M4 Junction 17 OBC

WC_M4J17-ATK-GEB-XX-RP-TB-000006

Social and Distributional Impact Appraisal

25/08/22

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Notice

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Document history

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Executive Summary

This report details the findings of the Social and Distributional Impact (SDI) Appraisal undertaken for the proposed M4 J17 Scheme, designed to improve the junction which provides a key linkage between the A350 Major Road Network (MRN) corridor and the Strategic Road Network (SRN). The scheme will build upon the recently delivered improvements scheme at M4 Junction 17 which introduced part-signalisation. The scheme aims to reduce instances of queuing on the M4 mainline, minimise delays at the junction, reduce collisions at the junction and improve junction capacity for future developments.

The distributional analysis aims to evaluate whether the M4 J17 scheme unduly favours or disadvantages any particular social or vulnerable group within the study area. An assessment of social impacts is also presented in the report. Understanding the social and distributional impacts is a crucial component of transport scheme appraisals as the benefits on the society are often significant and play a key role in justifying the progression of worthwhile transport projects.

The appraisal has been undertaken in accordance with requirements set out in TAG unit A4-1 (Social Impact Appraisal) and TAG unit A4-2 (Distributional Impact Appraisal) published by the Department of Transport (DfT). The results are presented in a seven-point scale of beneficial, neutral, or adverse.

A summary of the social analysis undertaken is presented below:

- The assessment of severance, journey quality, accessibility and personal affordability is appraised as **slight beneficial**.
- Physical activity, collisions and security impacts are considered to be **neutral.**

A summary of findings for the eight distributional impact indicators is provided below (overall impact):

- The overall user benefits DI appraisal is considered to be **moderate beneficial.**
- The impact of noise and personal affordability on vulnerable groups is scored as **slight beneficial.**
- Severance and collisions impacts are considered to be **neutral.**
- The overall air quality impact is appraised as **slight adverse.**

The benefits and disbenefits of the M4 J17 scheme are experienced to different extents by different specific social and income groups, including children, older people, Black, Asian and Minority Ethnic (BAME) communities, people without access to a car, people with a disability and people on low incomes. The report analyses whether people who belong to these vulnerable groups are not disadvantaged further by receiving a disproportionately low share of the benefits, or a disproportionately high share disbenefits. This analysis can inform measures to mitigate the impact of the project on those groups.

1.   Introduction

1.1.   Purpose of the report

This report details the findings from the Social and Distributional Impact (SDI) Appraisal of the M4 J17 Scheme. The appraisal has been undertaken in accordance with requirements set out in TAG unit A4-1 (Social Impact Appraisal) and TAG unit A4-2 (Distributional Impact Appraisal) published by the Department of Transport (DfT). This report complements the M4 Junction 17 Outline Business Case (WC_M4J17-ATK-GEN-XX-RP-TB-000001); in particular, it supports the Economic Dimension.

Social impacts (SIs) cover the human experience of the transport system and its impact on social factors not considered as part of economic or environmental impacts. These impacts may positively or negatively influence the preferences, well-being, behaviour or perception of residents and other social groups. The purpose of the Social Impact Appraisal is to evaluate, and where appropriate quantify, these impacts in order that they can be considered relative to other outcomes and where possible mitigated.

On the other hand, distributional impacts (DIs) consider the variance of transport intervention impacts across different social groups. The analysis of DIs is mandatory in the appraisal process and a constituent of the Appraisal Summary Table (AST). Both beneficial and adverse DIs of the transport intervention are considered, along with the identification of social groups likely to be affected. These may include children, older people, people with a disability, Black, Asian and Minority Ethnic (BAME) communities, no car households and people on low incomes. It is important to make sure that the most vulnerable groups are not disadvantaged further by receiving a disproportionately low share of benefits, or a disproportionately high share of the disbenefits. This analysis can inform measures to mitigate the impact of the project on those groups or amendment of the project itself.

The report is organised as follows: Section 1 discusses the project objectives and the project option as described in the Strategic Case; Section 2 presents the results of the approach to the appraisal of the social impacts of the scheme, Section 3 is devoted to a description of the distributional impact appraisal where consideration is given to the impacts on key groups; and Section 4 describes the main outputs from the appraisal in a matrix and contains summary text to be included within an Appraisal Summary Table.

1.2.   Background

The M4 Junction 17 is located between Swindon (J15, J16) and Bath (J18) at the intersection between the A350 and A429. M4 Junction 17 comprises a five armed approach from the A429 to the north, M4 to the east, B1422 to the south east, A350 to the south and M4 to the west. There are currently signals on both motorway off slips to the junction and on the gyratory which is currently two lanes. All other approaches are not signalised.

Pedestrian and cycling provision are limited on the M4 Junction 17 and does not connect to a wider footway network. A footway runs along the nearside of the roundabout gyratory, connecting to two maintenance areas by traffic signals. A footway also connects to the M4 Junction 17 from the northbound carriageway of the A350. Currently, there are no local bus services or rail stations in the vicinity of the M4 Junction 17, the closest bus stops are located in Stanton St Quintin to the north west of the scheme and Chippenham station to the south of the scheme.

Based on the options assessment report (OAR) process Option B+ was selected as the preferred option for the M4 Junction 17 scheme. The proposed preferred option is illustrated in **Figure 1-1**. The scheme primarily comprises of:

- Widening of M4 Westbound off-slip from two lanes to three lanes.
- Extension of flare length from two lanes to stopline on the M4 westbound off-slip.
- Two lanes allowed to make movement from the A350 northbound approach to the M4 westbound on-slip.
- Extension of the southbound flare from two lane section on A429 southbound approach to the stopline.
- Widening of approach on the A429 southbound from 2 to 3 lanes.

Figure 1-1 – M4 Junction 17 preferred option scheme layout
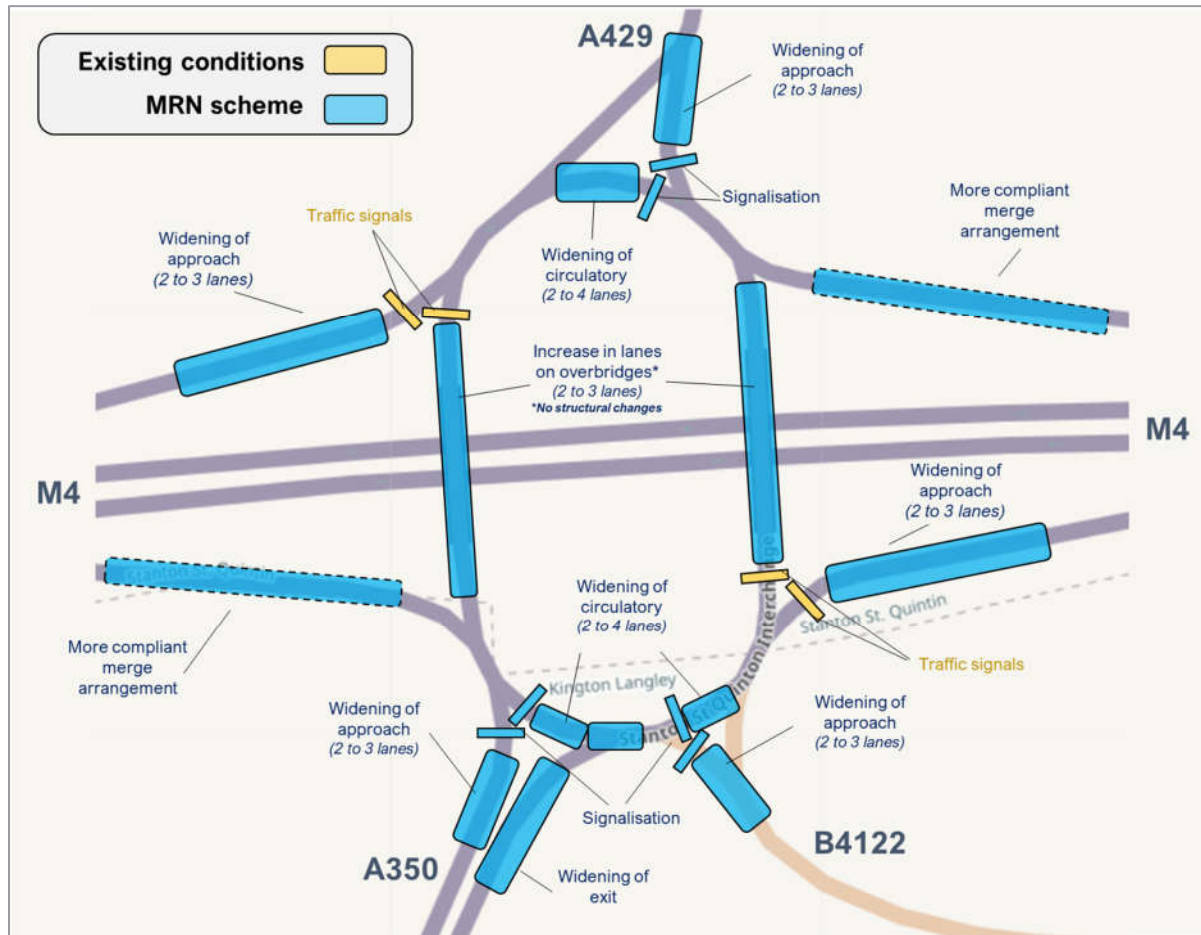
In addition to the proposed design elements outlined above the scheme proposes to deliver a signed cycle route to the west of the scheme. The scheme will add signage to the route, which will run from the south of the M4 J17 from the A350, through Kington St Michael, along Stanton Lane to Stanton St Quintin and onwards to the A249 via Church Lane to the north of the M4 J17. The outline of the proposed cycle route is illustrated in **Figure 1-2**.

As described in the OBC Strategic Case, the five transport objectives of the scheme are:

- To reduce delay and improve journey time reliability at M4 Junction 17, supporting journeys on the SRN.
- To support the overall success of the A350 improvements programme (including MRN) by delivering complementary improvements at M4 Junction 17.
- To improve north-south connectivity on the A350 through improvements to M4 Junction 17, the gateway to the A350 from the SRN.
- Ensure that M4 Junction 17 has the capacity to accommodate planned and future growth in the A350 Corridor and in the A350 and Swindon M4 SWLEP Growth Zones, including the Chippenham Urban Expansion and the Wiltshire Local Plan Review.
- Improve existing safety levels at M4 Junction 17, considering forecast traffic growth.

Figure 1-2 – M4 Junction 17 proposed cycle route signage
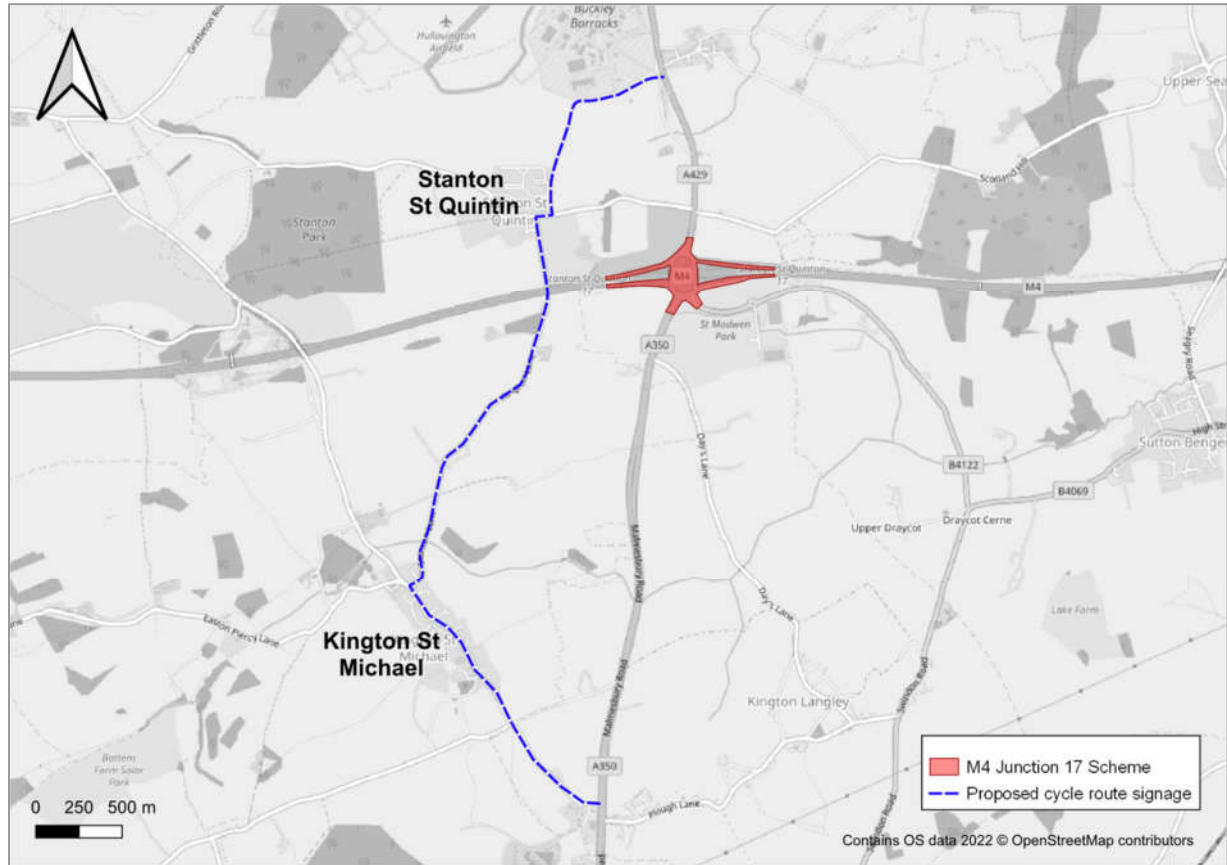
2.   Social Impact appraisal

2.1.   Methodology

Social impacts are defined in the literature as changes in transport sources that positively or negatively influence the preferences, well-being, behaviour or perception of individuals, groups, social categories and society in general[1]. However, most social assessments of transport decisions are often superficial since, in practice, there is little guidance for its comprehensive analysis[2].

As the M4 Junction 17 project is expected to improve the economic, social and environmental well-being of the relevant area, there is a need to better demonstrate the additional benefits derived. Quantifying such social benefits could provide a complete understanding of the extent to which they can be considered in the Value for Money assessment. Understanding the social impacts is a crucial component of transport scheme appraisals as the benefits on the society are often significant and play a key role in justifying or supporting the progression of worthwhile transport projects.

This section presents the results of the Social Impact Assessment prepared for the M4 Junction 17 scheme. A proportionate approach to the scheme current stage of development has been undertaken to deliver the analysis. A qualitative assessment of each of the following social impact indicators has been undertaken, supplemented by quantitative measures where appropriate. Where possible, the analysis has been validated by findings from the literature.

As mentioned, the Social Impact Appraisal was undertaken in accordance with requirements set out in TAG unit A4-1 published by the Department of Transport (DfT). These impacts are covered in 8 categories, as shown in **Figure 2-1** below.

Figure 2-1 – Social Impacts covered in this assessment
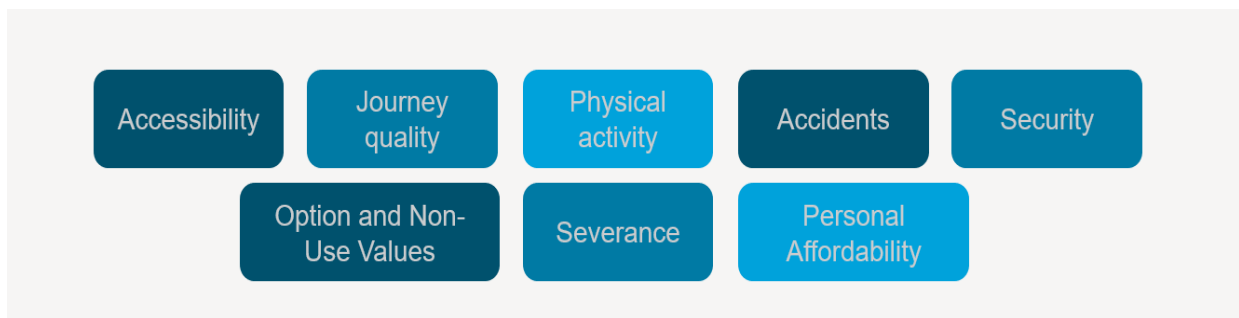
A summary of the approach undertaken to complete this social assessment is presented in **Table 2-1**. Final results are presented in a seven-point scale of beneficial, neutral or adverse in the Appraisal Summary Table (AST).

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[1] Geurs, K. T., Boon, W., & Van Wee, B. (2009). Social impacts of transport: literature review and the state of the practice of transport appraisal in the Netherlands and the United Kingdom. Transport reviews, 29(1), 69-90.

[2] Bueno Cadena, P. C. (2017). Assessing social and distributional impacts of transportation policies for optimizing sustainability (Doctoral dissertation, Caminos).

Table 2-1 – Approach for the Social Impact Assessment

Indicator	Assessment
Physical Activity	According to the guidance, it is proportionate in most cases to appraise most social impacts in a qualitative manner. In this study, social impacts were assessed by means of expert assessment and in active cooperation with the economic appraisal team.
Security	
Severance	Qualitative assessments are supported by available literature and benchmark cases.
Journey Quality	
Accessibility	
Personal Affordability	Commuting and other user impacts will be assessed using TUBA outputs from the modelling team. Based on these results, a high-level qualitative assessment will be provided in the Social Impact Appraisal section. It should be noted that distributional impacts are calculated quantitatively in Section 3.
Collisions	Results for the core safety assessment undertaken as part of the economic case will be utilised for the analysis of collisions. The full analysis is reported in the OBC Economic Case.
Option and Non-Use Values	Not assessed

2.1. Physical activity

2.1.1. Introduction

Inactivity is a major health risk which is contributing to an estimated 1.9 million deaths worldwide annually[3]. An increase in uptake of active travel modes can have vast benefits on both physical and mental health. In accordance, TAG unit A4-1 notes that transport and the physical environment both play a major role in the amount of physical activity that people are engaged in on a day-to-day basis. As there is a recognition of the interrelationship between transport, the environment and health, there are currently several environmental and transport policy interventions to promote physical activity.

The preferred junction improvement scheme (Option B+) comprises of the following elements:

- Widening of M4 Westbound off-slip from two lanes to three lanes.
- Extension of flare length from two lanes to the stopline on the M4 westbound off-slip.
- Two lanes allowed to make movement from the A350 northbound approach to the M4 westbound on-slip.
- Extension of the southbound flare from two lane section on A429 southbound approach to the stopline.
- Widening of approach on the A429 southbound from 2 to 3 lanes.

As well as the junction improvements, the scheme proposes to deliver cycle route signage along a quiet route located to the west of the M4 Junction 17, for cyclists crossing the M4. The new signage will navigate cyclists along the quieter roads, avoiding the busy junction, running from the south of the M4 J17 from the A350, through Kington St Michael, along Stanton Lane to Stanton St Quintin and onwards to the A249 via Church Lane to the north of the M4 J17 (see **Figure 1-2**).

2.1.2. Assessment

TAG Guidance Unit A4-1 requires consideration of the impacts of any travel scheme on physical activity. This is required even if an intervention is unlikely to significantly affect active modes of travel directly.

As mentioned, the scheme plans to provide new signage for cyclists to follow that runs west of the junction. As outlined in the WCHAR the demand for active journeys crossing the M4 J17 is low with the pedestrian count surveys undertaken in June 2016 showing no evidence of pedestrian journeys through the junction during the survey period. Additionally, the Propensity to Cycle Tool (PCT) estimated 10 cyclists' route through the M4 Junction 17 each day, and the same figure choosing the quieter route option to the west. The improved signage

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[3] World Health Organization, 2004, Department of Health Physical Activity and Health Improvement and Promotion, 2004

for cycling the quieter local route may redirect more cyclists away from M4 Junction 17. The local routes around the scheme are used by local cycling groups, particularly at weekends, however, there are no survey counts or evidence of numbers. The improved cycling signage may encourage some uptake in localised, leisure cycling trips. Generally, given the nature of proposal, it is not expected that the scheme or the new cycle signage will have a noticeable impact on active travel in terms of increasing or decreasing uptake in a significant way, and subsequently the impact on physical activity will be minimal. The overall impact on physical activity was therefore assessed as **neutral**.

2.2.   Security

2.2.1.   Introduction

Transport interventions may impact the level of security for transport users. TAG Unit A4-1 states that security concerns are greater on roads where motorists are required to slow or stop their vehicles.

Any security impacts derived from the M4 Junction 17 scheme will mainly affect road users, with no significant changes proposed to public transport routes or facilities. As there are no formal guidelines for road users, a proportionate qualitative assessment of changes in security is provided in this section.

2.2.2.   Assessment

The design of the junction seeks to ensure safe provisions for pedestrians, cyclists and horse-riders through crossing facilities and the use of signal controls. These provisions would improve the safety and security of road users, in particular cyclists and pedestrians, as they will have dedicated crossing facilities and thus, minimising the possibility of collisions. However, as there is a potential for overlap with Journey Quality, consideration of indicators which reflect both security and journey quality is given only in the journey quality impacts assessment.

Instead, a high-level qualitative assessment of key security indicators has been undertaken in accordance with the requirements of TAG Unit 4-1. A summary of the appraisal is provided in **Table 2-2.**

Table 2-2 – Summary of security appraisal.

Security Indicator	Relative Importance	Scheme Impact	Comments
Site perimeters, entrances and exits	Medium	Neutral	The scheme is not expected to have any material impact on site perimeter issues.
Formal surveillance	High	Neutral	Scheme design assumed to encourage formal surveillance. However, this indicator is appraised as neutral. This is a conservative assessment given the lack of detailed data available at this stage on elements such as CCTV provision.
Informal surveillance	Medium	Neutral	It is not anticipated that the scheme will have a material impact on informal surveillance.
Landscaping	High	Slight beneficial	As part of the scheme there would be opportunities for landscape planting to be included along the route to help mitigate impacts on the residential and rural areas. The impact is appraised as slight beneficial as specific scheme details are not available at this stage.
Lighting and visibility	High	Slight beneficial	Changes to lighting and visibility have not been confirmed as part of the scheme at this stage. However, the scheme provides an opportunity to upgrade lighting and visibility where required at the junction.
Emergency call	Low	Neutral	There will be no changes to the provision of emergency phones as part of this scheme.

As the appraisal has resulted in a neutral assessment for most security indicators, the overall assessment for security is considered to be **neutral**. It should be noted that the landscape/lighting improvements are assumed to positively impact the level of security for transport users to some extent. Care should be taken when considering the result of this assessment because the level of data available affecting security are limited at this stage.

2.3.   Severance

2.3.1.   Introduction

Community severance is defined in TAG unit A4-1 as the separation of residents from facilities and services they use within their community caused by substantial changes in transport infrastructure, or by changes in traffic flows. Severance primarily concerns those using non-motorised modes, particularly pedestrians. To ensure a consistent approach, the assessment is based on pedestrians only. As the scheme includes changes to the road network and changes in traffic flows, an overall assessment of this impact will need to be considered.

As recognised in literature, motorised traffic using the infrastructure can be a physical barrier, as it reduces the opportunities for crossing the road[4]. On the contrary, the provision of better integrated cycling and pedestrian facilities and crossing points is expected to reduce severance. The difficulty of crossing the road is then influenced by a number of elements, including the width of the roadway, the volume, speed and composition of the traffic, and any street environment adjustments (e.g., traffic lights, pedestrian crossings, pedestrian traffic islands). Finally, street connectivity is one of the main elements of walkability and may be considered as the converse of severance.

2.3.2.   Assessment

Severance can either be affected by substantial physical changes in transport infrastructure or through changes to traffic conditions. As a result, the assessment is focused on the following key questions:

1) Does the proposed scheme infrastructure or complementary measures cause or remove physical barriers between residents and community facilities and services?
2) Do changes in traffic flows resulting from the scheme option cause or remove barriers between residents and community facilities and services?

The assessment of severance in this context focuses on the first key question. This is according to the guidance, which states that severance impacts should be assessed and presented qualitatively in the AST (from the social point of view). A more detailed analysis examining key links within the modelled area that are forecast to have a 10% increase or decrease in traffic flow between the do minimum and do something scenarios is undertaken in the Distributional Impact Appraisal section.

The scheme aims to provide enhanced opportunities for cycling by providing signage along a route to the west of the junction. There will be signage put in place along a proposed cycle route to indicate a route which will run from the south of the M4 J17 from the A350, through Kington St Michael, along Stanton Lane to Stanton St Quintin and onwards to the A249 via Church Lane to the north of the M4 J17 – shown in **Figure 1-2**. There are no Public Rights of Way (PROWs) which cross the M4 junction 17.

The proposed cycle route signage is only expected to have a neutral impact on severance, as there will not be infrastructure improvements along this route such as new or improved crossing points or a segregated cycleway which would improve or disimprove severance.

In addition to the cycle signage, the scheme also aims to provide enhanced opportunities for walking and cycling through the introduction of signalisation on three arms of the M4 junction 17 gyratory, which will include pedestrian crossing facilities. Having said this, the area is primarily used for maintenance access with few pedestrian trips taking place. Whilst the new signalisation could benefit severance for pedestrians in the area, the number of pedestrians benefiting is likely to be small and therefore the overall impact to severance minimal.

On the other hand, the physical changes in road alignment and traffic re-assignment across the road network could have a beneficial or adverse impact to severance. Traffic flow changes (>10% increase or decrease) have been assessed to understand the scheme impact on severance (in line with TAG Unit 4-2). Significant increases in traffic can act as a barrier to non-motorised movements and journeys.

Figure 2-2 shows the significant changes in traffic flow as a result of the M4 J17 improvements.

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[4] Anciaes, P. R., Jones, P., & Mindell, J. S. (2016). Community severance: where is it found and at what cost? Transport Reviews, 36(3), 293-317.

Figure 2-2 – Traffic Flow Changes (>10%) to surrounding area of the M4 J17 scheme
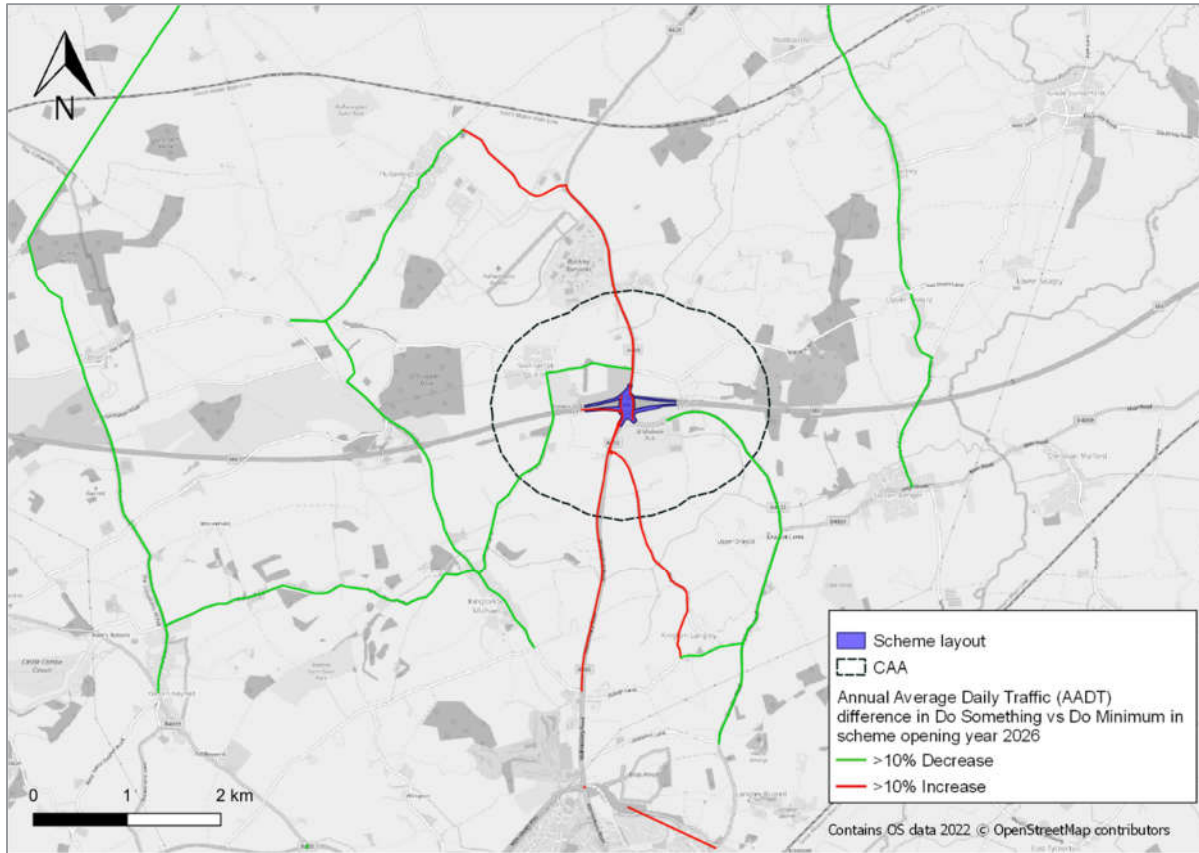
As shown in the figure above, significant (>10%) increases in traffic are expected at the M4 Junction 17 roundabout, and along the A350 south of the junction and A429 to the north. There are few settlements close to some routes with over 10% increase in traffic including Lower Stanton St Quintin and north of Chippenham where one road link shows significant increase. Generally however, the significant increases in traffic flow lie predominantly on roads that already contain high traffic volumes and in locations where there is already limited access for pedestrian trips and movement.

The figure also shows a number of local roads which are expected to experience a significant (>10%) decrease in traffic as a result of re-routing traffic. A number of these roads pass through communities or settlements, including:

West of M4 J17, along:

- The Street through Hullavington
- Honey Knob Hill through Kington St Michael
- Fosse Way, and Alderton Road through Grittleton
- The Street through Yatton Keynell

East of M4 J17, along:

- B4122, B4069 near Kington Langley
- Seagry Road north of Sutton Benger
- Unnamed road off Seagry Road through Upper Seagry

Under the assumption that busy roads are a barrier to the movement of pedestrians, the scheme is expected to reduce severance in these locations as traffic flows decreases.

This severance assessment has examined the key links within the modelled area that are forecast to have a 10% increase or decrease in traffic flow between the do minimum and do something scenarios. There are more

road links with a reduction in traffic flow, a number in areas with communities and settlements close by. It is expected there will be greater pedestrian activity and movement in these locations compared to pedestrian movements across the M4 Junction where traffic is expected to worsen.

Based on the above assessment, the overall assessment on severance is considered to be **slight beneficial**.

2.4.   Journey quality

2.4.1.   Introduction

Journey quality is generally understood as the cumulative travelling experiences of the quality and ambience of a journey[5] . As recognised in TAG Unit A4-1, it represents a measure of the real and perceived physical and social environment experienced while travelling and includes factors such as perceptions of safety, information provision and comfort. Specifically, journey quality impacts can be sub-divided into three groups:

1) Traveller care: aspects such as cleanliness, level of facilities, information and the general transport environment.

2) Travellers' views: the view and pleasantness of the external surroundings in the duration of the journeys; and

3) Traveller stress: frustration, fear of collisions and route uncertainty.

TAG Unit A4-1 also states that in most cases travel is a derived demand that arises from people's desire to access other services or engage in other activities. Therefore, a poor journey experience is easily noticed by travellers. As a consequence, it is important that journeys are made as simple and easy as possible to improve the perceived physical and social environment experienced while travelling, as well as to prevent boredom and associated psychological issues. Research on travel behaviour has shown that journey quality factors are of significant importance and that users are willing to pay to improve the quality of a journey.

The scheme intends to reduce delay and improve journey time reliability at M4 Junction 17, improve the north-south connectivity on the A350 through these improvements at the junction, and ensure the junction has the capacity to accommodate planned and future growth in the area. The scheme achieving these objectives is expected to improve journey quality for road users.

In addition to the junction improvements, the scheme proposes new signage for cyclists, directing them onto an alternative, quieter, and safer route compared with the M4 Junction 17. The signage should also contribute towards improved journey quality for road users. As a result, it is considered appropriate to appraise this impact.

2.4.2.   Assessment

The assessment of the difference between the journey quality factors for the without-scheme and with-scheme cases is used to inform a qualitative seven-point scale assessment which ranges from 'large adverse' through 'neutral' to 'large beneficial'. The following table presents the assessment of the scheme in respect of the journey quality sub-categories.

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[5] Geurs, K. T., Boon, W., & Van Wee, B. (2009). Social impacts of transport: literature review and the state of the practice of transport appraisal in the Netherlands and the United Kingdom. Transport reviews, 29(1), 69-90.

Table 2-3 – Journey quality assessment

Category	Impact Assessment
Traveller care	The proposed junction improvements take account of existing Public Rights of Way (PRoW) and other facilities currently used by pedestrians. There are two existing signalised pedestrian crossings at the junction, and the scheme intends to introduce signalisation on the other three arms of the roundabout, which will include pedestrian crossing facilities. In addition, the scheme proposes new signage along the quieter and alternate route around the junction for cyclists and pedestrians. Even though the numbers of pedestrians and cyclists crossing the M4 J17 are low, these measures are expected to improve traveller care factors, resulting in a better user experience.
Travellers' views	The scheme is not expected to have a significant impact on travellers' views as the junction improvements are proposed at an existing junction, and the cycling signage is an existing route.
Traveller stress	The scheme aims to reduce congestion at the M4 Junction 17 and provide more reliable and quicker journey times. As a consequence, a significant reduction in driver frustration is expected as a result of the scheme and reduced traveller stress. The scheme also proposes new signage for cyclists, encouraging them to travel via quieter, local roads rather than through the M4 J17. Despite the limited demand of people undertaking this journey, the signage should have a small positive impact on traveller stress, reducing likelihood of collisions for cyclists.

Based on this analysis and accounting for the magnitude of journey quality benefits and the qualitative analysis derived from **Table 2-3**, the overall impact assessment for journey quality has been appraised as **slight beneficial.**

2.5. Option and non-use values

2.5.1. Introduction

An option value is the benefit an individual receives from knowing a service exists should they need to use it. A non-use value stems from the knowledge that other people can use the service providing an altruistic benefit.

As indicated in the guidance (TAG Unit 4-1), option values and non-use values relate to the implementation or withdrawal of a public transport service and should only be assessed if the scheme includes measures that will substantially change the availability of transport services within the study area. For example, when as part of the scheme the opening or closure of a rail service is being proposed or when public bus services are being introduced, reorganised or withdrawn.

As the M4 Junction 17 scheme includes no changes to any public transport routes or services provided in the area, no significant impacts are associated with the valuation of option values and non-use values. Therefore, **no further appraisal** is required for this social indicator.

2.6. Accessibility

2.6.1. Introduction

In the transport arena, accessibility is often used as a social indicator. Accessibility is defined and operationalised in several ways. According to TAG Unit 4-1, accessibility measures are seen as a holistic concept with the potential to reduce social exclusion and address the transportation needs of different groups in society. TAG Unit 4-1 recognises the following aspects (defined as 'key barriers') impacting on accessibility:

1) The cost of transport;
2) The availability and physical accessibility of transport;
3) Services and activities located in inaccessible places;
4) Safety and security;
5) Travel horizons.

One of the scheme objectives is to reduce journey times and delays and improve journey reliability on the M4 Junction 17 supporting journeys on the SRN. In addition, the scheme will help to improve local and regional north-south connectivity on the A350 and support the overall success of the A350 improvements programme,

through the complementary improvements at M4 Junction 17. As a result, it is considered appropriate to appraise the accessibility impact from the social dimension.

2.6.2.   Assessment

Given that the proposed scheme is a highway-improvement scheme and has little direct influence on public transport services, a high-level qualitative assessment based on the previously described five key barriers has been undertaken. Table 2-4 presents a summary of the assessment of the Scheme in the context of such barriers.

Table 2-4 – Accessibility assessment

Barrier to accessibility	Impact Assessment
Cost of transport	Journey time improvements and traffic relief are expected to bring user benefits and, consequently, to change the cost of travel. It should be noted that within the net outcome of user benefits, some people may experience disbenefits, for example through longer journey times. This is analysed in full in the Distributional Impact Assessment.
The availability and physical accessibility of transport	The scheme is not considered to have any impact on access by rail or bus transport. The improvement at the junction is not anticipated to alter existing public transport routes and likewise, the scheme will not alter existing rail or bus infrastructure (e.g., bus stops).
Services and activities located in inaccessible places	Not applicable (all areas are reasonably accessible). The scheme will however provide improved north-south connectivity along the A350 Corridor, and improved east-west SRN journey times through the M4 Junction 17. The scheme will ensure the junction has the capacity to accommodate planned and future growth in the A350 Corridor and in the A350 and Swindon M4 SWLEP Growth Zones, including the Chippenham Urban Expansion and the Wiltshire Local Plan Review.
Safety and security	Improving the existing safety levels at the M4 Junction 17 is one of the main scheme objectives. To make the corridor safer and more resilient would help to deliver desired strategic and local outcomes.
Travel horizons	The improvements at M4 Junction 17 would lead to wider travel horizons for residents of some nearby areas, providing faster and more reliable journey times through the junction and on the A350 to access leisure, employment, and education opportunities.

Based on the qualitative analysis derived from **Table 2-4**, the overall impact assessment for accessibility has been appraised as **slight beneficial,** with the scheme expected to bring user benefits in terms of journey time improvements, resulting in wider travel horizons and improved north-south and east-west connectivity.

2.7.   Personal affordability

2.7.1.   Introduction

The M4 Junction 17 is expected to have an impact on the affordability of car travel for road users. This section focuses on the monetary costs of travel exclusive of any time saving benefits resulting from the scheme. This assessment considers the impact on affordability from a broader perspective of net outcomes on affordability rather than potential 'winners' and 'losers'.

2.7.2.   Assessment

Given the nature of the scheme, the potential impact on the cost of travel or the availability of low-cost travel to vulnerable groups is considered to be mainly associated with changes in car fuel and non-fuel operating costs. Other factors such as public transport costs, parking charges, and toll charges are not considered to be of significance.

A reduction in congestion is expected to improve fuel efficiency for some users. Monetised vehicle operating cost savings have been carried out using TUBA software and have used a 60-year appraisal period in line with the design life of these investments.

The analysis of the TUBA outputs to inform the DI appraisal indicates that the scheme results in a benefit (£3,397,000)[6] in terms of vehicle operating costs (fuel and non-fuel operating costs) – see **Table 2-5.** There is not expected to be any significant increase in other costs including cycling, public parking, or road user charges as a result of this scheme.

Overall, **slight beneficial** impacts are anticipated for personal affordability for commuters and other non-business users. The distributional impacts across income quintiles are assessed and discussed in the separate Distributional Impact Appraisal section (Section 3.8).

Table 2-5 – Scope of potential changes in cost of travel for the scheme

Mode	Cost Change	Cost Change Expected	Change Captured in TUBA?	Quantified Impact
Car	Car fuel and non-fuel costs	Yes	Yes	£3,397,000
	Road user charges	No	N/A	N/A
	Public parking charges	No	N/A	N/A
	Other car charges/costs	No	N/A	N/A
Non-motorised users	Cycling costs	No	N/A	N/A

2.8.   Collisions

2.8.1.   Introduction

A transport intervention can influence the number of collisions and resulting casualties. It is important to examine these changes in collisions/casualty levels as there are significant costs associated with collisions for individuals, the government and private businesses. For example, casualty costs include the suffering of individuals and families, loss of economic output and medical costs. Costs of a collision includes damage to vehicles and infrastructure, police cost, legal and insurance costs and in certain cases losses due to extended journey times and road closures. A casualty refers to an individual who was injured in a collision (either slight, serious or fatal severity) and hence there may be more than one casualty in a collision.

The M4 Junction 17 scheme comprises different elements including:

- Widening of M4 Westbound off-slip from two lanes to three lanes.
- Extension of flare length from two lanes to stopline on the M4 westbound off-slip.
- Two lanes allowed to make movement from the A350 northbound approach to the M4 westbound on-slip.
- Extension of the southbound flare from two lane section on A429 southbound approach to the stopline.
- Widening of approach on the A429 southbound from 2 to 3 lanes.

These improvements would likely lead to a change in traffic flow and speed. In accordance, these are likely to affect collision rates.

An assessment using historic collision data (2016-2020) and the DfT's Cost Benefit Analysis – Light Touch (COBALT) tool was undertaken within the study area. The historic STATS19 data provides a snapshot of collisions that have taken place in the area in the past five-years. The COBALT assessment examines the costs associated with a collision and the resulting causalities. A comparison is made between the forecast collisions with the scheme and the forecast collisions without the scheme to show the resulting change in costs stemming from the scheme.

Results for the core safety assessment undertaken as part of the economic case will be utilised for the analysis of collisions. The full analysis is reported in the OBC Economic Case (WC_M4J17-ATK-GEN-XX-RP-TB-000001).

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[6] It should be noted that user benefits analysed for the purposes of DI appraisal are not directly comparable to the main economic appraisal outputs – see also section 3.7.3 for limitations.

2.8.2.   Historic Collisions

Historic collision data from 2016 to 2020 indicates there were 92 collisions that occurred within a 3km assessment area of the M4 Junction 17 improvement scheme. The collision locations and level of severity are presented in Figure 2-3. A 3km impact area has been used to capture the scheme and the proposed route for cycle signage and wider area.

Figure 2-3 - Collisions within 3km of the M4 Junction 17 scheme, 2016-2020 (STATS19)
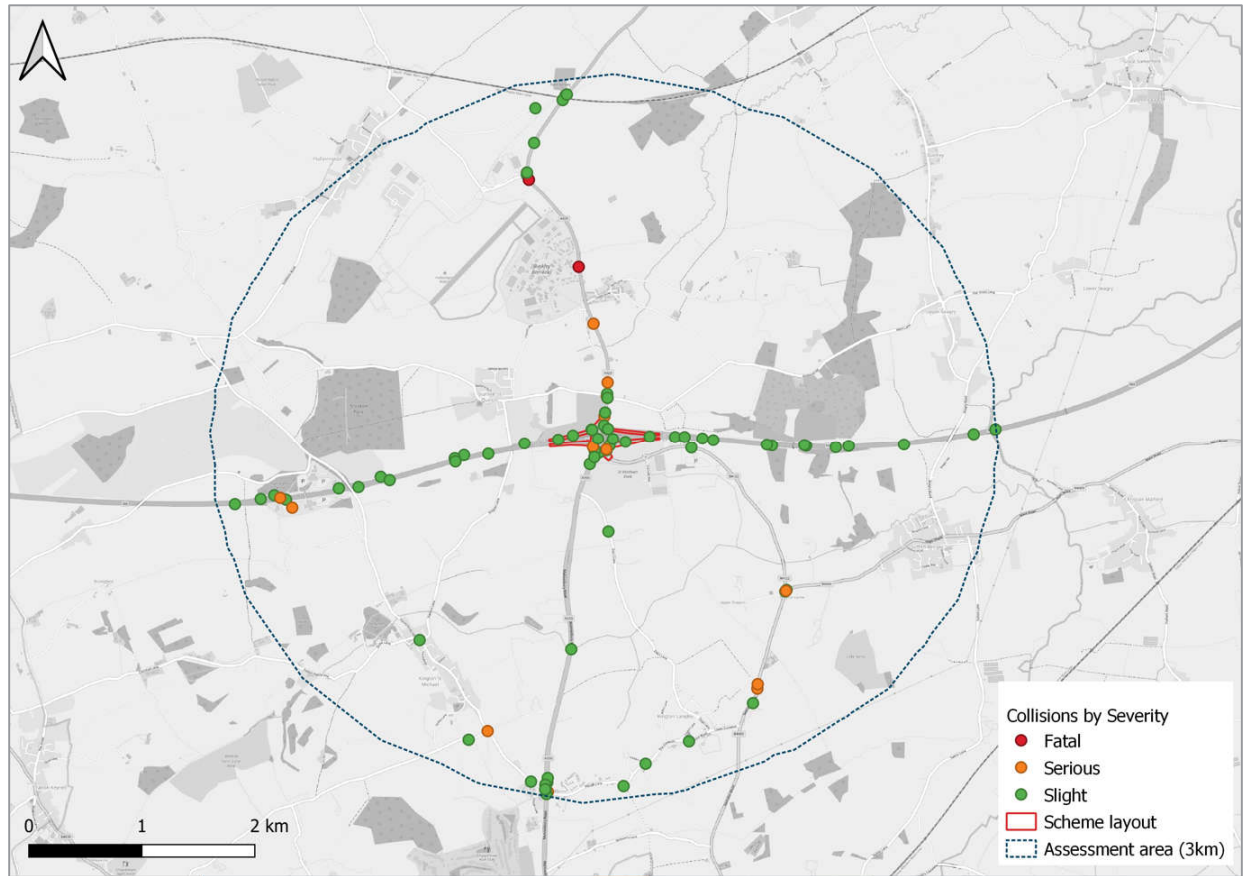
There were 75 slight collisions, 15 serious collisions, and 2 fatal collisions in the area in the five-year period assessed. As shown in the figure, there are collisions highly concentrated on the M4, particularly at the M4 junction 17, and on the A429 on the approaches to the roundabout. Over 50% of the collisions took place along the M4, with approximately 17 of these occurring at the M4 Junction 17 and its approaches.

On the A350, to the south of the assessment area, there is a cluster of collisions at the Plough Lane junction. There has been 8 collisions in this location between 2016 and 2020.

There have been 17 collisions on the A429, north of the M4 J17. These are generally dispersed along this route, however 4 occurred in close proximity at the roundabout approximately 1.5km north of Lower Stanton St Quintin. Both the fatal collisions in the assessment area occurred along this route; one at the roundabout mentioned in 2017, and the other adjacent to the Buckley Barracks in 2019.

Only approximately 15% of the collisions occurred along smaller local roads in the assessment area.

The historic collision analysis highlights the major safety issues along the M4 and at M4 Junction 17, which the scheme aims to improve through:

- Widening of M4 Westbound off-slip from two lanes to three lanes.
- Extension of flare length from two lanes to stopline on the M4 westbound off-slip.
- Two lanes allowed to make movement from the A350 northbound approach to the M4 westbound on-slip.

- Extension of the southbound flare from two lane section on A429 southbound approach to the stopline.
- Widening of approach on the A429 southbound from 2 to 3 lanes.

2.8.3. COBALT Assessment

As mentioned, a COBALT assessment was undertaken for the proposed scheme, taking into account anticipated traffic growth within the area as well as the proposed scheme interventions. **Table 2-6** reproduces the economic, collision and casualty summary result outputs of the COBALT analysis.

Table 2-6 – COBALT assessment collision summary

		Do Minimum	Do Something	Scheme Saving (DS-DM)
Collision Summary		1,447.9	1,446.4	1.5
Casualty Summary	Fatal	19.6	19.6	0.0
	Serious	195.5	195.3	0.2
	Slight	1,824.0	1,822.3	1.7
Economic Summary (£000s)		97,536.8	97,460.6	76.1

As the previous table shows, the M4 Junction 17 scheme is expected to reduce collision rates marginally. The scheme would result in a very slight reduction in collisions across the study area over the 60-year assessment period (1.5 collisions saved). There is an expected slight reduction in slight casualty rates (1.7) and a slight reduction in serious casualty rates (0.2). However, the scheme will have a neutral impact in terms of fatal casualties .

Calculations indicate a total safety-related benefit of £76,100 and an overall beneficial reduction in collisions. However, the overall reduction represents a very small proportion of the total number of collisions across the study area. The collision impacts have been scored as **neutral.** An assessment of the changes in collisions in relation to the proportions and locations of children, older people and young adults in the scheme area is provided in the Distributional Impacts Appraisal (see section 3.2).

3. Distributional Impact appraisal

Distributional impacts relate to the extent to which there are differences in the way impacts affect different groups in society. For example, the noise impacts of an intervention will affect different groups of households, with some experiencing increases, and others decreases.

In accordance with requirements set out in TAG unit A4-2 published by the Department of Transport (DfT), a three-step approach has been applied to undertake the distributional impact appraisal of the M4 Junction 17 scheme – see **Table 3-1**.

Table 3-1 – Distributional Impact appraisal process

Step		Description	Output
1	Screening	Identification of likely impacts for each indicator.	Screening Proforma
2	Assessment	Confirmation of the area impacted by the transport intervention (impact area). Identification of social groups in the impact area. Identification of amenities in the impact area.	DIs social groups statistics and amenities affected within the impact area
3	Appraisal of Impacts	Core Analysis of the impacts (including providing an assessment score for each indicator based on a seven-point scale – large beneficial to large adverse). Full appraisal of DIs and input into AST.	Appraisal worksheets and AST inputs

Source: DfT (2020). TAG unit A4-2 Distributional Impact Appraisal.

This chapter presents detailed findings from the screening process (Step 1) and the approach for the full appraisal (Steps 2 and 3) of the proposed scheme. The approach ensures that the DI appraisal is proportionate to the scale of the project and follow a process to ascertain whether a full DI appraisal is required. The eight indicators considered within the DI appraisal are:

- Accessibility;
- Collisions;
- Air Quality;
- Affordability;
- Noise;
- Security;
- Severance; and
- User Benefits.

The following sub-sections present an overview of the different steps considered within the appraisal.

3.1.1. Step 1 – Screening

Step 1 consists of a screening exercise that should be undertaken in order to identify whether a full appraisal is required. In order to ensure a proportionate approach, the analysis is carried out for each of the eight distributional impact indicators.

Supporting socio-demographic mapping for the study area has been included within Appendix A. The screening exercise is summarised in a proforma table, as outlined below. The screening proforma can be found in Appendix B. Finally, Appendix C identifies amenities that are in geographic areas that could be affected by proposed measures, and which may attract vulnerable groups within the impact area for each of the eight DI indicators.

3.1.2.   Step 2 – Assessment

Step 2 consists of a detailed spatial analysis to confirm the overall geographical area experiencing impacts and consider which specific areas are relevant to the appraisal. This step also requires consideration of the socio-economic, social and demographic characteristics of social groups in the impact area. Data sources used for the socio-demographic mapping and population statistics are summarised in **Table 3-2**.

Table 3-2 – Socio-demographic data sources

Vulnerable Group	Data Source
Resident Population	ONS Population Estimates (2019)
Income Deprivation	IMD Income Domain (2019)
Children	ONS Population Estimates (2019)
Elderly	ONS Population Estimates (2019)
Disability	DWP DLA Claimants (2018)
Black and Minority Ethnic (BME)	ONS QS201EW Ethnic Group (2011)
Women	ONS Population Estimates (2019)
No car households	ONS KS404EW Car or Van Availability (2011)

The analysis uses common datasets and plots the proportions of vulnerable groups within the impacted area for each indicator. **Table 3-3** sets out the groups of people to be identified in the analysis for each indicator, as defined in TAG Unit A4-2.

Table 3-3 – Scope of socio-demographic analysis for DIs (Step 2b)

Social Group	User Benefits	Noise	Air Quality	Collisions	Security	Severance	Accessibility	Affordability
Income Distribution	✓	✓	✓				✓	✓
Children: aged <16		✓	✓	✓	✓	✓	✓	
Young Adults: aged 16 to 24				✓			✓	
Older People: aged 70+				✓	✓	✓	✓	
Population with a disability					✓	✓	✓	
Population of Black Minority Ethnic origin					✓		✓	
Households without access to a car						✓	✓	
Households with dependent children							✓	

Source: DfT (2020). TAG unit A4-2 Distributional Impact Appraisal.

This step also requires the identification of amenities in the impact area including schools, hospitals, community facilities and other places where people (including vulnerable groups) may congregate during the day such as public parks. Appendix C presents the results of the identification of local amenities that will be used by vulnerable groups in the area.

3.1.3.   Step 3 - Appraisal of impacts

This step examines information collated in the previous steps to assess the potential impacts of the intervention on each indicator's social groups. An assessment score is given for each indicator and each of the social groups under consideration. The seven-point scoring system follows the standard DfT appraisal measures:

Table 3-4 – Key to individual Distributional Impact appraisal

Description	Score
Beneficial and the population impacted is significantly greater than the proportion of the group in the total population.	**Large Beneficial**
Beneficial and the population impacted is broadly in line with the proportion of the group in the total population.	**Moderate Beneficial**
Beneficial and the population impacted is smaller than the proportion of the group in the total population.	**Slight Beneficial**
There are no significant benefits or dis-benefits experienced by the group.	**Neutral**
Adverse and the population impacted is smaller than the proportion of the group in the total population.	**Slight Adverse**
Adverse and the population impacted is broadly in line with the proportion of the group in the total population.	**Moderate Adverse**
Adverse and the population impacted is significantly greater than the proportion of the group in the total population.	**Large Adverse**

Source: DfT (2020). TAG unit A4-2 Distributional Impact Appraisal.

The analysis to be undertaken in Step 3 provides an assessment score for each indicator and each of the social groups under consideration. In addition, a qualitative assessment will be provided for each indicator to describe the key impacts in each case. These will be summarised in the DI appraisal matrix.

3.2. Collisions

3.2.1. Step 1 – Screening

Comments

TAG Unit 4-2 indicates that a distributional appraisal is needed if the scheme is introducing changes in alignment that may have positive or negative safety impacts, or if any links are forecast to experience significant changes in vehicle flow, speed, or proportion of HGV traffic.

The M4 Junction 17 scheme is expected to result in changes in vehicle flow in some areas of the road network. This may impact on the rate and severity of collisions in the area. Changes in collision levels, particularly for vulnerable groups, will need to be examined further to assess the full impact.

Outcome

Continue to full appraisal. A COBALT assessment needs to be undertaken in order to identify the impacts to collision rates. Characteristics of the population and facilities surrounding these areas of predicted impact will also need assessing.

3.2.2. Step 2 – Assessment

Step 2a: Confirmation of impacted area

The approach for this DI appraisal of collisions uses data from the Cost and Benefit to Accidents – Light Touch (COBALT) modelling outputs in order to identify the impact on collisions of the scheme. The collision impact area comprises links and casualties that lie within the Affected Road Network (ARN), as shown in **Figure 3-1**. Analysis is then undertaken to identify all the links within the ARN that are forecast to experience greater than 10% change in collisions as a result of the scheme, as determined by the COBALT assessment.

Figure 3-1 – Affected Road Network (ARN)
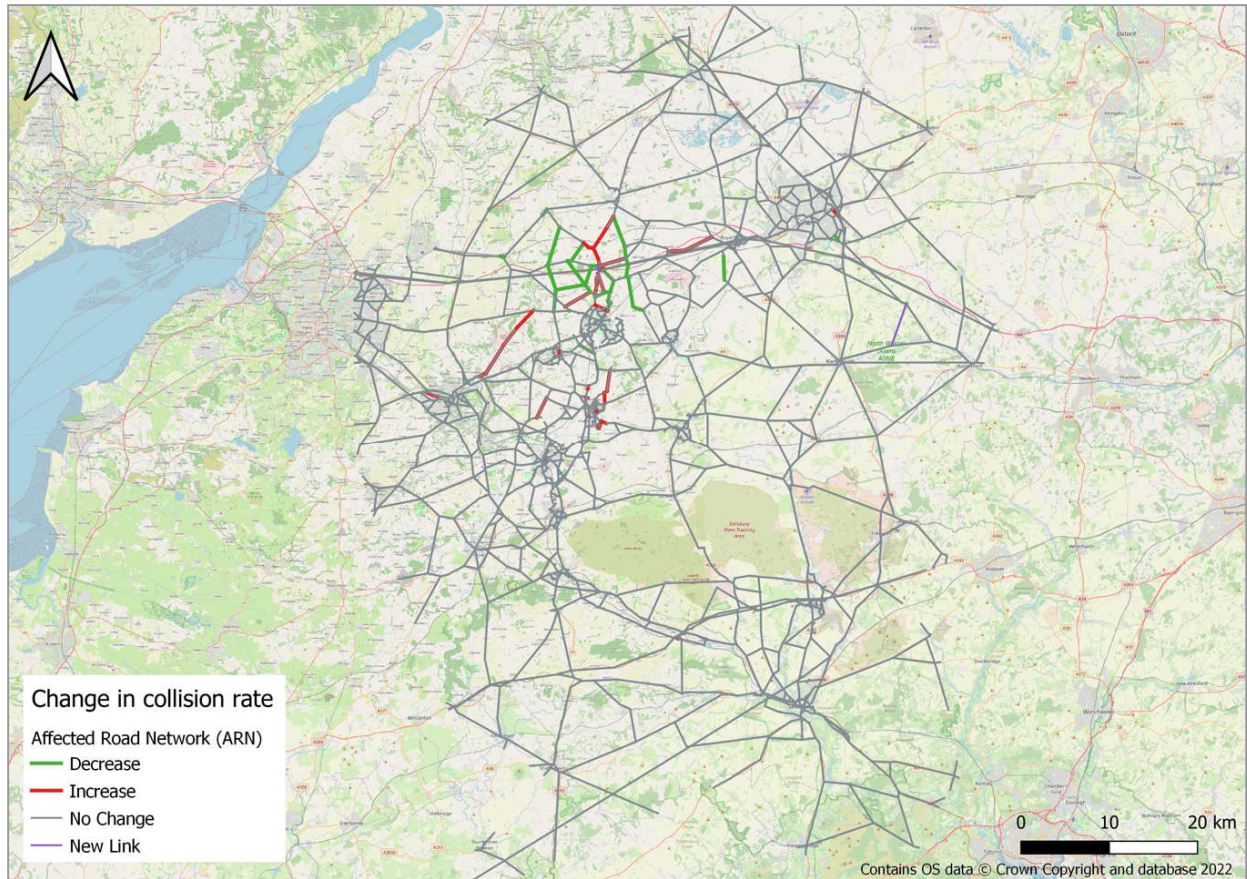
Step 2b: Identification of social groups in impact area

There are several potential vulnerable groups in terms of collisions including children and younger people (under 16 years old), young male drivers (ages between 16 and 25) and older people (over 70 years old), as well as vulnerable road users such as pedestrians, cyclists and motorcyclists. There is also evidence that people living in more deprived areas are more vulnerable to collisions on the highway network.

A collision analysis has been undertaken to identify concentrations of vulnerable groups that may be impacted as a result of the M4 Junction 17 scheme by using STATS 19 data on casualties for the five years from 2016 to 2020 on all links within the impact area (including increase, decrease and no change / negligible links). This data profiles casualties by age, gender and type of road user and is used to identify the baseline conditions in terms of victim typology in the impact area. Furthermore, the proportion of collision casualties in the most and least deprived quintiles has also been assessed. **Table 3-5** presents this data at a national and impact area level for comparison.

Table 3-5 – Casualty data between 2016 and 2020

Casualty Type	All Casualties (national rate)		All Casualties (impact area)	
	Number of casualties	%	Number of casualties	%
Vulnerable Users				
Pedestrians	115,618	13.6%	878	8.3%
Cyclists	90,076	10.6%	938	8.9%
Motorcyclists	90,299	10.6%	1,073	10.2%
Male drivers aged 16-25	92,917	10.9%	1,096	10.4%
Vulnerable Groups				
Under 16	89,837	10.5%	744	7.1%
People aged 70+	57,940	6.8%	895	8.5%
Deprivation				
Casualty from 20% Most deprived LSOAs in UK	169,499	19.0%	256	2.4%
Casualty from 20% Least deprived LSOAs in UK	107,643	12.0%	3,399	**32.3%**
Total Casualties	**850,132**	**100.0%**	**10,538**	**100.00%**

Table 3-5 illustrates that the percentage of casualties which occurred within the 20% most income deprived LSOAs is significantly lower than the national average (2.4% compared to 19.0%). In contrast, the percentage of casualties from the least deprived LSOAs is significantly higher than national average.

The proportions of casualties from pedestrians, cyclists, and children is slightly lower within the scheme area that across the whole of England. Casualties involving motorcyclists and young male drivers are broadly consistent with the national casualty rate. The proportion of casualties that are over the age of 70 is higher in the study area (8.5%) than the national average (6.8%).

Step 2c: Identification of amenities in impact area

The scheme is located in a relatively rural setting, with small settlements close by including Lower Stanton St Quintin and Stanton St Quintin. The larger urban area of Chippenham is located south of the scheme, and is home to a range of amenities serving its residents, and residents within the study area. Numerous retail facilities, schools, care homes and medical facilities are likely to be amongst the most attractive destinations in the area and all lie within the vicinity of the affected road network meaning that access is likely to involve some use of the affected road network.

3.2.3.   Appraisal

The COBALT assessment showed an overall reduction in the number of collisions and resulting casualties as a result of the scheme. **Table 2-6** in the Social Impact Appraisal section of the report summaries the changes in the number of collisions and casualties and the resulting impact in costs.

Table 3-6 below summarises the casualties that have been involved in collisions between 2016 and 2020 by vulnerable user type, age group and the overall deprivation quartile and have been calculated by the forecast change in collision rates (i.e., split by highway links forecast to experience benefits or disbenefits in collisions).

Table 3-6 – Profile of existing casualties (2016 to 2020) across links with a forecast change in collision rate greater than 10%

Casualty Type	Links with forecast >10% increase in collision rate (Disbenefit)		Links with forecast >10% decrease in collision rate (Benefit)	
	Number of casualties	% total casualties in impact area (10,538 casualties)	Number of casualties	% total casualties in impact area (10,538 casualties)
Vulnerable User				
Pedestrians	9	0.1%	3	0.0%
Cyclists	15	0.1%	2	0.0%
Motorcyclists	14	0.1%	2	0.0%
Male drivers aged 16-25 [3]	14	0.1%	10	0.1%
Vulnerable Groups				
People aged under 16	9	0.1%	3	0.0%
People aged 70+	9	0.1%	3	0.0%
Deprivation				
20% Most deprived LSOAs in UK	0	0.0%	0	0.0%
20% Least deprived LSOAs in UK	78	0.7%	25	0.2%
Total casualties	126	-	46	-

There are more collisions that have occurred on links that are forecast to experience a disbenefit from the scheme. On links predicted to have an increase in collision rates, there is a higher percentage in all vulnerable user and user groups with the exception of the most deprived income group. The analysis found no casualties from the 20% least income deprived LSOAs which occurred on links with greater than 10% increase and decrease in collisions. 78 casualties were found on links with an increase in collision rate (>10%) in the 20% least income deprived LSOAs. On links that are forecast to experience a benefit from the scheme, there were 25 casualties from the 20% most income deprived LSOAs.

Outcome and Qualitative Comment

The COBALT assessment shows an overall expected reduction of just 1.5 collisions as a result of the scheme (**Table 2-6**). A reduction in serious and slight casualties of 0.2 and 1.7, respectively, is anticipated over the 60-year COBALT assessment period. No reduction in fatal collisions is expected as a result of the scheme.

As shown in **Figure 3-1** the majority of roads experience no change in terms of collisions. However, there are a number of links that experience an increase ('disbenefit') and decrease ('benefit') in collision rate as a result of the scheme.

Detailed analysis of existing historical collision data demonstrates that collisions involving the vulnerable groups are more likely to occur on links experiencing an increase, or disbenefit, in collision rates as a result of the scheme. However, the proportion of collisions involving each user is small compared to the number of collisions across the impact area. Hence, any impact to collisions as a result of the scheme is expected to be minimal.

As shown in **Table 3-5**, there are below national average proportions of historical casualties involving income deprived residents, children, pedestrians and cyclists across the collision impact area. The rate of casualties involving motorcyclists and young male drivers is broadly in line with the national rate. There is a higher proportion of elderly casualties than the national average for England.

There are no income deprived residents involved in casualties across links forecast to have an increase or decrease in collision rate. **Table 3-6** shows there is a greater prevalence of all the other vulnerable groups or users involved in casualties across links forecast to have an increase in collision rate, than decrease.

Whilst a greater number of casualties are shown on links with an increase in collision rate, the proportion of collisions involving each user is small compared to the number of collisions across the impact area. A slight adverse assessment for the least income deprived residents due to the significant number of casualties on links

with an anticipated increase in collisions. However, due to the minimal difference between casualties on links with a forecast increase and forecast decrease in collisions, the overall impact has been assessed as **neutral**.

Table 3-7 – Collision assessment by vulnerable group

Group	Outcome
Pedestrians	Neutral
Cyclists	Neutral
Motorcyclists	Neutral
Young male drivers	Neutral
Older people	Neutral
Children	Neutral
Most income deprived residents	Neutral
Least income deprived residents	Slight Adverse
Overall score	**Neutral**

3.3. Air Quality

3.3.1. Step 1 - Screening

Comments

There are no areas formally designated as Air Quality Management Areas (AQMA) in relation to the scheme's impact area. Roadside emissions for Nitrogen Dioxide (NO_2) and PM_{10} are both within the UK Government's national air quality objective of 40 µgm-3.

Air quality poses a risk to health, for certain groups in particular children under 16. As a result, there is a need to examine the outputs from the air quality assessments to ascertain the distribution of impacts across income groups and children in the area.

Outcome

Continue to full DI appraisal.

3.3.2. Step 2 - Assessment

Step 2a. Confirmation of Impacted Area.

TAG Unit 4-2 states that the impact area should be defined through the air quality analysis, which should be undertaken in accordance with the requirements of TAG Unit A3. The air quality assessment for this scheme assess PM_{10} and NO_x. The PM_{10} results have been converted to $PM_{2.5}$ by factoring the PM_{10} results by 0.71[7]. There is no appropriate conversion between NO_x and NO_2, therefore the following assessment uses the NO_x results as an indicative assessment for NO_2.

In this instance, the air quality impact area includes all OAs/LSOAs within 200m of modelled road links with an increase or decrease in $PM_{2.5}$ and NO_x concentrations, as shown in **Figure 3-2**. The $PM_{2.5}$ and NO_x assessments found the same road links experienced an increase or a decrease in concentration of these two indicators. It should be noted that the Air Quality appraisal indicated that an increase of less than 0.05% between the do minimum and do something emissions was observed across the study area, indicating a very small change in air quality emissions across the modelled road network. This assessment evaluates these small changes as an overall increase in emissions despite being a very small increase.

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[7] https://www.epd.gov.hk/epd/english/environmentinhk/air/guide_ref/guide_aqa_model_g5.html

Figure 3-2 – Air quality impact area
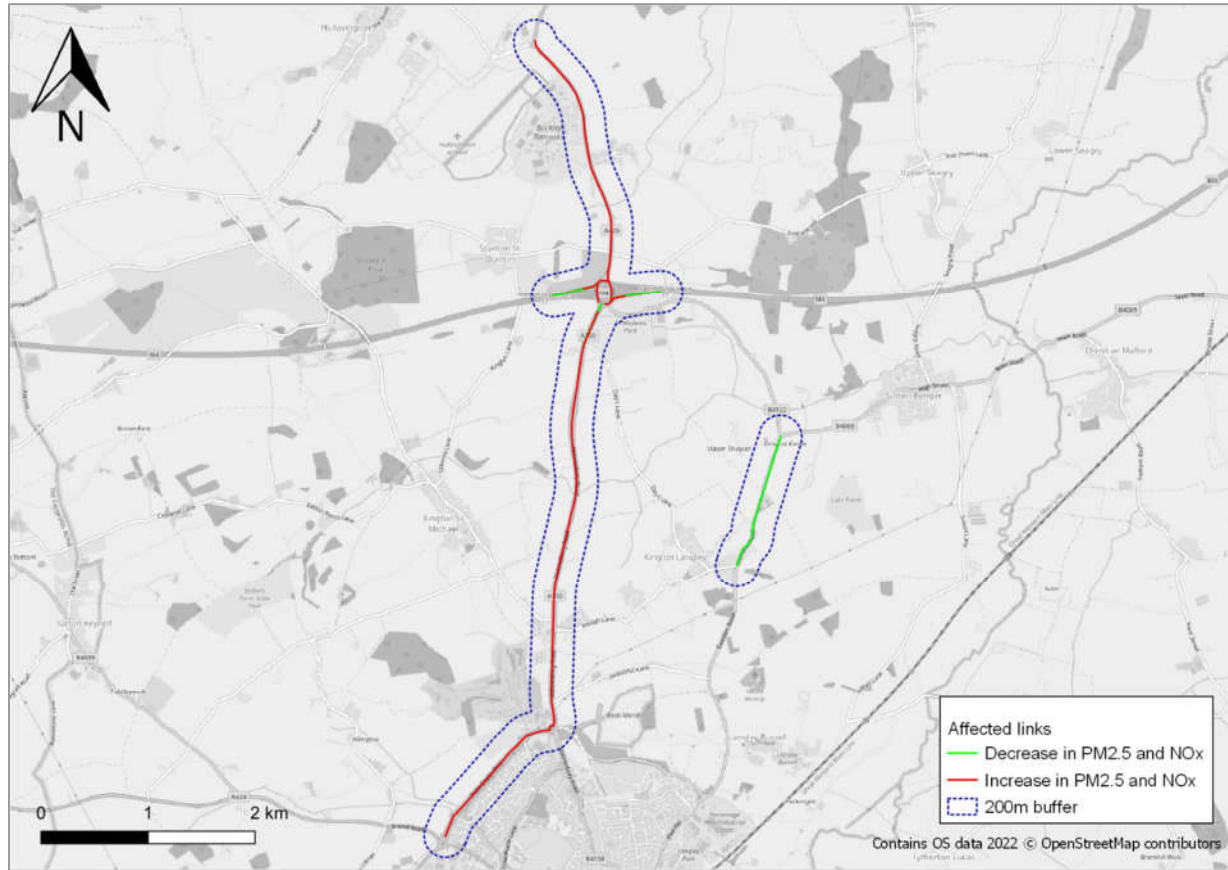
Step 2b: Identification of Social Groups in Impact Area

Ambient air pollution can have a significant adverse impact on public health. Long-term exposure to air pollution can cause chronic conditions such as cardiovascular and respiratory diseases. Children and infants are particularly vulnerable to the effects of poor air quality and therefore concentrations of children under 16 years of age and the locations of schools within the assessment area have been considered to assess the likely impacts on this group. Children, particularly young children, are more vulnerable to pollution as they are at a developmental stage of growth. In addition, the appraisal of air quality DIs requires an examination of impacts across income deprivation in the area.

Table 3-8 shows the proportions of each income quintile and children for the air quality impact areas in comparison to national values. There are above the English average proportions of residents with income quintiles 5 (least deprived). In comparison to the national average, there is a slightly lower proportion of children in the air quality impact area.

Table 3-8 – Vulnerable population concentrations nationally and in the air quality impact area

Group	National Average	Impact Area
Quintile 1 (most deprived)	20.0%	0.0%
Quintile 2	20.0%	11.1%
Quintile 3	20.0%	0.0%
Quintile 4	20.0%	15.4%
Quintile 5 (least deprived)	20.0%	**73.6%**
Children (under 16)	19.1%	17.1%

Step 2c: Identification of Amenities in Impact Area

There are no schools or education establishments located within the air quality impact area and as such, daytime populations of children in the area for school is expected to be low.

3.3.3.   Step 3 – Appraisal

The DI appraisal for air quality identifies the winners and losers as a result of the implementation of the scheme and demonstrates the overall net disbenefit/benefit on the population within the impact assessment area. **Table 3-9** presents an examination of the distribution of the number of links experiencing improvement, deterioration or no change in air quality compared to what may be expected based on the proportion of the populations within each income quintile. The assessment was completed looking at changes in $PM_{2.5}$ and NO_x per link, to be proportional to the air quality analysis completed, rather than examining the number of properties per receptors which was not completed for this Scheme. It should therefore be noted that this analysis is an indication of changes in air quality and is a conservative assessment.

Table 3-9 – Change in annual $PM_{2.5}$ and NO_x concentrations by income quintile

	Income quintile					Total
	Most deprived ⟶ Least deprived					
	1	2	3	4	5	
No. of links with decreased $PM_{2.5}$ and NO_x	0	0	0	2	2	4
No. of links with no change in $PM_{2.5}$ and NO_x	0	0	0	0	0	0
No. of links with increased $PM_{2.5}$ and NO_x	0	0	0	10	25	35
Net change	0	0	0	-8	-23	
Total number of winners/losers across all groups	-31					
Net winners/losers in each group as % of total	0.0%	0.0%	0.0%	25.8%	74.2%	0%
Share of total population in the impact area	0.0%	11.1%	0.0%	15.4%	73.6%	100%
Assessment	**Neutral**	**Neutral**	**Neutral**	**Slight Adverse**	**Moderate Adverse**	

There are no LSOAs classified as income quintile 1 and 3 in the 200m air quality impact area. As a result, the air quality assessment is considered neutral for these income groups. Income quintile 2 was present in the impact area, however, did not overlap with any of the affected links, therefore, is assessed as neutral.

The least deprived quintile (income quintile 5) has a 74.2% share of the total population in the impact area, and 73.6% of the 'net losers' in terms of increased NO_x and $PM_{2.5}$ concentration levels. In this case, given the size of the population that fall within this quintile in the assessment area it is appropriate to give a score of moderate adverse.

Income quintile 4 has been assessed as slight adverse given the presence of the population in these quintiles in the assessment area in proximity to affected links with an increase in $PM_{2.5}$ and NO_x.

Finally, there are slightly below national average proportions of children within the air quality impact area. There is only one OAs within the 20% highest concentrations of children nationally, located to the north of the assessment area, adjacent to the A429 which shows an increase in $PM_{2.5}$ and NO_x. The overall air quality assessment for children has been appraised as slight adverse.

Overall, the M4 Junction 17 scheme has an adverse impact in air quality terms. The impacts which occur are predominantly within income quintile 4 and 5, with a greater proportions of these groups within the impact area. The assessments show much higher proportion of road links experiencing an increase in concentration of $PM_{2.5}$ and NO_x as a result of the scheme.

In summary, there is a moderate to slight adverse impact to air quality for income quintile 4 and 5 and children. Income quintile 1, 2 and 3 have a neutral impact to air quality, as these income quintiles are not present in the air quality assessment area or are not in proximity to an affected link. As a result, the overall impact to air quality is considered **slight adverse**.

Table 3-10 – Air quality assessment by income quintile

Vulnerable Group	Outcome
Quintile 1 (most deprived)	Neutral
Quintile 2	Neutral
Quintile 3	Neutral
Quintile 4	Slight adverse
Quintile 5 (least deprived)	Moderate adverse
Children (under 16)	Slight adverse
Overall	**Slight adverse**

3.4. Noise

3.4.1. Step 1 – Screening

Comments

Capacity improvements at the M4 Junction 17 will be achieved through the widening of the existing gyratory roundabout, approach on the A429 southbound and flare length on the M4 westbound off-slip. An increase in vehicles at the junction due to increased capacity is likely to give rise to changes in noise levels along the route, which may impact on receptors near the route.

As a result, noise impacts will need to be further appraised to determine their effect on nearby residents. Noise impacts were assessed within the impact area based on key receptors which represent a number of dwellings. Noise has been assessed in accordance with DMRB LA 111[8] .

Outcome

Continue to full DI appraisal.

3.4.2. Step 2 – Assessment

Step 2a – Confirmation of impacted area

TAG Unit A4-2 outlines that noise impacts are likely to occur where an intervention results in changes to traffic flows or speeds, or where the physical gap between people and traffic is altered. LA111 Noise and Vibration defines the noise impact area as a 600m buffer of new road links or road links physically changed or bypassed by the project. The study area also considers the area within 50m of other road links with potential to experience a changes in noise levels as a result of the project. In this instance, the noise impact area is shown in **Figure 3-3**. This area encompasses 600m from the M4 Junction 17 scheme and local roads including Scotland Hill, Seagry Road, B4069 High Street and B4122 to the east of the scheme and Stanton Lane, Easton Piercy Lane and Cromhall Lane to the south west of the scheme.

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[8] https://www.standardsforhighways.co.uk/prod/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364

Figure 3-3 – Noise impact area
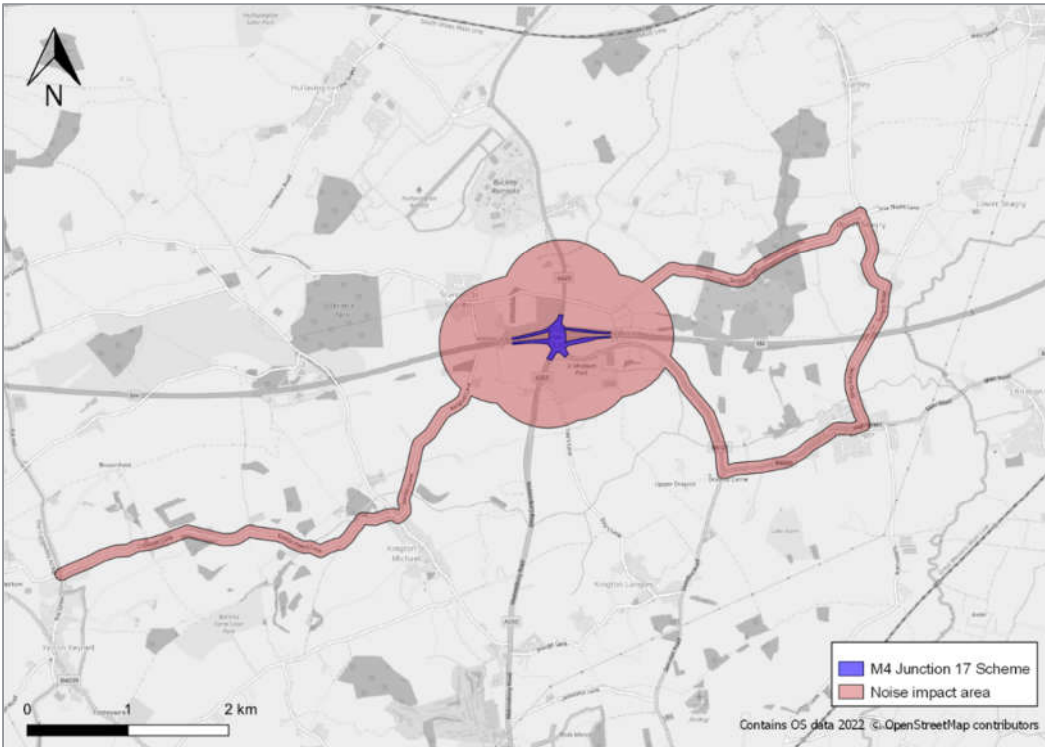
Step 2b – Identification of social groups in impact area

Children are particularly vulnerable to the effects of noise and therefore concentrations of under 16s and the location of schools within the assessment area have been considered. Similarly, the appraisal of noise also requires an examination of impacts to elderly people and across income deprivation in the area. **Table 3-11** shows the proportions of income deprived households for England and for children and elderly people over England and Wales as well as for the noise impact area.

Within the noise impact area, the proportion of income quintile 4 and 5 (40% least income deprived) is significantly higher when compared to the national average. Within the noise impact area, there are no proportions of income quintile 1, 2 and 3. The proportion of children is slightly below the national average while the proportion of elderly residents is slightly above the average for England and Wales.

Table 3-11 – Vulnerable population concentrations nationally and in the noise impact area

Income Group	National Average	Impact Area
Quintile 1 (most deprived)	20.0%	0.0%
Quintile 2	20.0%	0.0%
Quintile 3	20.0%	0.0%
Quintile 4	20.0%	**39.3%**
Quintile 5 (least deprived)	20.0%	**60.7%**
Children (under 16)	19.1%	18.3%
Elderly (over 70)	13.5%	**14.2%**

Step 2c: Identification of Amenities in Impact Area

The desktop analysis identified 2 schools (Stanton St Quintin Primary and Nursery School, Seagary Church of England Primary School) and no care homes within the noise impact area which suggests some presence of children, but less elderly people in the area.

3.4.3. Step 3 - Appraisal

The DI appraisal has considered the likely population affected by significant changes in noise levels. In this instance a significant impact to noise is defined as a change in noise levels in excess of 0dB in the short term (2026 opening year). This is calculated as the highest magnitude difference between the do minimum and do something in the opening year. **Table 3-12** shows the number of properties with improved or worsened noise levels as a result of the scheme within each income quintile.

Table 3-12 – Change in noise by income quintile

	Income quintile					Total
	Most deprived ⟶ Least deprived					
	1	2	3	4	5	
No. of properties with increased noise levels	0	0	0	202	118	320
No. of properties with decreased noise	0	0	0	0	0	0
No. of properties with no change	0	0	0	31	25	56
No. of net winners/ losers	0	0	0	171	93	264
Total number of winners/losers across all groups	264					
Net winners/losers in each group as % of total	0.0%	0.0%	0.0%	64.8%	35.2%	-
Share of total population in the impact area	0.0%	0.0%	0.0%	39.3%	60.7%	-
Assessment	**Neutral**	**Neutral**	**Neutral**	**Large beneficial**	**Slight beneficial**	-

This shows that there are more receptors forecast to experience a decrease in noise levels than an increase. In the noise study area there are only populations in income quintiles 4 and 5, therefore, income quintiles 1, 2 and 3 have been assessed as neutral. In income quintile 4 and 5, beneficial impacts are experienced by more dwellings than negative noise impacts.

The highest income group (comprising areas with the lowest income deprivation) is positively affected, with 35% of the net numbers experiencing an improvement (with a share of 60.7% of the total population). This has resulted in a slight beneficial assessment as the net proportion experiencing an improvement is less than the proportion of the population experiencing the benefits.

Income quintile 4 is scored as large beneficial as the proportion of the population experiencing benefits within these quintiles is greater than the proportion of the population of the group overall (and more than 5% greater).

There are slightly below national average proportions of children and 2 schools within the noise impact area. In addition, there are no OAs within the impact area within the 20% highest proportion of children residents nationally. Seagry Church of England Primary School is located to an equal number of receptors with an increase and decrease in noise levels. Whereas Stanton St Quintin Primary and Nursery School is located in proximity to receptors with a decrease in noise levels. Overall, it is noted that there will be a slight beneficial impact on children due to the location of schools in proximity to primarily receptors with an anticipated decrease in noise levels.

The proportion of elderly people within the noise impact area is slightly above the national average, however, there are no OAs within the impact area with the 20% highest proportion of elderly residents nationally. There are no specific amenities within the noise impact area which elderly residents are likely to visit in particular. Therefore, the noise impact for elderly has been appraised as slight beneficial due to the slightly above national average elderly population and greater number of receptors with a decrease in noise.

The DI assessment demonstrates whether the noise impacts as a result of the proposed scheme are distributed evenly and contextualises who the likely winners and losers are in terms of vulnerable groups.

Overall, the M4 Junction 17 scheme has beneficial noise impacts. The most deprived areas (income quintile 1, 2 and 3) are not present within the noise impact area, therefore, are assessed as neutral. Beneficial impacts are anticipated for the least deprived residents in income quintiles 4 and 5. Income quintile 4 is assessed as moderate beneficial due to the greater proportion of properties experiencing a decrease in noise levels versus the proportion of the population. Income quintile 5 is assessed as slight beneficial as there is a lower proportion of properties experiencing a decrease in noise levels versus the proportion of the population. Children and elderly are assessed as slight beneficial owing to the known presence of both groups in the study area and the greater number of properties with a decrease in noise levels.

Overall, the impact on vulnerable groups from noise is considered **slight beneficial.**

Table 3-13 – Noise assessment by income quintile

Group	Outcome
Quintile 1 (most deprived)	Neutral
Quintile 2	Neutral
Quintile 3	Neutral
Quintile 4	Moderate beneficial
Quintile 5 (least deprived)	Slight beneficial
Children (under 16)	Slight beneficial
Elderly (over 70)	Slight beneficial
Overall	**Slight beneficial**

3.5.   Security

3.5.1.   Step 1 – Screening

3.5.1.1.   Comments

Based on available information at this stage, a security assessment based on the design element was undertaken as part of the Social Impacts Appraisal (see Section 2.2).

There are no significant planned changes to public transport waiting/interchange services as part of the scheme. Changes to pedestrian or cyclist facilities along the route are not expected to have any material impact on security issues in the area.

As security is likely to be minimally affected as a result of the scheme, no further assessment of security distributional impacts is required.

3.5.1.2.   Outcome

No further appraisal needed.

3.6.   Severance

3.6.1.   Step 1 – Screening

Comments

As shown in the Social Impact Appraisal Section (Section 2.4), the scheme aims to provide enhanced opportunities for cycling by providing signage along a route from Kington St Michael to Stanton St Quintin. This

is expected to have a neutral impact on severance, as there will not be infrastructure improvements along this route such as new or improved crossing points or a segregated cycleway which would improve or disimprove severance.

On the other hand, physical changes in road alignment and traffic re-assignment across the road network could have an adverse impact to severance as pedestrians may have to travel further to cross the road. The scheme will also result in a number of links on the road network experiencing an increase in traffic flows. This could also impact on severance in the area.

As a result, the impact of the scheme to severance will need to be examined further to assess the full impact. This information can then be used to identify scheme measures that will impact on severance levels in the local area.

Outcome

Continue to full appraisal. The impact on groups that are potentially vulnerable to the effects of severance will need to be examined for each package. Such groups include people without access to a car, older people, children and people with disabilities.

3.6.2.   Step 2 – Assessment

Step 2a: Confirmation of Impacted Area

TAG Unit A4-2 recommends the impact area for severance to include any location with physical changes in road alignment or where links on the road network will experience significant changes (>10%) in traffic flows, speed or HGV content. Building on this recommendation, an impact area including all LSOAs within 1km of affected links was defined for undertaking the severance assessment, as shown in as shown in **Figure 3-4**. This assessment has been based on an examination of changes in traffic flow (24-hour AADT).

Figure 3-4 – Severance impact area
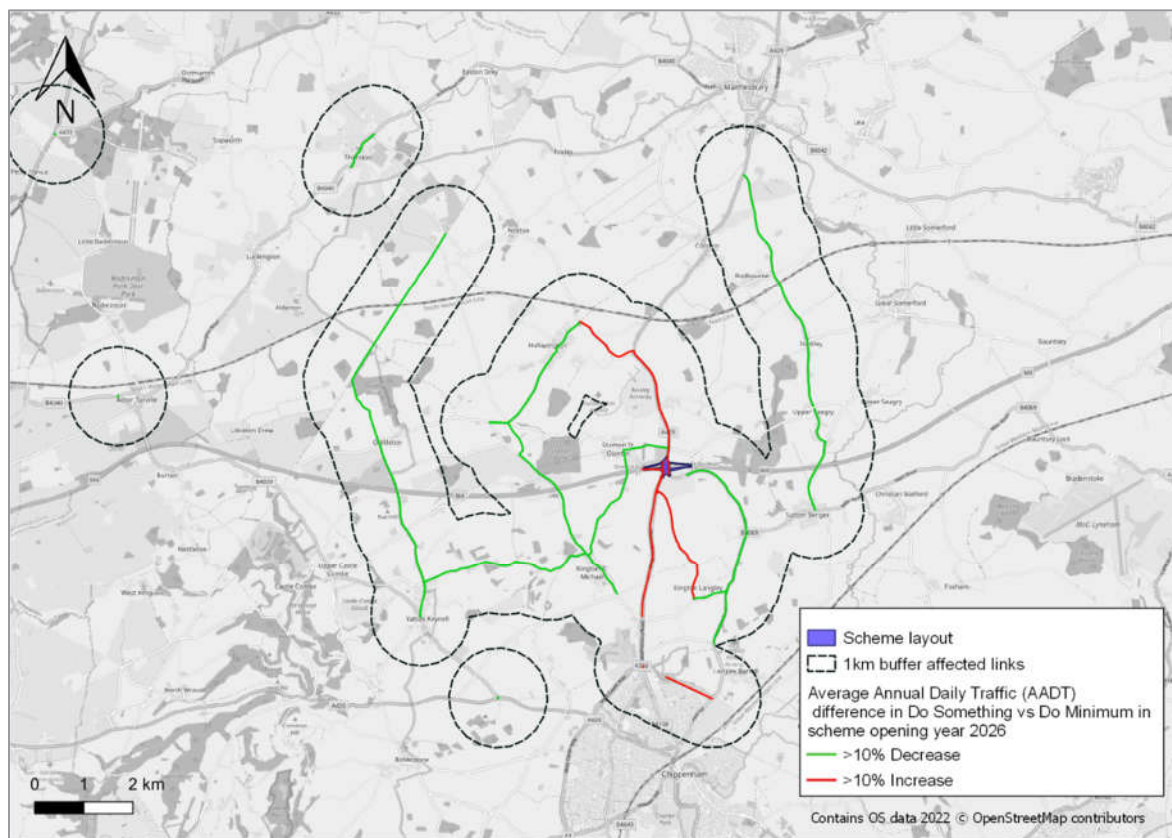
Step 2b: Identification of Social Groups in Impact Area

Certain groups are particularly vulnerable to the effects of severance, including no car households, older people, children and people with disabilities. Analysis has been undertaken to assess the proportions of these vulnerable groups within the scheme areas compared to the national average.

Table 3-14 shows the proportions of vulnerable groups for England as well as the severance impact area. Within the study areas, there are below the national average proportions of children, disability allowance claimants and households without access to car or van. The proportion of elderly residents is higher compared to the average for England.

Table 3-14 – Proportions of vulnerable groups within England and the severance impact area

Vulnerable Group	England	Severance impact area
Children (aged under 16)	19.1%	18.2%
Older People (aged 70+)	13.5%	**16.1%**
Disability Living Allowance Claimants	2.9%	2.6%
Proportion of households without access to a car or van	26.1%	14.4%

Step 2c: Identification of Amenities in Impact Area

Within the severance study area, there are a number of amenities which are likely to be used by vulnerable groups. There are 12 educational establishments, 1 GP surgery, 5 care homes, 7 community centres, 16 places of worship – see Figure 3-5. Some of these amenities may suggest the presence of vulnerable groups such as elderly people and children.

Figure 3-5 – Location of amenities within the severance impact area
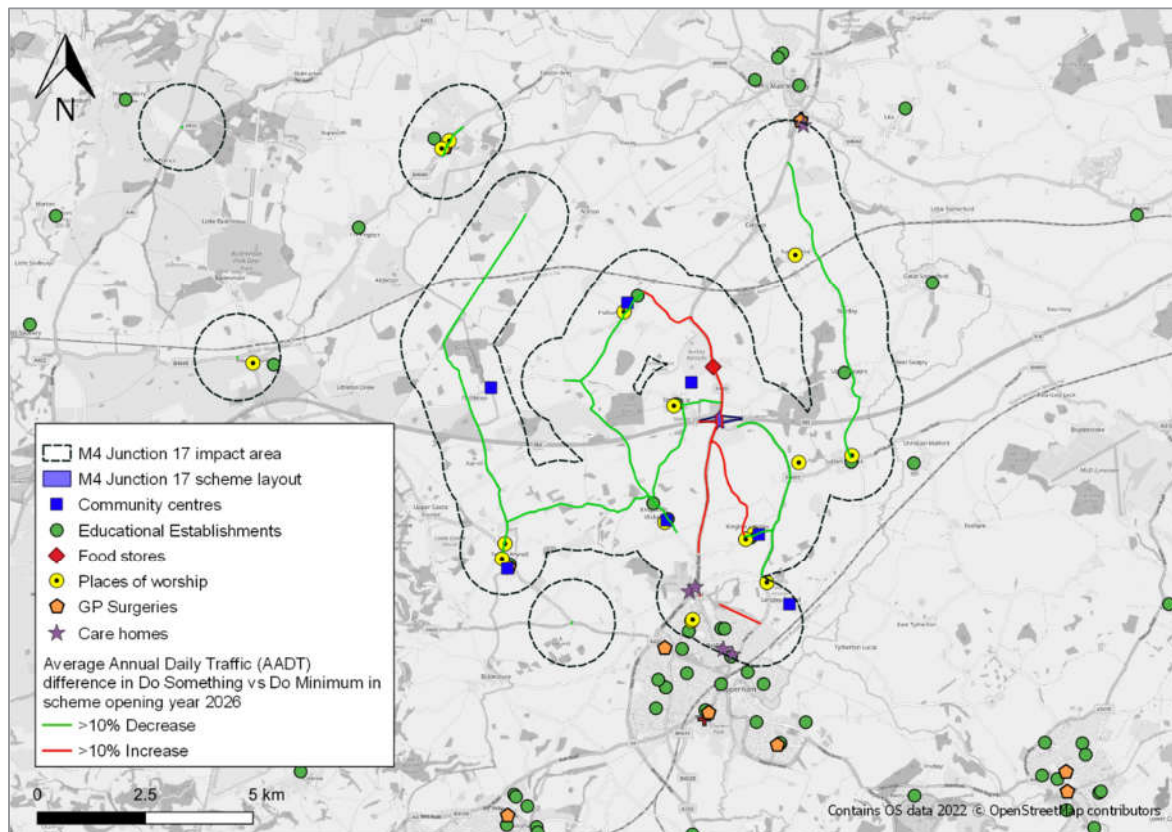
3.6.3. Step 3 – Appraisal

The scheme aims to reduce delays and improve journey time reliability at the M4 Junction 17, through a widening of the M4 junction 17 gyratory and motorway on slips and off slips. The scheme also aims to improve

north-south connectivity on the A350 through improvements to the M4 junction 17. The M4 Junction 17 provides a key linkage from the M4 to the A350, connecting Malesbury to the north and Chippenham to the south on the A350 and to Swindon, Reading and London to the east and Bristol to the west on the M4. The M4 junction 17 is situated in a primarily rural area, therefore, it is unlikely increased traffic at the junction will affect access to amenities.

As outlined in the Strategic Case, traffic flows are high in the area with approximately 28,000 vehicles in each direction on the M4 and 7,000 vehicles on each of the on/off slips (12-hour flows). HGVs account for approximately 10% of traffic demands on the M4 Junction 17.

As previously mentioned, the scheme also aims to provide enhanced opportunities for walking and cycling through the introduction of signalisation on three arms of the gyratory, which will include pedestrian crossing facilities. Although, this area is primarily used for maintenance access, this would reduce severance for pedestrians and improve access to amenities nearby, but the impact is likely to be minimal. In addition, there will be signage put in place along a proposed cycle route to indicate a route which will run from the south of the M4 J17 from the A350, through Kington St Michael, along Stanton Lane to Stanton St Quintin and onwards to the A249 via Church Lane to the north of the M4 J17 – shown in **Figure 1-2**. There are no PROWs which cross the M4 junction 17.

In order to conduct a more detailed analysis on the potential impacts of the scheme on specific groups who are vulnerable to severance (i.e., elderly, children, no car households and DLA claimants), road links with a significant change in AADT and the prevalence of vulnerable groups are presented in **Figure 3-6** to **Figure 3-9**.

Figure 3-6 – Links with a change in traffic flow and the 20% highest proportions of children as compared to the average in England
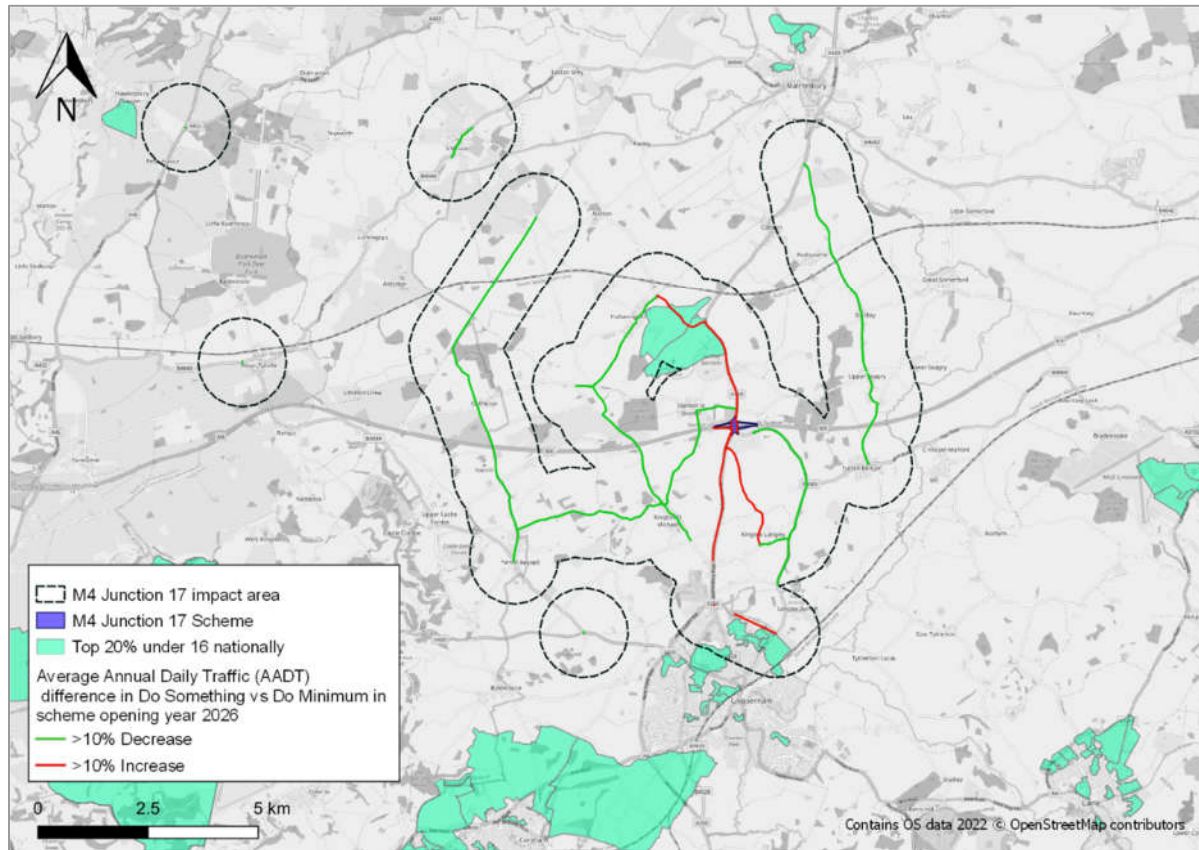
Figure 3-7 – Links with a change in traffic flow and 20% highest proportions of elderly population
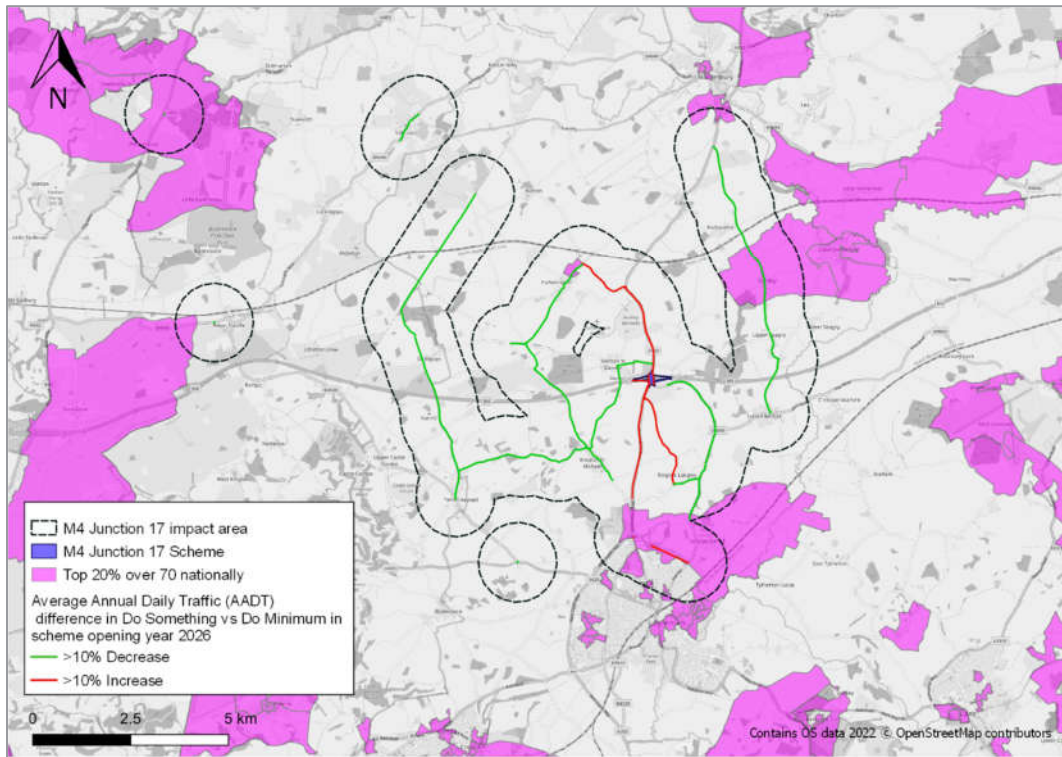

Figure 3-8 – Links with a change in traffic flow and 20% highest proportions of DLA claimants as compared to the average in England
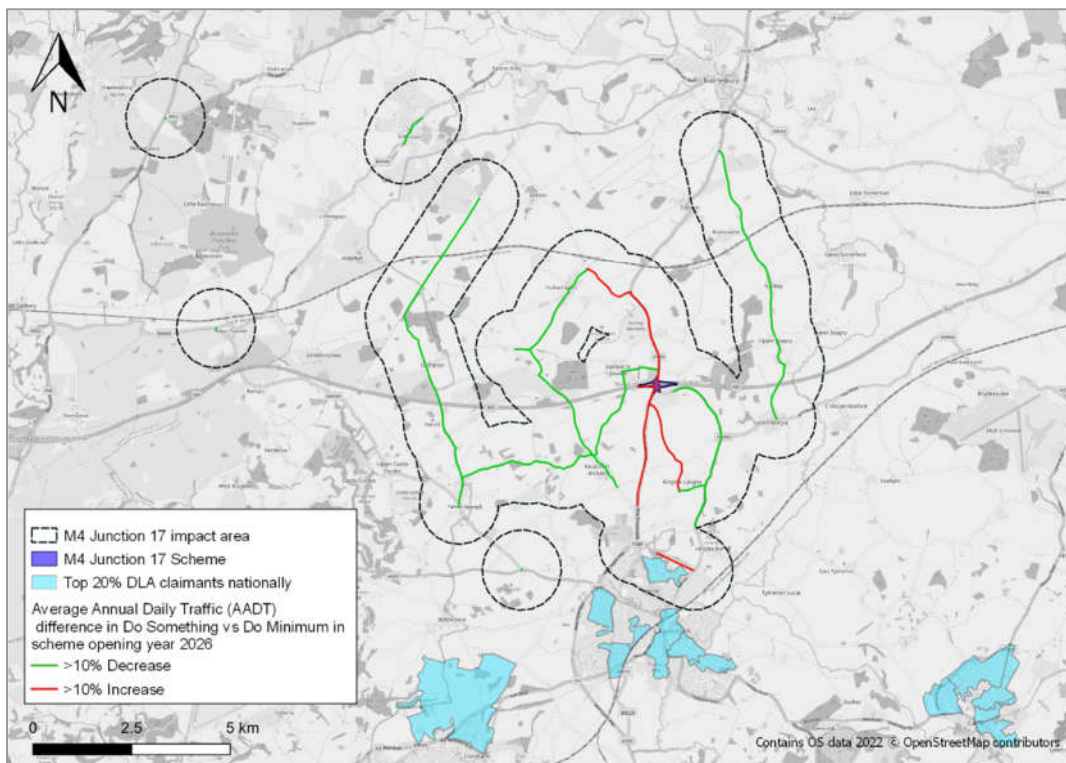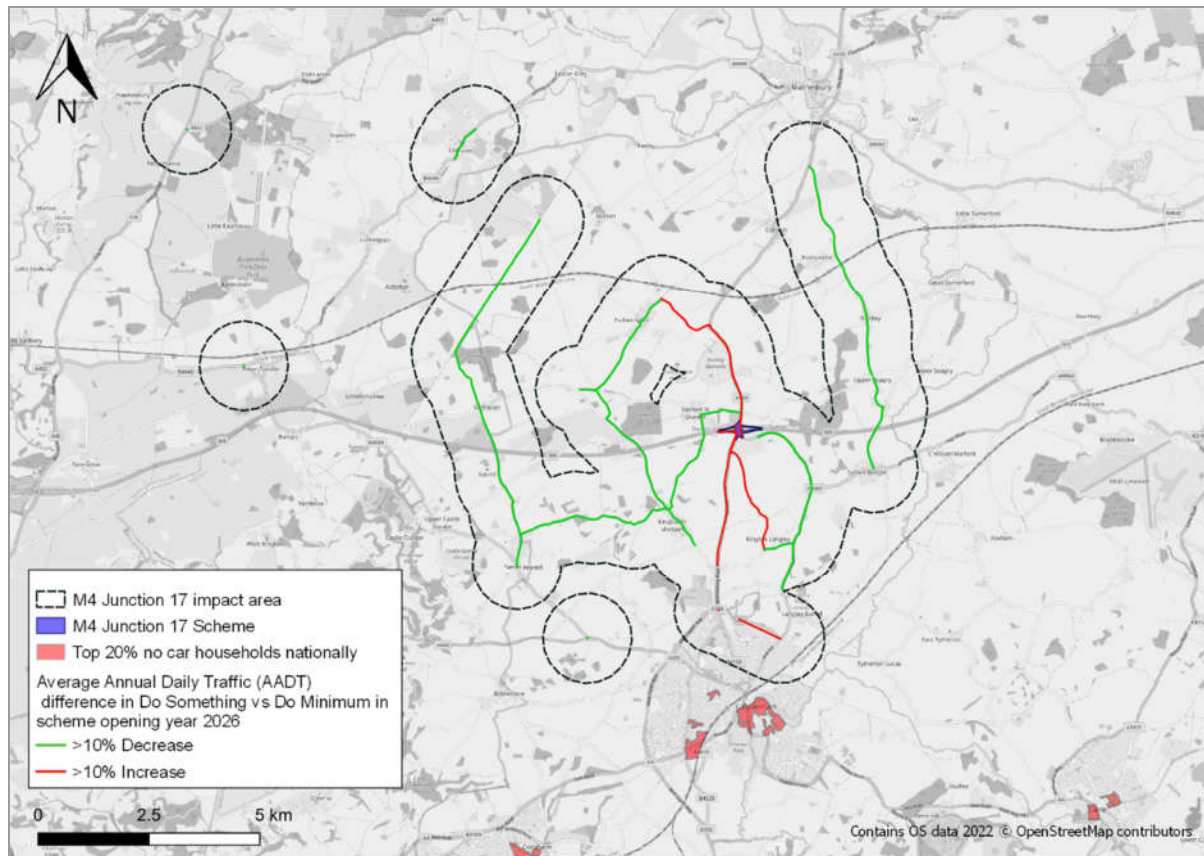
Figure 3-9 – Links with a change in traffic flow and 20% highest proportions of households with no access to a car/van as compared to the average in England

Children

Children are considered to be vulnerable to severance as they are more likely to cross the road at dangerous crossing points and find it difficult to judge the speed of traffic, hence putting themselves at risk of road collisions. These groups often experience longer journey times or are often required to use pedestrian routes that are inappropriate and difficult to use. The scheme aims to improve north-south connectivity on the A350 through improvement to the M4 junction 17. **Figure 3-6** shows that there are high concentrations of children in proximity to Buckley Barracks and Hullavington to the northeast of the scheme and clusters in north Chippenham, south of the M4 junction 17. Both these concentrations of children are situated in proximity to a link which is forecasted to experience an increase in traffic flow greater than 10%. Children who live in proximity to these links may find it more difficult to cross a road with increased traffic flows to reach amenities such as schools or playgrounds, such as the schools present in Hullavington and north Chippenham. These high concentrations of children could therefore experience negative impacts in terms of severance. Overall, throughout the severance impact area there is a low concentration of children and is lower than the national average of children in the population.

In summary, in areas with high concentration of children, there are more links that are forecast to have an increase in traffic flow. Therefore, it is concluded that children will experience a **slight adverse.** It is noted that this is a conservative estimate given that there is a low concentration of children throughout the severance study area.

Elderly

Similar to children, older people are considered vulnerable to changes in severance. As shown in **Figure 3-7,** there are areas with high proportions of elderly residents to the north of Chippenham, Hullavington to the north-west of the scheme, Startley to the northeast of the scheme and in Petty France to the north-west of the scheme. Three of these concentrations of elderly are situated in proximity to links forecasted to have a greater than 10% decrease in traffic flow (Hullavington, Startley and Petit France). Elderly residents may wish to cross

these roads to access local amenities such as the community centre in Hullavington. A reduction in traffic flows would reduce severance for elderly travelling in these areas. In north Chippenham there was an increase in traffic flow greater than 10%, in proximity to a number of amenities including a care home. An increase in traffic flows may make it more difficult to cross roads and access amenities for this group.

Overall, the assessment for elderly is likely to be **slight beneficial** as the minimal increase in severance in north Chippenham are broadly offset by a relief of severance as a result of decrease traffic flows across the severance impact area.

Disabled residents

Figure 3-8 shows that is a small area of high concentrations of Disability Living Allowance (DLA) claimants solely in north Chippenham in the severance impact area. This concentration of DLA claimants is located in proximity to a link which experiences a greater than 10% increase in traffic flows. However, there is an overall lower than the national average population of DLA claimants in the study area and it is not expected that this population would need to use this link to reach amenities such as healthcare facilities, as there are other more direct alternative routes. There are no high concentrations of DLA claimants where measures which would decrease severance are present, such as the increased cycle way signage or signalised pedestrian crossings at the M4 junction 17.

Consequently, the overall impact of severance on DLA claimants is considered to be **neutral.**

No car households

Households without access to a car are more likely to walk to access amenities and therefore be impacted by changes to severance. There is a concentration of no car households to the south of the severance impact area and no high concentrations of no car households within the severance impact area - see **Figure 3-9**. This is in line with the low proportion of no car households in the severance impact area versus the national average (**Table 3-14**). Overall, the assessment for no car households is considered to be **neutral** due to the lack of presence of this group in the severance impact area.

Outcome

The main area expected to benefit from a reduction in severance is around the M4 junction 17 and signage for a cycle route, which will run from the south of the M4 J17 from the A350, through Kington St Michael, along Stanton Lane to Stanton St Quintin. There are not high concentrations of older people, children, disability living allowance claimants or no car households in proximity to these improvements. As there are a small number of areas with high concentrations of children and disability living allowance claimants in proximity to links with an increase in traffic flows greater than 10%, an adverse impact is expected on severance for these groups. There are concentrations of elderly in proximity to links with a decrease in traffic flows greater than 10%, who will experience a benefit as a result of changes to severance due to the scheme.

The overall severance assessment is therefore considered to be **neutral**.

Table 3-15 – Severance assessment for vulnerable groups

Vulnerable Group	Assessment
Children (aged under 16)	Slight adverse
Older People (aged 70+)	Slight beneficial
Disability Living Allowance Claimants	Neutral
Proportion of households without access to a car or van	Neutral
Overall	**Neutral**

3.7.   User Benefits

3.7.1.   Step 1 – Screening

Comments

User benefits and disbenefits associated with a transport intervention are generally net outcomes. Within the net outcome, some people may experience disbenefits, for example through longer journey times or lower public transport service frequencies.

Improving the M4 Junction 17 may result in changes in the cost of travel (including time and financial based costs) for users of the transport network using private vehicles. As a result, it is considered appropriate to understand the pattern of user benefits and disbenefits generated by the intervention and to examine the distribution of such impacts across different areas.

Outcome

Continue to full DI Appraisal. The distribution of user benefits across different income groups will need to be examined in further detail.

### 3.7.2.   Step 2 – Assessment

Step 2a: Confirmation of Impacted Area

Transport user benefits have been estimated using Transport User Benefit Appraisal (TUBA), the DfT's appraisal software. TUBA calculations are based on the following:

- Home based trips (using AM origins as home location and PM destinations as home location);
- Home based trips calculated using 'commuting and other' trips (i.e., excluding business travel);
- Only internal to internal trips within the impact assessment area; and
- 60-year appraisal period.

As indicated in the guidance, the impact area should be defined as the area in which the transport intervention will result in changes to the cost of travel[9]. In this case, the assessment area for user benefits is defined as the core modelled area and external zones within the transport model, which includes a total of 8 external zones, covering the whole of England and 497 core modelled zones – see Figure 3-10. Recognising the role of the scheme in unlocking development, the assessment area also considers a number of development points (76 development points) – see Figure 3-11. Benefits associated with unlocking dependent developments were also considered in the DI analysis.

Figure 3-10 – External Modelled Area and Core Modelled Area for the purposes of the DI assessment

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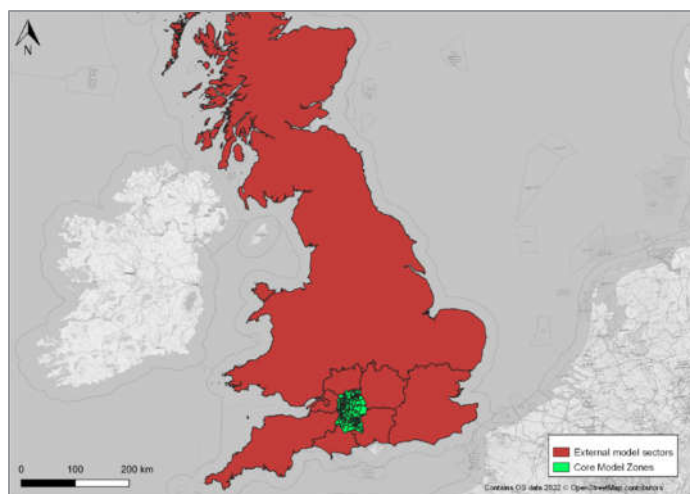
[9] The user benefits assessment considers the change in the cost of travel for users of the transport network, both for cars and for public transport. However, the analysis does not consider public transport since the M4 Junction 17 is a highway only scheme.

Figure 3-11 – Core Modelled Area and development points
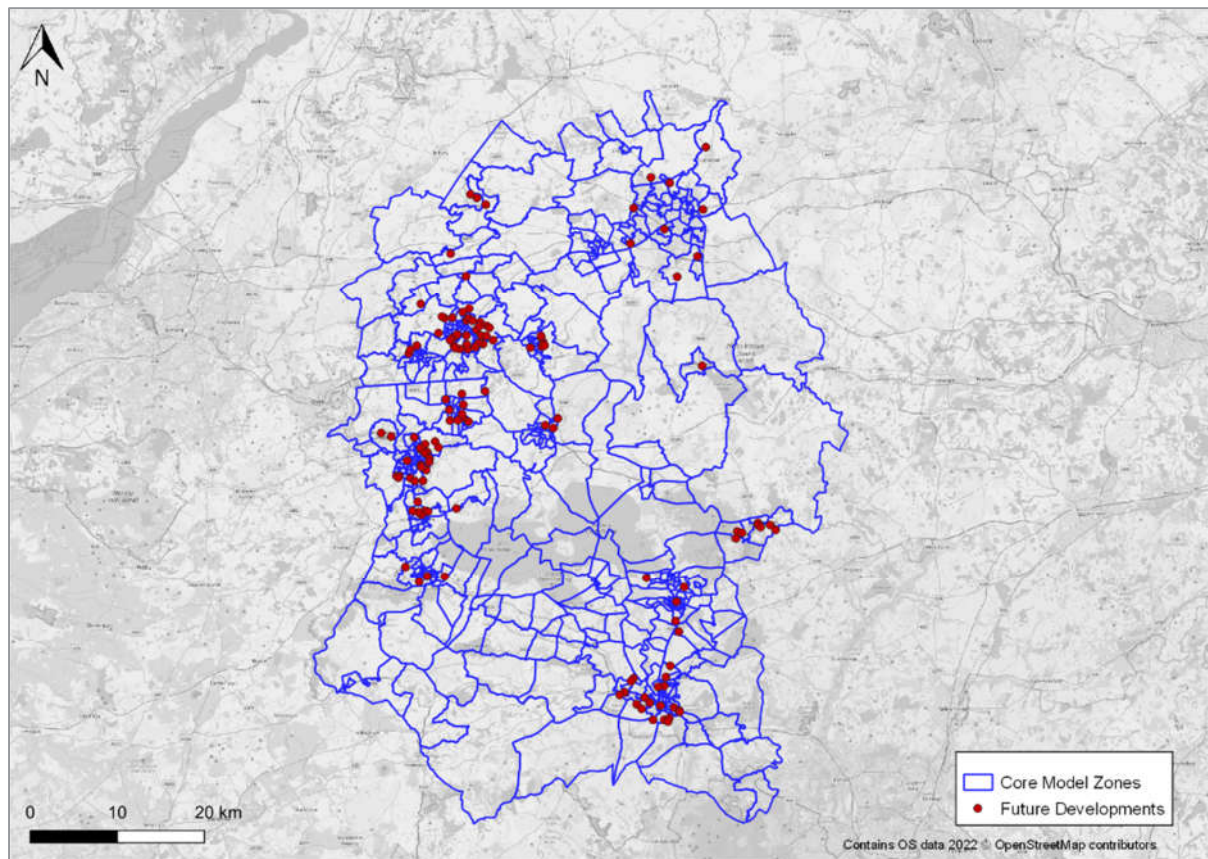
Step 2b: Identification of Social Groups in Impact Area

As per the guidance (TAG Unit 4-2), User Benefits have to be distributed amongst different income groups. As disaggregate income data is not available, this analysis has been undertaken by mapping variations in income deprivation using data from the Indices of Deprivation (IoD 2019) Income Domain at Super Output Area level, according to their national rank.

To understand possible future income distributions of users within the scheme area for those residing at new developments five sensitivity tests were completed:

- Sensitivity test 1 – Considering modelled zones population and all populations associated with new developments to be in the most deprived quintile (Quintile 1).

- Sensitivity test 2 - Considering modelled zones population and all populations associated with new developments to be in Quintile 2.

- Sensitivity test 3 - Considering modelled zones population and all populations associated with new developments to be in Quintile 3.

- Sensitivity test 4 - Considering modelled zones population and all populations associated with new developments to be in Quintile 4.

- Sensitivity test 5 - Considering modelled zones population and all populations associated with new developments to be in the least deprived quintile (Quintile 5).

For the calculations, the new developments were assumed to have an average population of 2.3 persons per household as per the guidance in TAG unit M4 and ONS data for south west England[10].

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[10] Households by household size, regions of England and GB constituent countries, Dataset, 2021 Estimate, ONS available at: Households by household size, regions of England and GB constituent countries - Office for National Statistics

Table 3-16 shows that the proportion of residents within each income quintile group is broadly in line with the national average in all sensitivity tests, with income quintile 5 marginally above the national average at 20.7% and 20.8%. The consideration of the development points does not significantly alter the population proportions.

Table 3-16 – Proportions of income groups within the user benefits impact area

Income Group	England	Impact Area (all zones without development points)	Impact Area (Sensitivity test 1)	Impact Area (Sensitivity test 2)	Impact Area (Sensitivity test 3)	Impact Area (Sensitivity test 4)	Impact Area (Sensitivity test 5)
Quintile 1 (most deprived)	20%	19.9%	20.0%	19.8%	19.8%	19.8%	19.8%
Quintile 2	20%	19.9%	19.9%	**20.1%**	19.9%	19.9%	19.9%
Quintile 3	20%	19.8%	19.8%	19.8%	20.0%	19.8%	19.8%
Quintile 4	20%	19.6%	19.6%	19.6%	19.6%	19.8%	19.6%
Quintile 5 (least deprived)	20%	**20.7%**	**20.7%**	**20.7%**	**20.7%**	**20.7%**	**20.8%**

Step 2c: Identification of Social Groups in Impact Area

Identification of amenities for the user benefits DI appraisal is not required according to the TAG guidance.

3.7.3. Step 3 – Appraisal

The modelled zone user benefit analysis used the capability of TUBA to provide benefit outputs disaggregated at a zone to zone movement level. Benefits were assigned to social groups through spatial location assuming the home end of a commuting trip to be the origin in the AM peak and destination in the PM peak. Details of the methodology are provided below:

- A baseline assessment was completed, only taking into account benefits that can be assigned to modelled zones for all modelled area. This is only for reference and aims to understand the impact of the benefits assigned to proposed residential sites (development points).

- The following assessment was completed to understand the combined benefits from modelled zones and development points:
  - Modelled zone benefits were distributed using LSOA postcode database population and assigned to different income quintiles. Income groups were based on the income deprivation score for each area, at census LSOA level.
  - Development point benefits were distributed in the following way:
    - Using 'Dwellings' as a proxy for households, as recommended in TAG Unit M4. This was calculated as the total number of dwellings (sourced from the modelling team uncertainty log of developments) multiplied by the average population per dwelling, which for south west England is 2.3 according to the ONS 2021 estimates[11].
    - Five sensitivity tests were completed to assume different income quintiles assigned to the development point populations, assigned to Income Quintiles 1, 2, 3, 4 and 5.

There are three key limitations and assumptions to note as a result of this analysis:

- It is assumed for the sensitivity tests that all populations will be within one particular income quintile. As the income quintiles of these future populations is unknown there is likely to be a considerable uncertainty in the user benefits DI results.

- An average population per dwelling has been used, however, the population per dwelling is likely to vary between different household types owing to the size of housing and type of housing.

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[11] Households by household size, regions of England and GB constituent countries, Dataset, 2021 Estimate, ONS available at: Households by household size, regions of England and GB constituent countries - Office for National Statistics

- Where postcode data does not overlap with model zones due to the size of the model zones these benefits have not been captured. There is, therefore, likely to be uncertainty in the user benefits DI results.

Baseline assessment

Table 3-17 compares the relative proportion of benefits and disbenefits against the proportion of the population in each income quintile for the modelled zone impact area only. A final assessment per quintile has been made based on the table system for grading of transport user benefits DIs set out in TAG Unit 4-2.

Table 3-17 – Overall user benefits for commuters and other non-business trips across income quintiles

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,528,723	10,486,044	10,380,069	10,941,904	52,841,595
Proportion of each group	19.9%	19.9%	19.8%	19.6%	20.7%	-
Total benefits	£1,943,885	£4,275,884	£2,986,832	£9,823,965	£12,850,907	£31,881,473
Distribution of benefits	6.1%	13.4%	9.4%	30.8%	40.3%	-
Sum of disbenefits	-	-	-	-	-	£0
Distribution of disbenefits	-	-	-	-	-	-
Overall	£1,943,885	£4,275,884	£2,986,832	£9,823,965	£12,850,907	£31,881,473
Assessment	Slight Beneficial	Slight Beneficial	Slight Beneficial	Large Beneficial	Large Beneficial	**Moderate Beneficial**

There is a beneficial impact to user benefits for all income quintile groups, as a result of the scheme. There is a total benefit of £31.9m for the scheme, with the greatest benefits found for income quintiles 4 and 5, and therefore assessed as large beneficial as there is a greater proportion of benefits compared to the proportion of the total population. Income quintiles 1, 2 and 3 receive slight beneficial impacts due to the distribution of benefits being less than the proportion of the overall population in each income quintile.

Following the assessment, it can be concluded that the user benefits DI appraisal for the baseline assessment, which only include modelled zones and no future development points, is considered to be **moderate beneficial**.

Combined assessment

Each user benefits assessment for the five sensitivity tests has been completed in **Table 3-18 to Table 3-22** These results compare the relative proportion of benefits and disbenefits against the proportion of the population in each income quintile for the modelled zone impact area and development points with population assigned to varying income quintiles as outlined above.

Table 3-18 – Sensitivity test 1

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,596,271	10,528,723	10,486,044	10,380,069	10,941,904	52,933,011
Proportion of each group	20.0%	19.9%	19.8%	19.6%	20.7%	-
Total benefits	£3,459,847	£4,275,884	£2,986,832	£9,823,965	£12,850,907	£33,397,435
Distribution of benefits	10.4%	12.8%	8.9%	29.4%	38.5%	-
Sum of disbenefits	-	-	-	-	-	£0
Distribution of disbenefits	-	-	-	-	-	-
Overall	£3,459,847	£4,275,884	£2,986,832	£9,823,965	£12,850,907	£33,397,435
Assessment	Slight Beneficial	Slight Beneficial	Slight Beneficial	Large Beneficial	Large Beneficial	**Moderate Beneficial**

Table 3-19 – Sensitivity test 2

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,620,139	10,486,044	10,380,069	10,941,904	52,933,011
Proportion of each group	19.8%	20.1%	19.8%	19.6%	20.7%	-
Total benefits	£1,943,885	£5,791,846	£2,986,832	£9,823,965	£12,850,907	£33,397,435
Distribution of benefits	5.8%	17.3%	8.9%	29.4%	38.5%	-
Sum of disbenefits	-	-	-	-	-	£0
Distribution of disbenefits	-	-	-	-	-	-
Overall	£1,943,885	£5,791,846	£2,986,832	£9,823,965	£12,850,907	£33,397,435
Assessment	Slight Beneficial	Moderate Beneficial	Slight Beneficial	Large Beneficial	Large Beneficial	**Moderate Beneficial**

Table 3-20 – Sensitivity test 3

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,528,723	10,577,460	10,380,069	10,941,904	52,933,011
Proportion of each group	19.8%	19.9%	20.0%	19.6%	20.7%	-
Total benefits	£1,943,885	£4,275,884	£4,502,794	£9,823,965	£12,850,907	£33,397,435
Distribution of benefits	5.8%	12.8%	13.5%	29.4%	38.5%	-
Sum of disbenefits	-	-	-	-	-	£0
Distribution of disbenefits	-	-	-	-	-	-
Overall	£1,943,885	£4,275,884	£4,502,794	£9,823,965	£12,850,907	£33,397,435
Assessment	Slight Beneficial	Slight Beneficial	Slight Beneficial	Large Beneficial	Large Beneficial	**Moderate Beneficial**

Table 3-21 – Sensitivity test 4

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,528,723	10,486,044	10,471,485	10,941,904	52,933,011
Proportion of each group	19.8%	19.9%	19.8%	19.8%	20.7%	-
Total benefits	£1,943,885	£4,275,884	£2,986,832	£11,339,927	£12,850,907	£33,397,435
Distribution of benefits	5.8%	12.8%	8.9%	34.0%	38.5%	-
Sum of disbenefits	-	-	-	-	-	£0
Distribution of disbenefits	-	-	-	-	-	-
Overall	£1,943,885	£4,275,884	£2,986,832	£11,339,927	£12,850,907	£33,397,435
Assessment	Slight Beneficial	Slight Beneficial	Slight Beneficial	Large Beneficial	Large Beneficial	**Moderate Beneficial**

Table 3-22 – Sensitivity test 5

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,528,723	10,486,044	10,380,069	11,033,320	52,933,011
Proportion of each group	19.8%	19.9%	19.8%	19.6%	20.8%	-
Total benefits	£1,943,885	£4,275,884	£2,986,832	£9,823,965	£14,366,868	£33,397,435
Distribution of benefits	5.8%	12.8%	8.9%	29.4%	43.0%	-
Sum of disbenefits	-	-	-	-	-	£0
Distribution of disbenefits	-	-	-	-	-	-
Overall	£1,943,885	£4,275,884	£2,986,832	£9,823,965	£14,366,868	£33,397,435
Assessment	Slight Beneficial	Slight Beneficial	Slight Beneficial	Large Beneficial	Large Beneficial	**Moderate Beneficial**

As expected, sensitivity tests undertaken as part of the assessment have shown that allocating the new development points populations to each quintile will increase the amount of benefits attributed to each respective quintile. All sensitivity tests result in a total benefit of £33.4m.

All five sensitivity tests result in an overall assessment of **moderate beneficial.** Income quintile 4 and 5 experience the greatest benefits and are assessed as large beneficial in each sensitivity tests, owing to the greater proportion of population and high distribution of benefits. Income quintiles 1 and 3 are assessed as slight beneficial in each assessment, as the proportion of benefits experienced in these quintiles is greater than 5% of the proportion of groups represented in the impact area. Income quintile 2 is assessed as slight beneficial in all sensitivity tests, except sensitivity test 2 where the proportion of benefits is in line (+/- 5%) with the proportion of the population and therefore was assessed as moderate beneficial.

3.7.4.   Outcome

Overall, there are net user benefits derived from the scheme, approximately £31.9m for the scheme modelled zones only and £33.4m for the scheme modelled zones and development points sensitivity tests over the 60-year appraisal period. Benefits considered in the user benefit appraisal consider both time and cost to the users.

Table 3-23 illustrated the user benefits assessment for the baseline and for each sensitivity test. An overall user benefits assessment is also presented. All of the income quintiles experience net user benefits overall. Since there are positive impacts for all income quintiles, ranging between slight beneficial to large beneficial. Overall the impact to user benefits due to the M4 Junction 17 scheme is considered **moderate beneficial**.

Table 3-23 – Outcome of the user benefit assessment

Vulnerable Group	Baseline User Benefits Assessment	Sensitivity Test 1 Benefits Assessment	Sensitivity Test 2 Benefits Assessment	Sensitivity Test 3 Benefits Assessment	Sensitivity Test 4 Benefits Assessment	Sensitivity Test 5 Benefits Assessment	Overall benefits Assessment
Quintile 1 (most deprived)	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial
Quintile 2	Slight Beneficial	Slight Beneficial	Moderate Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial
Quintile 3	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial
Quintile 4	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial
Quintile 5 (least deprived)	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial
Overall	**Moderate Beneficial**	**Moderate Beneficial**	**Moderate Beneficial**	**Moderate Beneficial**	**Moderate Beneficial**	**Moderate Beneficial**	**Moderate Beneficial**

3.8.   Personal affordability

3.8.1.   Step 1: Screening

Comments

The improvements at M4 Junction 17 will bring journey time savings and will cause a reduction in vehicle operating costs as a result of reduced congestion in the area. However, increased speed on the network can cause an increase in fuel consumption and therefore operating costs. Hence, the affordability impact of the scheme will need to be examined.

TUBA outputs by themselves do not show whether these costs are distributed evenly across income groups. As a result, a further analysis should be completed to quantify the potential distribution of affordability impacts amongst different income groups.

3.8.1.1. Outcome

Continue to full DI Appraisal. The distribution of affordability impacts across different income groups will need to be examined in further detail.

3.8.2.   Step 2: Assessment

Step 2a: Confirmation of Impacted Area

The affordability impacts consider vehicle operating costs, public transport costs, parking charges, and toll charges. Figure 3-11 in the User Benefits section above showcases the modelled zones which is also the impact area for affordability.

Similarly, the analysis has been completed for home-based commuting and other non-business trips. The distribution of benefits across different income quintiles (at postcode level) has been analysed, focusing on all trips with a trip originating within the core modelled area (i.e., internal trips and internal-external trips). The benefits have been calculated using 60-year appraisal TUBA outputs, which in turn take data from the model.

As with the user benefits analysis, there are also a number of development points which have been included within TUBA runs, depending on the certainty of the development being built. Trips have been included in TUBA outputs only where appropriate and will be fed through into the DI analysis.

3.8.2.1. Step 2b: Identification of Social Groups in Impact Area

As outlined within the user benefits section, five sensitivity tests have been completed to understand possible future income distributions of users within the scheme area for those residing at new developments. The sensitivity tests completed mirrors the user benefit appraisal component (see section 3.8). Likewise, the proportion of income groups within the user benefit impact area is also applicable to the affordability DI analysis.

3.8.2.2. Step 2c: Identification of Social Groups in Impact Area

Identification of amenities for the affordability DI appraisal is not required according to the TAG guidance.

3.8.3.   Step 3: Appraisal

Affordability assessment was captured as an output from the DfT's Transport Users Benefit Appraisal (TUBA) software. The analysis for personal affordability mirrors the user benefit appraisal component and is based on the user charge assessment as considered in the Transport Economic Efficiency analysis.

As outlined in section 3.8.3, a baseline-combined approach was completed to assign future uncertain development point populations to different income quintiles to understand the effect on the distribution of user benefits. This methodology was replicated for affordability for the baseline and the five sensitivity tests. Results are presented and discussed below.

Baseline assessment

Table 3-24 compares the relative proportion of benefits and disbenefits against the proportion of the population in each income quintile. A final assessment per quintile has been made based on the table system for grading of personal affordability DIs set out in TAG Unit 4-2.

Table 3-24 – Affordability impacts for commuter and other non-business trips across all income quintiles

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,528,723	10,486,044	10,380,069	10,941,904	52,841,595
Proportion of each group	19.9%	19.9%	19.8%	19.6%	20.7%	-
Sum of benefits	£6,415	£84,845	£19,300	-	£215,187	£325,747
Distribution of benefits	2.65%	35.02%	7.97%	-	88.83%	-
Sum of disbenefits	-	-	-	-£83,495	-	-£83,495
Distribution of disbenefits	-	-	-	-34.47%	-	-
Overall	£6,415	£84,845	£19,300	-£83,495	£215,187	£242,252
Assessment	Slight Beneficial	Large Beneficial	Slight Beneficial	Slight Adverse	Large Beneficial	**Slight Beneficial**

Overall, there are net affordability benefits from the scheme of £0.24m over the 60-year appraisal period, with a total £0.33 of benefits and -£0.83m disbenefits. When looking at the distribution of benefits, the analysis shows income quintiles 1, 2, 3 and 5 share the benefits, whereas income quintile 4 experiences the disbenefits of -£83,495.

This is likely attributed to the large area of the core modelled area situated in income quintile 4, where there is an overall expected increase in costs e.g. vehicle operating costs.

Whilst a slight adverse impact is expected in income quintile 4, overall it can be concluded that the affordability DI appraisal for the baseline assessment, which only include modelled zones and no future development points, is considered to be **slight beneficial**, as four of the income quintiles show benefits, and the overall total cost is positive.

Combined assessment

Affordability assessment for the five sensitivity tests has been completed in **Table 3-25 to Table 3-29.**

These results compare the relative proportion of benefits and disbenefits against the proportion of the population in each income quintile for the modelled zones impact area and development points with population assigned to varying income quintiles as outlined in step 2b.

Table 3-25 – Sensitivity test 1

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,596,271	10,528,723	10,486,044	10,380,069	10,941,904	52,933,011
Proportion of each group	19.8%	19.9%	19.8%	19.6%	20.7%	-
Total benefits	-	£84,845	£19,300	-	£215,187	£319,332
Distribution of benefits	-	44.4%	10.1%	-	112.7%	-
Sum of disbenefits	-£44,889	-	-	-£83,495	-	-£128,384
Distribution of disbenefits	-23.5%	-	-	-43.7%	-	-
Overall	-£44,889	£84,845	£19,300	-£83,495	£215,187	£190,948
Assessment	Slight Adverse	Large Beneficial	Slight Beneficial	Slight Adverse	Large Beneficial	**Slight Beneficial**

Table 3-26 – Sensitivity test 2

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,620,139	10,486,044	10,380,069	10,941,904	52,933,011
Proportion of each group	19.8%	20.1%	19.8%	19.6%	20.7%	-
Total benefits	£6,415	£33,541	£19,300	-	£215,187	£274,443
Distribution of benefits	3.4%	17.6%	10.1%	-	112.7%	-
Sum of disbenefits	-	-	-	-£83,495	-	-£83,495
Distribution of disbenefits	-	-	-	-43.7%	-	-
Overall	£6,415	£33,541	£19,300	-£83,495	£215,187	£190,948
Assessment	Slight Beneficial	Moderate Beneficial	Slight Beneficial	Slight Adverse	Large Beneficial	**Slight Beneficial**

Table 3-27 – Sensitivity test 3

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,528,723	10,577,460	10,380,069	10,941,904	52,933,011
Proportion of each group	19.8%	19.9%	20.0%	19.6%	20.7%	-
Total benefits	£6,415	£84,845	-	-	£215,187	£306,447
Distribution of benefits	3.4%	44.4%	-	-	112.7%	-
Sum of disbenefits	-	-	-£32,004	-£83,495	-	-£115,499
Distribution of disbenefits	-	-	-16.8%	-43.7%	-	-
Overall	£6,415	£84,845	-£32,004	-£83,495	£215,187	£190,948
Assessment	Slight Beneficial	Large Beneficial	Slight Adverse	Slight Adverse	Large Beneficial	**Slight Beneficial**

Table 3-28 – Sensitivity test 4

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,528,723	10,486,044	10,471,485	10,941,904	52,933,011
Proportion of each group	19.8%	19.9%	19.8%	19.8%	20.7%	-
Total benefits	£6,415	£84,845	£19,300	-	£215,187	£325,747
Distribution of benefits	3.4%	44.4%	10.1%	-	112.7%	-
Sum of disbenefits	-	-	-	-£134,799	-	-£134,799
Distribution of disbenefits	-	-	-	-70.6%	-	-
Overall	£6,415	£84,845	£19,300	-£134,799	£215,187	£190,948
Assessment	Slight Beneficial	Large Beneficial	Slight Beneficial	Slight Adverse	Large Beneficial	**Slight Beneficial**

Table 3-29 – Sensitivity test 5

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Total population	10,504,855	10,528,723	10,486,044	10,380,069	11,033,320	52,933,011
Proportion of each group	19.8%	19.9%	19.8%	19.6%	20.8%	-
Total benefits	£6,415	£84,845	£19,300	-	£163,883	£274,443
Distribution of benefits	3.4%	44.4%	10.1%	-	85.8%	-
Sum of disbenefits	-	-	-	-£83,495	-	-£83,495
Distribution of disbenefits	-	-	-	-43.7%	-	-
Overall	£6,415	£84,845	£19,300	-£83,495	£163,883	£190,948
Assessment	Slight Beneficial	Large Beneficial	Slight Beneficial	Slight Adverse	Large Beneficial	**Slight Beneficial**

Combined assessments were completed based on five sensitivity tests for new development points. As would be expected allocating the new development points populations to each quintile altered the amount of affordability benefits or disbenefits to each respective quintile.

Sensitivity test 1 and sensitivity test 3 showed the respective quintiles change from receiving benefits to disbenefits. Sensitivity test 2 and 5 showed the population in these quintiles still receiving benefits. Sensitivity test 4 shows income quintile 4 received disbenefits as a result of the development points being assigned as income quintile 4.

All sensitivity tests result in an overall assessment of slight beneficial.

3.8.4.   Outcome

Overall, there are net affordability benefits derived from the scheme, approximately £0.24m for the scheme modelled zones only and £0.19m for the scheme modelled zones and development points sensitivity tests over the 60-year appraisal period.

Table 3-30 illustrates the affordability assessment for the baseline and, each sensitivity test and an overall user benefits assessment. Based on the below assessments, M4 Junction 17 scheme overall impact on affordability has been assessed as **slight beneficial**.

Table 3-30 – Outcome of the affordability assessment

Vulnerable Group	Baseline User Benefits Assessment	Sensitivity Test 1 Benefits Assessment	Sensitivity Test 2 Benefits Assessment	Sensitivity Test 3 Benefits Assessment	Sensitivity Test 4 Benefits Assessment	Sensitivity Test 5 Benefits Assessment	Overall benefits Assessment
Quintile 1 (most deprived)	Slight Beneficial	Slight Adverse	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Beneficial
Quintile 2	Large Beneficial	Large Beneficial	Moderate Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial
Quintile 3	Slight Beneficial	Slight Beneficial	Slight Beneficial	Slight Adverse	Slight Beneficial	Slight Beneficial	Slight Beneficial
Quintile 4	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse
Quintile 5 (least deprived)	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial	Large Beneficial
Overall	**Slight Beneficial**	**Slight Beneficial**	**Slight Beneficial**	**Slight Beneficial**	**Slight Beneficial**	**Slight Beneficial**	**Slight Beneficial**

3.9. Accessibility

3.9.1. Step 1 – Screening

Comments

TAG Unit 4-2 states that the appraisal of accessibility focuses on the public transport accessibility aspect of accessing employment, services and social networks. As the M4 J17 scheme is not a public transport scheme, accessibility is likely to be minimally affected. As a result, no further assessment of accessibility distributional impacts is required.

It should be noted that based on available information at this stage, a high-level accessibility assessment was undertaken as part of the Social Impact Appraisal (see Section 2.6).

Outcome

No further appraisal needed.

4.   Summary of findings

This report details the findings of the Social and Distributional Impact (SDI) Appraisal undertaken for the M4 Junction 17 Scheme. An assessment of the social impacts is presented in accordance with the Department for Transport's Transport Analysis Guidance (TAG) Unit A4-1 'Social Impact Appraisal' (May 2020). The analysis of Distributional Impacts (DIs) was undertaken in accordance with the Department for Transport's Transport Analysis Guidance (TAG) Unit A4-2 'Distributional Impact Appraisal' (May 2020).

Using an approach which is appropriate to the size of scheme and the effort required to collect and develop bespoke data, a qualitative approach was deemed suitable for most social indicators, although a quantitative assessment was undertaken where evidence was available. A summary of findings for the Social Impact Appraisal (**Table 4-1**) is outlined below.

Table 4-1 – Summary of findings from the Social Impact Appraisal

Social Impact Appraisal indicators	Assessment
Physical Activity	Neutral
Security	Neutral
Severance	Slight beneficial
Journey Quality	Slight beneficial
Option Values and Non-use Values	No assessment required
Accessibility	Slight beneficial
Personal Affordability	Slight beneficial
Collisions	Neutral

Table 4-2 presents a summary of the Distributional Impact Appraisal for inclusion in the Appraisal Summary Table. This provides a final assessment for each indicator as a result of the scheme. The variance of impacts across quintiles of income deprivation is shown in **Table 4-3**. Finally, **Table 4-4** provides a summary of the impact of each indicator on vulnerable groups.

Table 4-2 – Summary of findings from the Distributional Impact Appraisal

Distributional Impact Appraisal indicators	Assessment
Collisions	Neutral
Noise	Slight beneficial
Air Quality	Slight adverse
Security	No assessment required
Severance	Neutral
Accessibility	No assessment required
User Benefits	Moderate beneficial
Personal Affordability	Slight beneficial

Table 4-3 – Distribution of impacts across income quintiles

|	0-20%	20-40%	40-60%	60-80%	80-100%	Are impacts distributed evenly?	Key Impacts/ Qualitative comments
User benefits	Slight beneficial	Slight beneficial	Slight beneficial	Large beneficial	Large beneficial	No	User benefits impacts favour the least deprived income quintiles as large beneficial versus slight beneficial for the most income deprived quintiles. However, all income quintiles are appraised as beneficial.
Noise	Neutral	Neutral	Neutral	Moderate beneficial	Slight beneficial	No	Noise impacts favour least deprived income quintiles. Residents in the least income quintiles experience slight to moderate beneficial impacts. Therefore, the impact is distributed unevenly.
Air quality	Neutral	Neutral	Neutral	Slight adverse	Moderate adverse	No	Air quality impacts mostly impact residents in income quintiles 4 and 5, which experience a slight to moderate adverse impact on air quality from the scheme. Those in the most deprived income quintile (quintile 1) that may be considered to be the most vulnerable experience a neutral impact due to the lack of presence in the study area.
Affordability	Slight beneficial	Large beneficial	Slight beneficial	Slight adverse	Large beneficial	No	Affordability impacts mostly favour residents in income quintile 1, 2, 3 and 5, with a slight adverse impact appraised for income quintile 4. Therefore, the impact is distributed relatively unevenly.

Table 4-4 – Distribution of impacts across social and user groups

Impact	Social groups						User groups				Qualitative statement (including any impact on residential population and identified amenities)
	Children and young people	Older people	Women	Disabled	BME	No access to car or van	Pedestrians	Cyclists	Motorcyclists	Young males	
Collisions	o	o					o	o	o	o	The analysis has shown that the majority of roads experience a slight disbenefit in terms of collisions, as there are more links that will experience an increase ('disbenefit') in collision rates than those experiencing a decrease in collision rates ('benefit'). However, detailed analysis of existing collision data demonstrates that collisions involving the vulnerable groups are generally not significantly different between links that are forecast to increase or decrease and are minimal compared to the wider impact area, therefore, the majority of vulnerable groups are assessed as neutral.
Noise	✓	✓									Since there are more properties with decreased noise levels in proximity to schools within the noise impact area, a slight beneficial benefit to noise is anticipated. There is a greater than national average population of elderly residents and a daytime population of children, therefore, both vulnerable groups are assessed as slight beneficial.
Air quality	x										A slight adverse assessment was outlined for air quality for children as there are more links with decreased PM2.5 and NO2 than with increased levels in areas with the 20% highest proportions of children.
Security											Security was screened out; therefore, a full appraisal was not carried out.

Impact	Social groups						User groups				Qualitative statement (including any impact on residential population and identified amenities)
	Children and young people	Older people	Women	Disabled	BME	No access to car or van	Pedestrians	Cyclists	Motorcyclists	Young males	
Severance	x	✓		o		o					Older people were appraised as having a slight beneficial impact in terms of severance due to improvements as a result of the M4 J17 improvements where there are high concentrations of older people present. A slight adverse impact was appraised for children due to increase in traffic flows contributing to increase severance in proximity to populations of children. Disabled residents and no car households were appraised as neutral due to the minimal presence of these vulnerable groups in the study area.
Accessibility											Accessibility was screened out; therefore, a full appraisal was not carried out.

✓ Slight beneficial, ✓✓ moderate beneficial, ✓✓✓ large beneficial, o neutral, x slight adverse, xx moderate adverse, xxx large adverse

Appendices
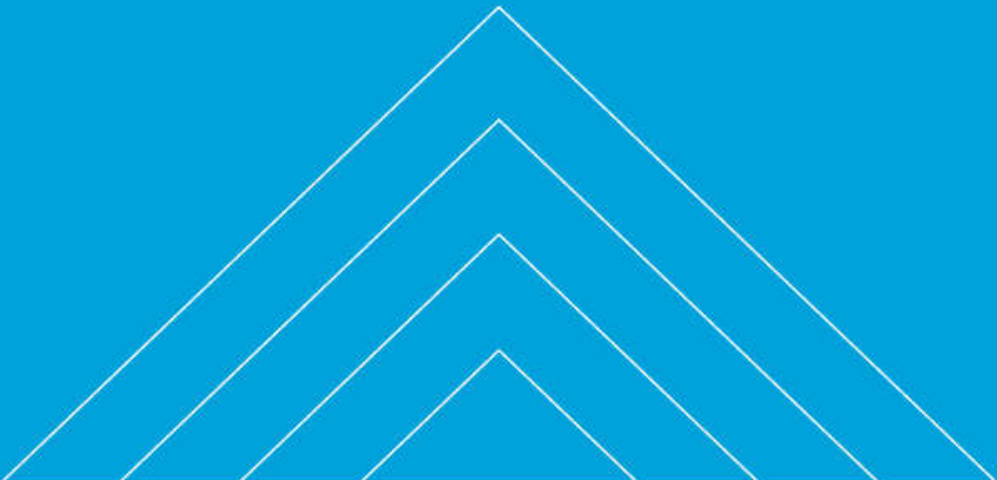
Appendix A.   Socio-demographic assessment figures

This appendix provides a socio-demographic profile of a 1km buffer around the scheme alignment, with maps illustrating specific areas of higher proportions of vulnerable groups, including income deprivation, children (under 16 years old), BAME communities and females.

Elderly (over 70 years old), DLA claimants and no car households are not displayed in mapping below as there were no geographical areas within the scheme extent or impact area which were in the greatest 20% of regions nationally of elderly population, DLA claimants or no car households. This indicates there are not high proportions of these vulnerable groups in the impact area.

The results of this analysis form the basis for the completion of Step 2b of the DI assessment.

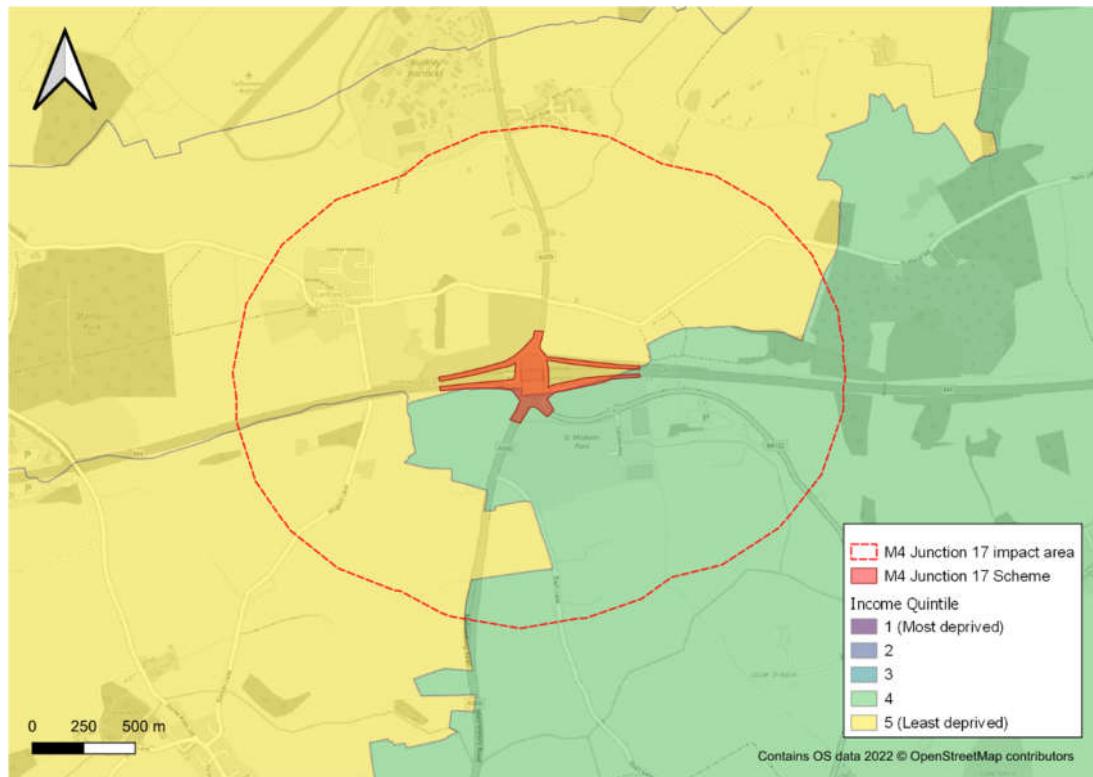**Figure A-1 – Proportion of Income Deprivation – Census 2011**

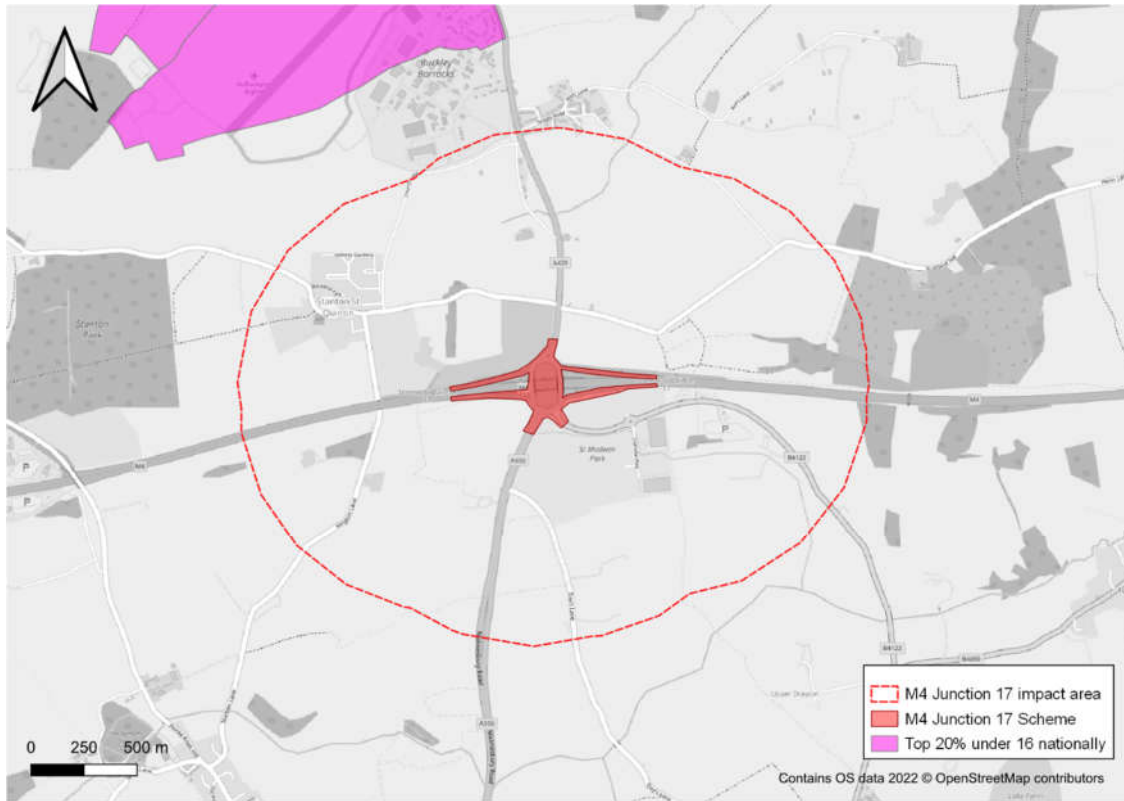**Figure A-2 – Proportion of Children (under 16) – Census 2011**

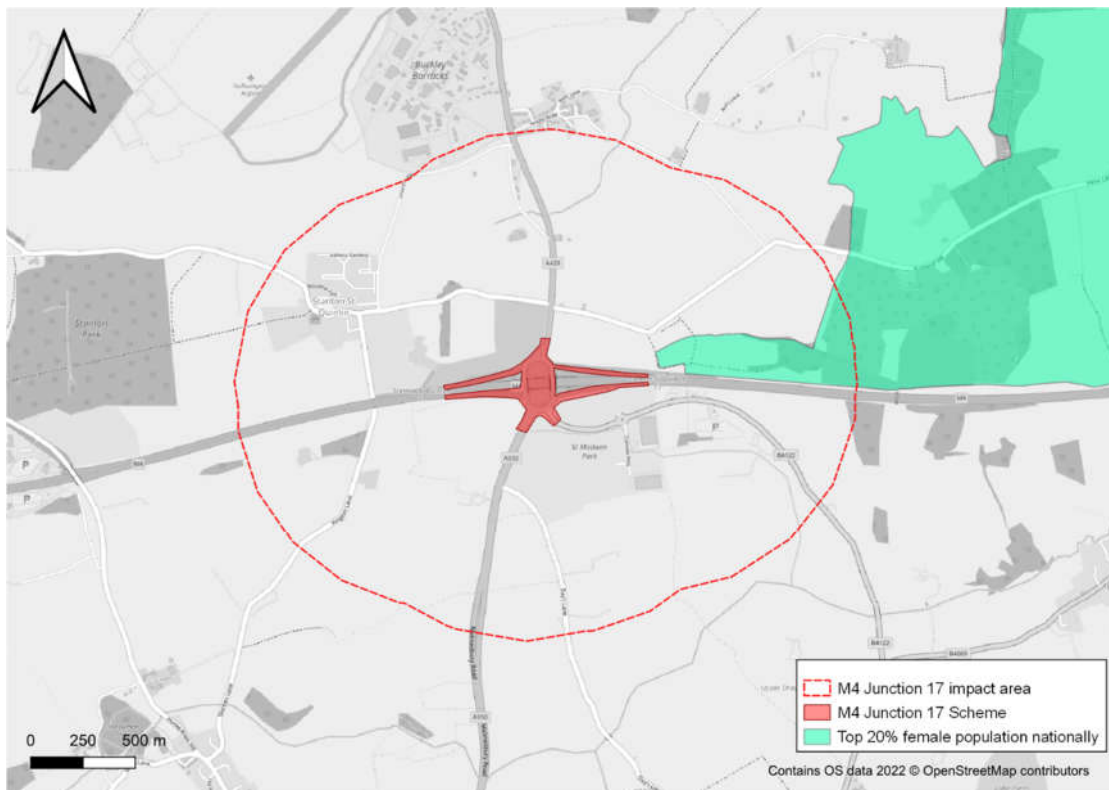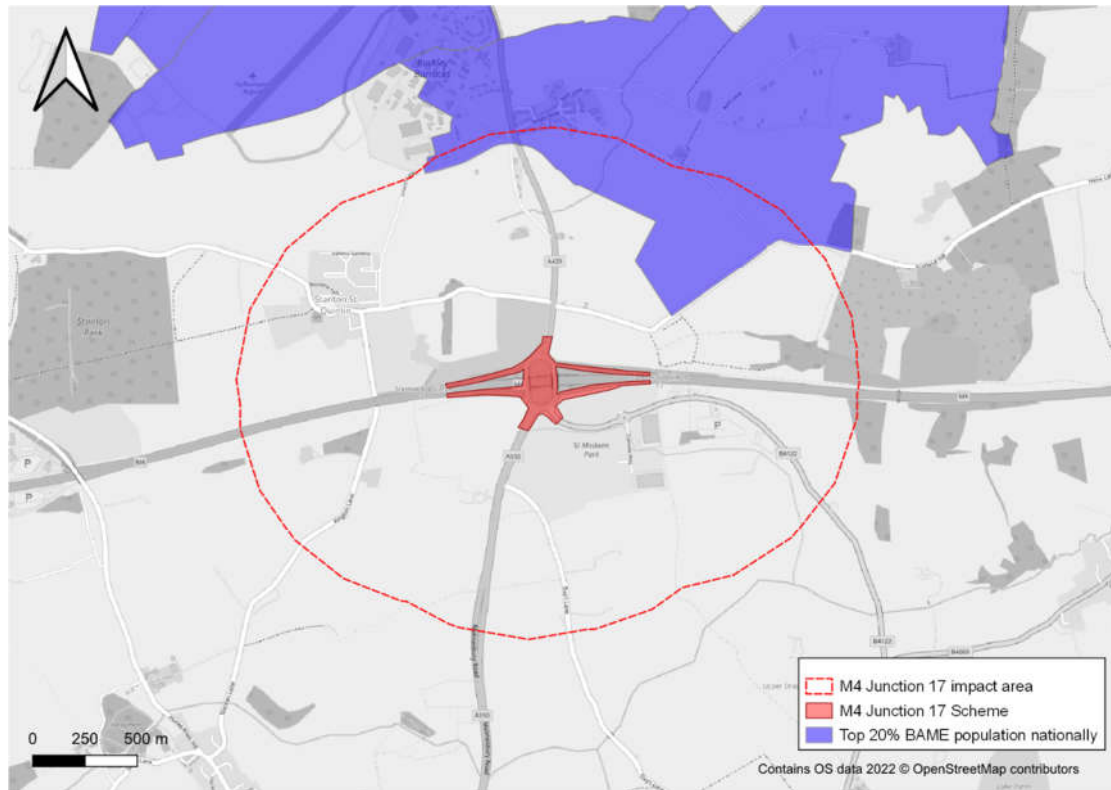**Figure A-3 – Proportion of Females – Population estimates 2019**

Figure A-4 – Proportion of Black and Minority Ethnic (BAME) groups – Census 2011

Appendix B.   Screening Proforma

ASSESSMENT OF DISTRIBUTIONAL IMPACTS (DIs) OF TRANSPORT INTERVENTIONS

Proforma for reporting conclusions of first screening stage (Step 1)

This form is intended for use by scheme promoters to capture the considerations, assessment, and conclusions of the first screening stage of the DI analysis (Step 1). For a full description of Step 1 please see TAG Unit A4.2. These initial screening tests are not intended to be onerous and should require no additional data collection or analysis. At this stage promoters are only expected to carry out a qualitative assessment, based on their professional judgement and that of the technical specialists responsible for undertaking assessment of noise, air quality, safety, security, severance, accessibility, personal affordability and user benefits.

Scheme name: The M4 Junction 17 Scheme

Brief description of scheme

The M4 J17 scheme comprises:

- Widening of M4 Westbound off-slip from two lanes to three lanes.
- Extension of flare length from two lanes to stopline on the M4 westbound off-slip.
- Two lanes allowed to make movement from the A350 northbound approach to the M4 westbound on-slip.
- Extension of the southbound flare from two lane section on A429 southbound approach to the stopline.
- Widening of approach on the A429 southbound from 2 to 3 lanes.

Scheme Objectives

Five transport objectives have been identified for the scheme, which would help to deliver desired strategic and local outcomes.

- To reduce delay and improve journey time reliability at M4 Junction 17, supporting journeys on the SRN.
- To support the overall success of the A350 improvements programme (including MRN) by delivering complementary improvements at M4 Junction 17.
- To improve north-south connectivity on the A350 through improvements to M4 Junction 17, the gateway to the A350 from the SRN.
- Ensure that M4 Junction 17 has the capacity to accommodate planned and future growth in the A350 Corridor and in the A350 and Swindon M4 SWLEP Growth Zones, including the Chippenham Urban Expansion and the Wiltshire Local Plan Review.
- Improve existing safety levels at M4 Junction 17, taking into account forecast traffic growth.

Indicator	(a) Appraisal output criteria	(b) Potential impact (yes / no, positive/negative if known)	(c) Qualitative Comments	(d) Proceed to Step 2
User benefits	The TUBA user benefit analysis software or an equivalent process has been used in the appraisal; and/or the value of user benefits Transport Economic Efficiency (TEE) table is non-zero.	Yes – positive	Currently, journey time is negatively impacted by high levels of congestion experienced on the M4 J17. The widening of the junction from two to three lanes on the M4 J17 approaches and gyratory is intended to improve journey time reliability. As journey times will be reduced, local residents will also benefit.	Yes – distribution of benefits across different areas will need to be examined.
Noise	Any change in alignment of transport corridor or any links with significant changes (>25% or < -20%) in vehicle flow, speed or %HDV content.	Yes – the overall impact is expected to be positive, however some areas may experience dis-benefits.	The scheme aims to have an overall positive effect, with the aim to improve north-south connectivity reducing congestion in local areas to the north and south of the junction. However, some areas in proximity to the junction may be exposed to increased noise levels due to a widening of the junction allowing higher vehicle flows.	Yes - noise impact on local areas will need to be examined

Air quality	Any change in alignment of transport corridor or any links with significant changes in vehicle flow, speed or %HDV content: • Change in 24-hour AADT of 1000 vehicles or more • Change in 24-hour AADT of HDV of 200 HDV vehicles or more • Change in daily average speed of 10kph or more • Change in peak hour speed of 20kph or more	Yes – the overall impact is expected to be positive, however some areas may experience dis-benefits.	Reduced congestion and changes in flow rates will have an impact on emissions in the area. As a consequence, there is a need to examine the outputs from the air quality assessments to ascertain the distribution of impacts across income groups and children in the assessment area.	Yes - air quality impact on local areas will need to be examined
Collisions	Any change in alignment of transport corridor (or road layout) that may have positive or negative safety impacts, or any links with significant changes in vehicle flow, speed, %HGV content or any significant change (>10%) in the number of pedestrians, cyclists or motorcyclists using road network.	Yes – positive	The scheme aims to improve existing safety levels at M4 Junction 17, considering forecast traffic growth. As the intervention is likely to cause significant changes in vehicle flow, changes in collision levels will need to be examined further to assess the full impact.	Yes - changes in accident levels, particularly for vulnerable groups, will need to be examined.
Security	Any change in public transport waiting/interchange facilities including pedestrian access expected to affect user perceptions of personal security.	No	There are no planned changes to public transport waiting/interchange services. There should be no changes in user perception of personal security since no pedestrianised areas are affected by the scheme. As a result, no further assessment is required.	No

Severance	Introduction or removal of barriers to pedestrian movement, either through changes to road crossing provision, or through introduction of new public transport or road corridors. Any areas with significant changes (>10%) in vehicle flow, speed, %HGV content.	Yes - the overall impact is expected to be positive, however some areas may experience dis-benefits	The scheme will likely result in increased flows on main roads due to capacity improvements. However, there is expected to be a reduction in traffic on local roads resulting in an overall positive impact on severance, as traffic will be diverted away local roads. Other roads may also experience a change in traffic volume due to traffic redistribution.	Yes - changes to severance, particularly for vulnerable groups, will need to be examined
Accessibility	Changes in routings or timings of current public transport services, any changes to public transport provision, including routing, frequencies, waiting facilities (bus stops / rail stations) and rolling stock, or any indirect impacts on accessibility to services.	No	The scheme does not introduce any new bus stops, timings or services. Therefore, further assessment of accessibility is not required.	No further appraisal needed.
Affordability	In cases where the following charges would occur; Parking charges; Car fuel and non-fuel operating costs (where, for example, rerouting or changes in journey speeds and congestion occur resulting in changes in costs); Road user charges; Public transport fare changes; or public transport concession availability.	Yes- unknown	The scheme will result in a number of links experiencing changes in traffic volumes and hence changes in car fuel and non-fuel operating costs might be considered. TUBA outputs by themselves do not show whether these costs are distributed evenly across income groups. As a result, a further analysis should be completed to quantify the potential distribution of affordability impacts amongst different income groups.	Yes - distribution of benefits across the area will need to be examined

Appendix C. Identification of amenities in the impact area

The concentration of vulnerable groups is based not only on the resident population but also on trip attractors/amenities that are within the impact area. There are several amenities within the area that will attract vulnerable groups; hence adding to the movement and daytime population of those considered vulnerable to any impacts. Using desktop analysis, the local amenities which are likely to be used by the identified social groups for each DI indicator are identified.

Figure C1-1 – Amenities in the M4 J17 Scheme area

Figure C1-1 shows where amenities located within the study area. The area is not highly populated, hence there is not a large number of amenities in the local area. The majority of amenities are located in Stanton St Quintin to the north west of the impact area and to the north of the scheme in proximity to Buckley Barracks located outside of the impact area. Within the 1km impact area there are 5 bus stops, 1 church, 1 school, 1 community centre and 1 food store. There are no hospitals or care homes located in the study area.

Some of these amenities include:

- St Giles Church
- Stanton St Quintin Primary and Nursery School
- Stanton St Quintin Village Hall
- Costcutter

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