shows that this option would generate a larger percentage of unusable material due to it crossing an area of woodland, which makes Alternative 2 a better option in this regard.

As it runs alongside the proposed route of the A417, Alternative 2 would also be the least disruptive option in terms of construction impact on road users, the community, the environment, and local ecology. In these categories, Alternative 1 performs the worst, although Alternative 3 is likely to encounter more environmental and ecological constraints due to crossing through an existing woodland area. Alternative 1 performs the best in regard to land take and impact on utilities, which is a result of the option following the existing A417.

4.2 Summary matrix

Table 4.1 below is a matrix which compares the alternatives in regard to engineering and buildability.

Table 4.1: Engineering & buildability summary matrix (ranked from 1, comparative best performing, to 3 comparative lowest performing)

	Alternative 1	Alternative 2	Alternative 3
Construction length	3	1	2
Land take	1	2	3
Cut/fill balance & earthworks	3	1	2
Programme	-	-	-
Temporary traffic management	3	1	2
Utilities impact	1	2	3
Environment & community impact	3	1	2
Structures	3	1	2
Overall	3	1	2



Table 4.1 shows that Alternative 2 is the best option in regard to engineering and buildability, performing better than the other two options in all but two categories. Alternative 1 performs best in land take and utilities impact but worst in the remaining categories, making Alternative 3 the second best option behind Alternative 2 for engineering and buildability.

5 Appraisal summary

This chapter provides a summary of the WebTAG assessment and appraisal undertaken on the three alternatives. The assessments are summarised in WebTAG Appraisal Summary Tables (ASTs), which have been produced for all three options to collate the assessments and appraisals summarised within this report.

5.1 Environmental appraisal

Quantitative results

Table 5.1 provides a summary of the quantitative environmental appraisal undertaken for air quality, noise and greenhouse gases in line with WebTAG guidance.

Table 5.1: Summary of environmental results

Item	Alternative 1	Alternative 2	Alternative 3
Air quality	-1.00	-0.80	-0.70
Noise	0.70	1.00	1.00
Greenhouse Gases	-1.00	-0.81	-0.82

Note: all monetary values have been removed to protect commercial sensitivity and are expressed as a proportion of the greatest value to allow comparison

All three alternatives would have an overall negative impact on local and regional air quality but with no new exceedances and a predicted improvement in air quality at properties within the Birdlip AQMA and Oxford AQMA near the ARN. Negative monetary impacts are also predicted regarding greenhouse gases, due to a rise in the number of vehicle vehicles travelled relative to the Do Minimum scenario. Net monetary benefits for noise are predicted as a result of the A417 moving away from properties.

Qualitative results

Table 5.2 provides a summary of the qualitative environmental appraisal undertaken for landscape, historic environment, biodiversity and the water environment in line with WebTAG guidance.

Table 5.2: Summary of qualitative environmental results

Item	Alternative 1	Alternative 2	Alternative 3
Landscape	Large adverse	Large adverse	Large adverse
Historic environment	Large adverse	Large adverse	Large adverse
Biodiversity	Large adverse	Large adverse	Large adverse
Water environment	Very large adverse	Very large adverse	Very large adverse

The three alternatives cannot be differentiated by the qualitative environmental WebTAG assessment that was undertaken. All of them are predicted to have large adverse effects on landscape, historic environment, biodiversity, and very large adverse effects on the water environment. This is largely due to the alignment of the mainline A417 staying the same for all three options.

5.2 Social appraisal

Quantitative results

Table 5.3 provides a summary of the quantitative social appraisal undertaken for commuting and other users, reliability impact on commuting and other users, and accidents in line with WebTAG guidance.

Table 5.3: Summary of quantitative social results

Item	Alternative 1	Alternative 2	Alternative 3
Commuting and other users	0.83	0.95	1.00
Reliability impact	0.92	0.97	1.00
Accidents	0.98	1.00	0.98

Note: all monetary values have been removed to protect commercial sensitivity and are expressed as a proportion of the greatest value to allow comparison

Qualitative results

Table 5.4 provides a summary of the qualitative environmental appraisal undertaken for physical activity, journey quality, security, access to services, affordability, severance and option and non-use values in line with WebTAG guidance.

Table 5.4: Summary of qualitative social results

Item	Alternative 1	Alternative 2	Alternative 3
Physical activity	Neutral	Neutral	Neutral
Journey quality	Slight beneficial	Slight beneficial	Slight beneficial
Severance	Neutral	Neutral	Neutral

5.3 The three alternatives cannot be differentiated by the qualitative social WebTAG assessment that was undertaken. Summary

Overall, while the three alternatives show differing environmental and social effects from the appraisal, they can't be separated in regard to their overall qualitative results. The quantitative results are factored into the economic assessment which is detailed in Section 6.

6 Economics

This chapter provides a summary of the economic assessment and appraisal undertaken on two scheme options under consideration at PCF Stage 2.

6.1 Estimation of costs

Highways England has prepared cost estimates for all scheme options. The expenditure profiles are based upon cost estimates for each financial year prepared in Q1 2016 prices and then inflated to outturn costs using Highways England projected construction related inflation. These costs have then been rebased to 2010 calendar year profiles for economic calculations, using the Gross Domestic Product (GDP)-deflator series as published in the WebTAG Databook. The costs exclude all recoverable VAT and all historic costs have been removed.

Table 6.1: Estimated total costs

	Alternative 1	Alternative 2	Alternative 3
Estimated total cost	0.98	1.00	0.99

Note: all monetary values have been removed to protect commercial sensitivity and are expressed as a proportion of the greatest value to allow comparison

6.2 Economic assessment results

The overall monetised economic impacts of the scheme with each of the three alternatives are summarised in the Analysis of Monetised Costs and Benefits (AMCB) table, which includes results from the TUBA, COBALT and QUADRO programs, as well as the assessments undertaken for journey time reliability, noise, air quality, greenhouse gases and wider economic benefits. The AMCB is shown in Table 6.2. As per WebTAG all costs and benefits reported in this section are in 2010 prices, discounted to 2010.

Table 6.2: Analysis of costs and benefits

Item	Alternative 1	Alternative 2	Alternative 3
Accidents (not assessed by TUBA)*	0.98	1.00	0.98
Roadworks (not assessed by TUBA)**	-1.00	-1.00	-1.00
Greenhouse Gases (not assessed by TUBA)***	-1.00	-0.81	-0.82
Noise (not assessed by TUBA)****	0.69	0.96	1.00
Air Quality (not assessed by TUBA)*****	-1.00	-0.80	0.71
Economic Efficiency: Consumer Users (Commuting)	0.84	0.92	1.00
Economic Efficiency: Consumer Users (Other)	0.79	0.99	1.00
Economic Efficiency: Business Users and Providers	0.87	0.92	1.00
Wider Public Finances (Indirect Taxation Revenues)	0.95	1.00	0.95
Present Value of Benefits (PVB)	0.88	0.96	1.00
Broad Transport Budget Present Value of Costs (PVC)	0.98	1.00	0.99
OVERALL IMPACTS			
Net Present Value (NPV)	0.62	0.88	1.00
Initial Benefit to Cost Ratio (BCR) (ranked from 1 comparative best to 3 comparative worst)	3	2	1
Reliability Benefits	0.96	0.99	1.00
Wider Economic Benefits	0.78	0.90	1.00
Adjusted BCR (ranked from 1 comparative best to 3 comparative worst)	3	2	1

Note: all monetary values have been removed to protect commercial sensitivity and are expressed as a proportion of the greatest value to allow comparison

The analysis of monetised costs and benefits shows that Alternatives 2 and 3 have better BCRs than Alternative 1, with Alternative 3 having a slightly better BCR than Alternative 2.

7 Conclusion and recommendation

7.1 Comparison of alternatives

Table 7.1 below provides a summary of the assessment that has been undertaken on the three A436 alternatives. Each section in this report has identified the alternative with the most benefits/opportunities within that category, and these results are summarised in the matrix.

Table 7.1: Alternatives summary matrix (ranked from 1, comparative best performing, to 3 comparative lowest performing)

	Alternative 1	Alternative 2	Alternative 3
Traffic assessment	3	2	1
Environmental opportunities	3	1	2
NPSNN compliance	3	1	2
Engineering and buildability	3	1	2
Benefit cost ratios	3	2	1

Most benefits/opportunities	←→	Fewest benefits/opportunities	Minimal differences between options
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The assessment that has been undertaken shows that Alternative 1 provides the fewest benefits and therefore it is recommended that it is discounted.

While Alternative 3 has benefits above that of Alternative 2 regarding traffic, it performs worse under environmental opportunities and compliance with NPSNN, particularly for landscape which is an important factor in the AONB. Furthermore, it is only slightly ahead of Alternative 2 regarding traffic and BCR ratio which does not outweigh its potential environmental impacts.

It is therefore recommended that Alternative 2 is progressed as the preferred option for the A417 Missing Link scheme. This option has a number of advantages as a result of running alongside the A417 mainline, particularly regarding the environmental opportunities this presents. It also poses the lesser risk of non-compliance with the relevant tests set out in NPSNN, particularly as it would cause significantly less disruption to the local environment, landscape and ecology during construction. One of the key aims of the A417 Missing Link scheme is to be landscape led, and the selection of Alternative 2 matches this objective.