

A417 Missing Link
TR010056

6.4 Environmental Statement
Appendix 3.1 Scheme Assessment
Report Appraisal Summary Tables

Planning Act 2008

APFP Regulation 5(2)(a)
Infrastructure Planning (Applications: Prescribed Forms and
Procedure) Regulations 2009

Volume 6

May 2021

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning
(Applications: Prescribed Forms
and Procedure) Regulations 2009**

A417 Missing Link

Development Consent Order 202[x]

**6.4 Environmental Statement
Appendix 3.1 Scheme Assessment Report Appraisal Summary Tables**

Regulation Number:	5(2)(a)
Planning Inspectorate Scheme Reference	TR010056
Application Document Reference	6.4
Author:	A417 Missing Link

Version	Date	Status of Version
C01	May 2021	Application Submission

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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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				
Economy	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		
	Economy	Regeneration	The scheme is not in close proximity to a regeneration area.		Not applicable		Not applicable	N/A	
		Economy	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
	Environmental		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
Environmental		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).
		Environmental	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
Environmental			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
	Environmental	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	
		Environmental	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> <th>130.8</th> </tr> <tr> <th colspan="4">Net journey time changes (£m)</th> </tr> <tr> <th>0 to 2min</th> <th>2 to 5min</th> <th>> 5min</th> <th></th> </tr> </thead> <tbody> <tr> <td>-13.6</td> <td>114.6</td> <td>29.8</td> <td></td> </tr> </tbody> </table>	Value of journey time changes(£m)			130.8	Net journey time changes (£m)				0 to 2min	2 to 5min	> 5min		-13.6	114.6	29.8		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																	