Tayside and Central Scotland Regional Transport Strategy

DRAFT Appraisal Summary Tables

February 2023

The below tables provide an assessment of the potential impacts of interventions being considered for the emerging Tayside and Central Scotland Regional Transport Strategy.

The individual interventions have been grouped into nine delivery themes for presentational purposes, comprising:

1. Improving safety
2. Influencing travel choices and behaviour
3. Improving access to public transport
4. Improving sustainable travel opportunities
5. Decarbonising transport and a just transition
6. Improving the accessibility and security of our transport networks
7. Reducing the need to travel by car through the location of development and services
8. Improving strategic connectivity
9. Improving network resilience

The assessment of delivery themes has been made based on a seven-point score, as shown in the below table:

+++	Major Positive
++	Positive
+	Minor Positive
0	Neutral
-	Minor Negative
--	Negative
---	Major Negative

1. Improving safety

Potential interventions include:

I. Reduce Speeds

i. Reducing speeds in Settlements
- Expansion of 20mph limits and zones
- Review speed limits in residential and neighbourhood environments focusing on areas with road safety concerns
- Other localised safety schemes such as traffic calming measures and road / junction realignments and redesigns

ii. Addressing network blackspots
- Review speed limits
- Road / junction realignments and redesigns

iii. Road safety enforcement, including enforcement of speed restrictions via camera technology

II. Provide Road Safety Education

Education measures, which include training and publicity, aiming to provide road users with the knowledge and skills needed to use the roads safely. Focused on:

i. Road safety education pre-school, primary and secondary schools
ii. Road safety education for adults, such as drivers
iii. Road safety education for 17-25yr olds

III. Improve Rest and Welfare Facilities for Hauliers

Increase the range of rest facilities within the region available to drivers

Freight is still predominantly road-based with most drivers regularly traveling long distances. Without sufficient rest, drivers can experience fatigue which can be dangerous for themselves and other road users.

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	Creating residential areas where people feel safer on the roads is likely to encourage a greater number of trips by active travel leading to lower traffic emissions. Providing people with the knowledge and skills needed to use the road safely is likely to encourage a greater number of trips by active travel leading to lower traffic emissions.	+
PO2: Improving Health and Wellbeing	Creating residential areas where people feel safer on the roads is likely to encourage a greater number of trips by active travel leading to increased health and wellbeing benefits.	+

Objective	Qualitative Impact	Score
	Physical inactivity can cause a range of chronic diseases. There is unequivocal evidence from many reviews that have linked it with increased risk of coronary heart disease and stroke, as well as certain cancers and diabetes. Physical activity also has an impact on mental health and has a protective function against depression, dementia, and anxiety.	

	Angus	Dundee City	Perth and Kinross	Stirling	Scotland
Rate for Cancer Registration	562	635	575	584	634
Rate for patients hospitalised for chronic heart disease	401	479	337	348	440
Percentage of people prescribed medication for anxiety, depression or psychosis	17	20	15	16	17

Table 1: Ill-Health and Mental Health 2011 - 2013[1]

Likewise physical activity also reduces the risk of injuries from falls in old age.

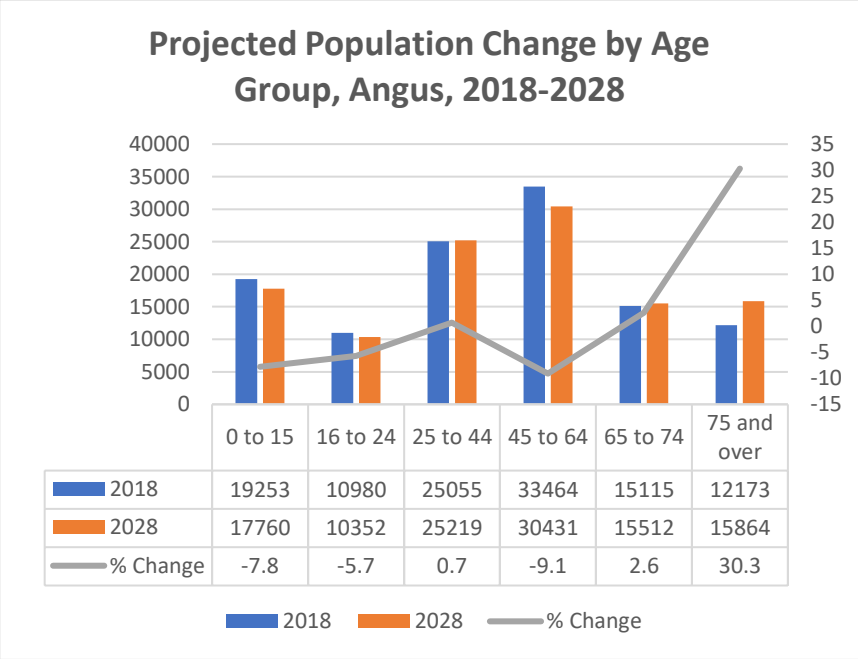
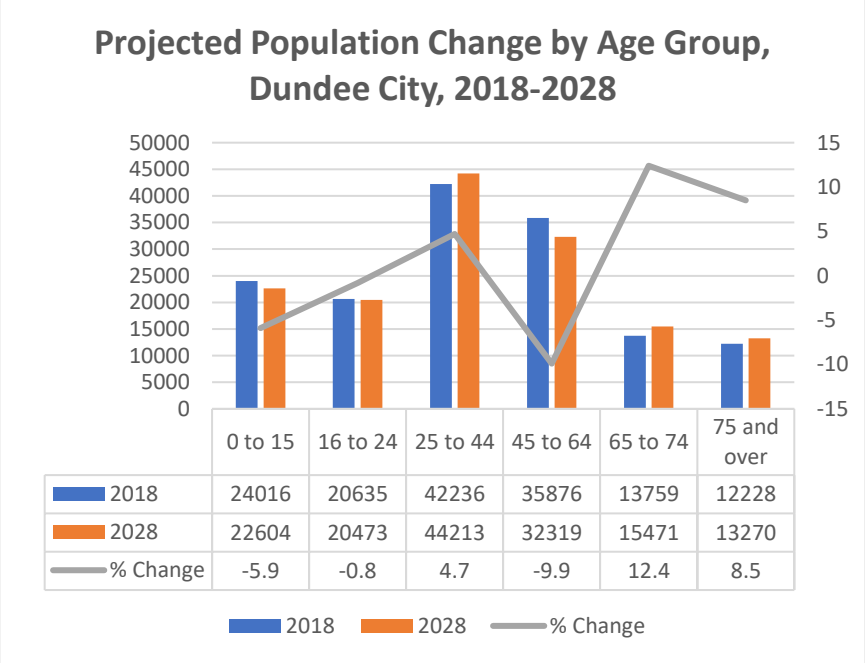
By 2028 the population in the Tactran region is projected to increase by 1.0% from 510,410 in 2018 to 515,103 in 2028. The population change varies considerably by constituent Council, with both Angus (-0.8%) and Dundee City's (-0.3%) population expected to fall slightly by 2028. In Perth and Kinross, the population is projected to increase by 1.0% between 2018 and 2028, and the population of Stirling will increase by 4.8% by 2028[2].

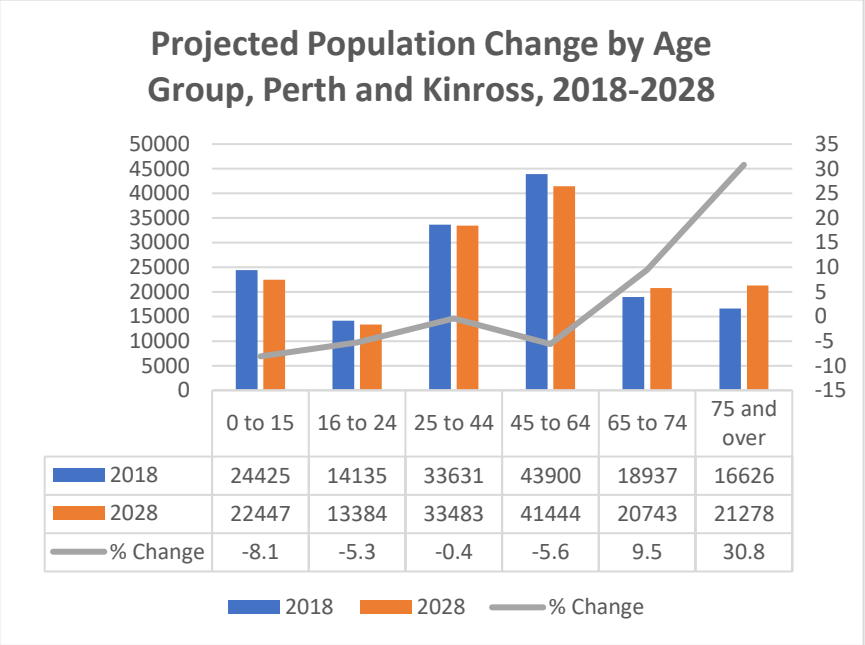
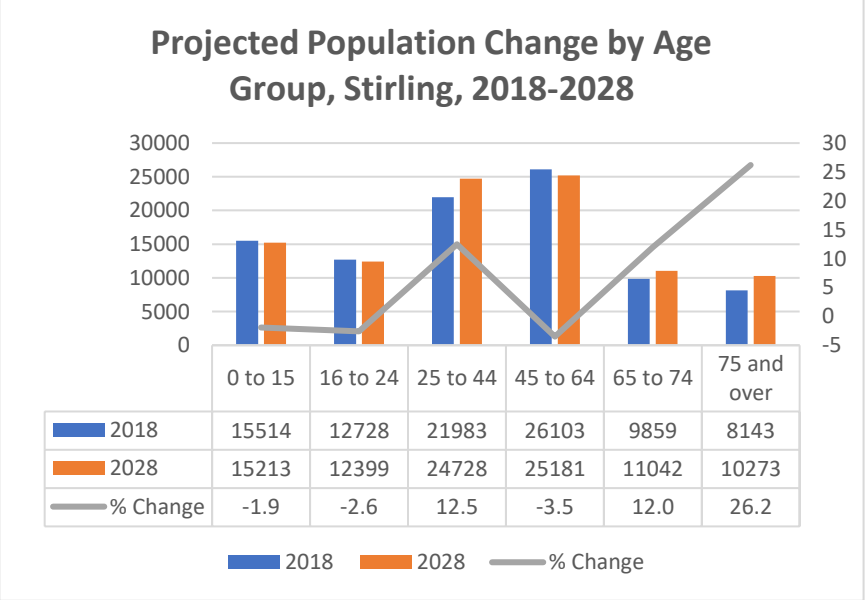
The projected change is not consistent across all age groups. Continuing the current trend of an increasingly ageing population, between 2018 and 2028, the 65 to 74 age group (+8.8%) the 75 and over age group (+23.8%) is projected to see the largest percentage increase[3].

[1] MILLARD A, MCCARTNEY G, MACKINNON A, VAN HEELSUM A, GASIOROWSKI A, BARKAT S. Angus, Dundee City, Perth and Kinross and Stiling Health and Wellbeing Profiles – key indicators and overview. Edinburgh: ScotPHO; 2016.

[2] NATIONAL RECORDS OF SCOTLAND (2020): Population Estimates Time Series Data

[3] NATIONAL RECORDS OF SCOTLAND (2020): Population projections for Scottish Areas (2018-based)

Objective	Qualitative Impact	Score
	 *Source: National Records of Scotland (2020): Population projections for Scottish Areas (2018-based)*  *Source: IBID*	

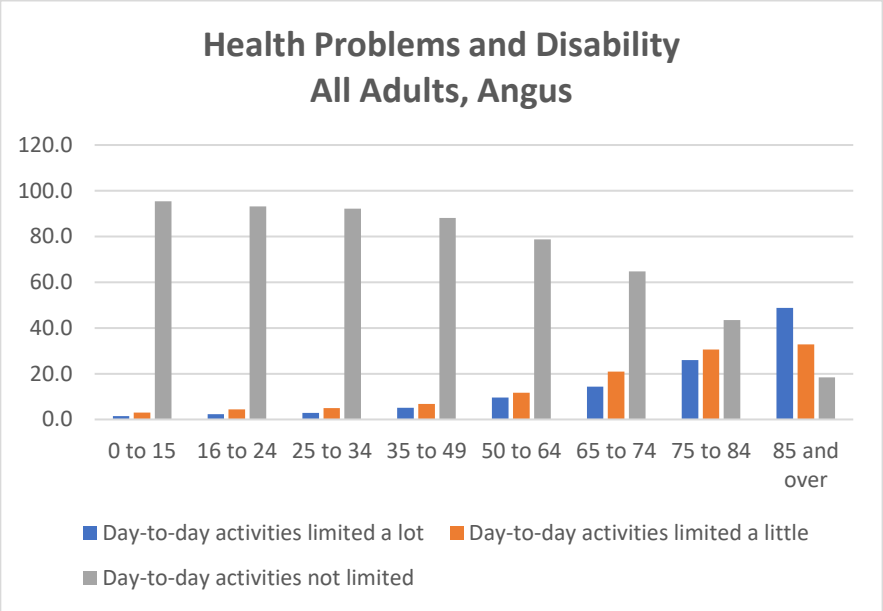
Objective	Qualitative Impact	Score
	 *Source: IBID*  *Source: IBID* Motor traffic volume is also a cause of injury. An increase of 1,000 vehicles a day on a road is associated with a 6% increase in pedestrian injuries, a 5% increase in cyclist injuries, and a 7% increase in vehicle occupant injuries[4]. Road safety education is a critical element helping to achieve the safety of all road users, including casualty reductions, and facilitating safe means of active travel.	

[4] Cp. MORENCY (2012): Neighbourhood social inequalities in road traffic injuries: the influence of traffic volume and road design. In: Am J Public Health, 2012;102:1112–1119

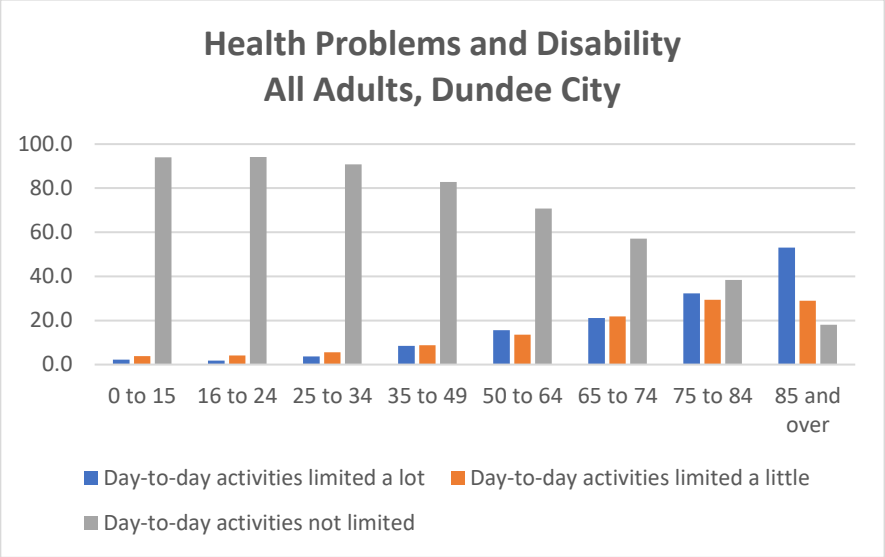
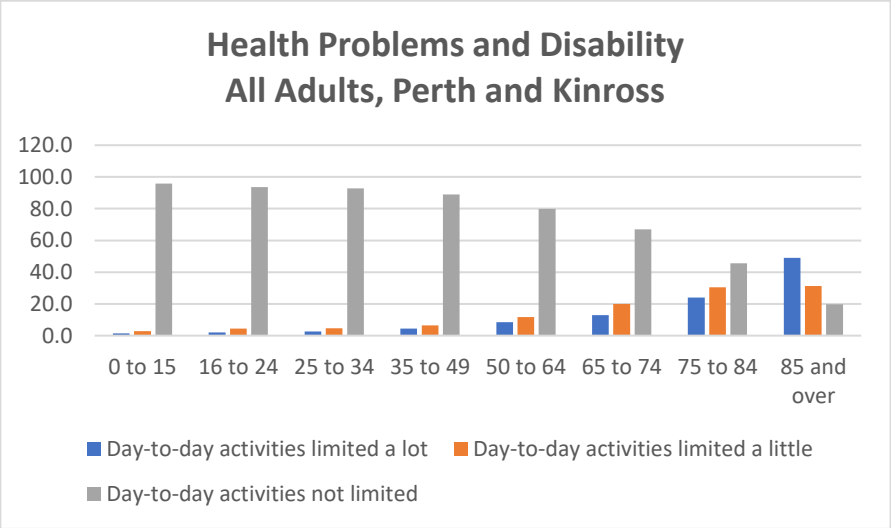
Objective	Qualitative Impact	Score
	In 2018, research into the 20pmh limit programmes was carried out. The research was based on 12 case study schemes in England, finding that 69% of residents agreed that the 20mph limits are beneficial for cycling and walking. From 1994, there was a widespread introduction of 20mph zones in Hull, and by 2003, there were 120 zones covering 500 streets. The casualty statistics between 1994 and 2001 showed a drop of 14% in Hull, compared to a rise of 1.5% in the rest of Yorkshire and Humberside. A 2007 review of half of the 20mph zones which had been implemented in London (78 zones) found that they reduced injury accidents by about 42% and fatal or serious accidents by 53% (cp. Webster, D. and R. Layfield (2007): Review of 20 mph zones in London Boroughs). Potential for increased speeds outwith the areas with traffic calming measures as drivers try to make up for lost time. Potential displacement of traffic onto streets not within the 20mph zone. However, the evaluation of the 20mph scheme that was introduced in Edinburgh found no evidence of displacement of traffic from 20mph streets onto 30mph streets after implementation of the lower speed limit[5]. Improving rest facilities for hauliers will be reducing the risk of accidents, including those with hazardous materials.	
PO3: Reducing Inequalities	People with no social contact are between two to four and a half times more times likely to die prematurely than those who have the most social contacts. Social support networks are also important for good health. A recent review identified that wide social support networks reduce depression and problem behaviours as they tend to encourage positive health behaviours such as more physical activity[6]. Motor vehicle traffic volume affects the ability of people to create and maintain social contact. People who live on streets with higher volumes of motorised traffic adapted to the level of traffic by going out less, and so had fewer friends and acquaintances on the street than those who live on streets with lower traffic volumes. Community severance is a well-established phenomenon whereby both the speed and volumes of motorised traffic on roads bisecting neighbourhoods divide individuals and communities.	+

[5] https://democracy.edinburgh.gov.uk/documents/s9492/Item%207.3%20-%20Evaluation%20of%2020mph%20with%20appendices.pdf

[6] McPherson et al (2013).: The role and impact of social capital on the health and wellbeing of children and adolescents: a systematic review.

Objective	Qualitative Impact	Score
	Social contact and isolation can be a greater issue amongst the elderly. This can be the result of reduced mobility, especially where there is a lack of alternative forms of transport when an individual gives up driving. Infrastructure can limit independence and opportunities for social contact, and pedestrian crossings do not offer enough time for most older adults to cross the road. The 2011 Census collected information on the presence of a long-term health problem or disability. People were asked if their day-to-day activities were limited because of a health problem or disability which has lasted, or is expected to last, at least 12 months. In Angus, 8.4% of people reported a health problem or disability which limited activities 'a lot' and 10.5% reported a health problem or disability which limited activities 'a little'[7]. The proportion of people whose activities were limited was highest in the 65+ year group, with 22.6% saying their activities were limited 'a lot' and 25.7% saying their activities were limited 'a little'[8].  *Source: Scotland's Census, 2011* In Dundee City, 10.5% of people reported a health problem or disability which limited activities 'a lot' and 10.4% reported a health problem or disability which limited activities 'a little'[9]. With 29.4% of the over 65s saying their activities were limited 'a lot' and 25.5% saying their activities were limited 'a little'[10], the proportion of people	

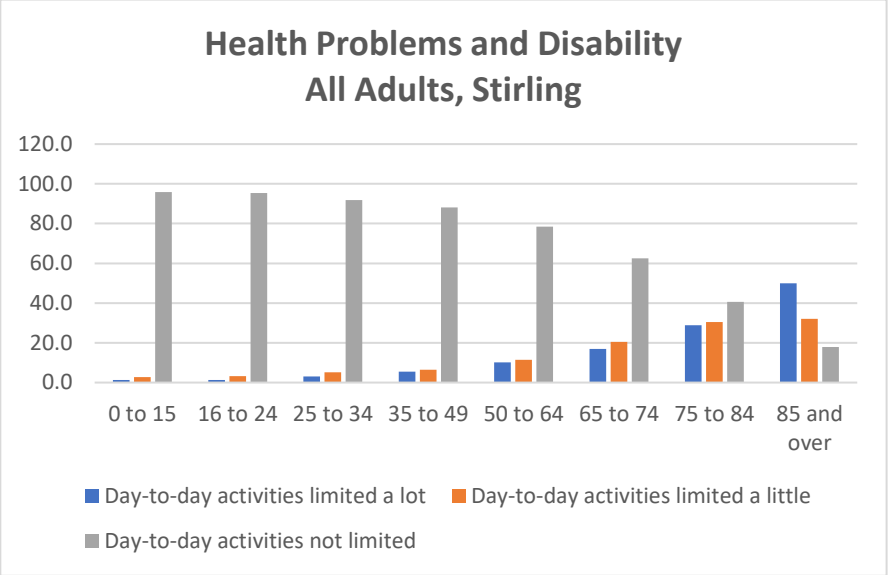
[7] NATIONAL RECORDS OF SCOTLAND (2012): Scotland's Census (2011)
[8] IBID
[9] NATIONAL RECORDS OF SCOTLAND (2012): Scotland's Census 2011
[10] IBID

Objective	Qualitative Impact	Score
	whose activities were limited because of a health problem or disability was highest in this age group.  *Source: Scotland's Census, 2011* In Perth and Kinross, 7.8% of people reported a health problem or disability which limited activities 'a lot' and 10.3% reported a health problem or disability which limited activities 'a little'[11]. 21.3% of the over 65s saying their activities were limited 'a lot' and 25.3% saying their activities were limited 'a little'[12].  *Source: Scotland's Census, 2011* In Stirling, 8.1% of people reported a health problem or disability which limited activities 'a lot' and 9.4% reported a health problem or disability which limited activities 'a little'[13]. The proportion of people	

[11] IBID

[12] IBID

[13] NATIONAL RECORDS OF SCOTLAND (2012): Scotland's Census 2011

Objective	Qualitative Impact	Score
	whose activities were limited was highest in the 65+ year group, with 24.8% saying their activities were limited 'a lot' and 25.2% saying their activities were limited 'a little'[14].  *Source: Scotland's Census, 2011* People living in more deprived areas often have less access to a car. This can result in social exclusion when it is harder to access education, work or healthcare. Children from the most deprived backgrounds are five times more likely to be injured on the roads compared with children from the most affluent backgrounds[15]. Other research making the same comparison, but using a different measure of social background, found that the pedestrian fatality rate per population was 20 times higher amongst children from the most deprived backgrounds than children from the least deprived[16]. In part, this is due to higher levels of walking or cycling, but also due to the social environment characterised in the more deprived areas. Despite lower car ownership, deprived areas often have roads which carry large volumes of through traffic which can lead to an increased risk of injury from road traffic collisions.	
PO4: Delivering Sustainable and Inclusive	Increased traffic journey times will lead to economic disbenefits with regards to Transport Economic Efficiency (TEE). The 2018 research study mentioned above, based on 12 case study schemes in England (cp. ATKINS, AECOM, MAHER, M (2018): 20mph Research Study - Process and Impact Evaluation: Headline Report) estimated that journey times have increased by 3% in residential areas and 5% in	++

[14] IBID

[15] Cp. ROBERTS and POWER (1996): Does the decline in child injury mortality vary by social class? A comparison of class specific mortality in 1981 and 1991. In: BMJ, 1996;313:784

[16] Cp. EDWARDS ET AL.(2006): Deaths from injury in children and employment status in family: analysis of trends in class specific death rates. In: BMJ, 2006

Objective	Qualitative Impact	Score
Economic Growth	city centre areas, based on the observed change in median speed (from journey speed data), adding less than half a minute to a two-mile trip and less than a minute to a five-mile trip. Potential for reduced visits to shops and local facilities within the 20mph zone. However, in the research study noted above, very few residents (3%) believed that the new speed limit meant that people were avoiding the 20-mph areas and were less likely to use local shops and amenities so there is unlikely to be any significant impact. Savings to the public purse from the reduced economic cost of accidents, including loss of output due to injury, human cost of casualties, damage to vehicle and property and police and insurance administration cost. Reduced costs to the regional economy due to reduced numbers of fatal, serious and slight casualties. Reduced costs to the National Health Service due to reduced numbers of fatal, serious and slight casualties. Rest and welfare facilities may hold the potential to cluster economic activities around rest areas such as by combining them with local consolidation centres for freight.	

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	No significant effects identified.	0
	Population and Human Health	Providing for safer travel may encourage more active travel and increase the use of public transport within the region. This may result in positive effects on physical activity, providing mental and physical health benefits. This may be of particular to adults and young people. Participation is physical activity is lower in older people (75+), unemployed and low-income groups, and people with disabilities. However, providing for safer travel may remove some barriers to active travel modes.	+
	Soil	No significant effects identified.	0
	Water	No significant effects identified.	0
	Air Quality	A reduction in transport related emissions including pollutants related to poor air quality. Results of an assessment by Transport for London concluded	+

Objective	Sub-Objective	Qualitative Impact	Score
		that 20 mph zones have no net negative effect on emissions. If benefits from increased levels of walking, cycling and public transport are included, however, there will be a positive impact. Smoother traffic flows are also expected to reduce particulate emissions.	
	Climatic Factors	A higher number of residents participating in active travel impacts carbon emissions positively.	+
	Material assets	No significant effects identified.	0
	Cultural heritage	Improved setting of heritage assets. Townscapes, streetscapes and heritage conversation will benefit from reduced congestion levels and reduced levels of pollutants as more people take up active modes or shift to public transport.	+
	Landscape	As above. Townscapes in particular benefit from the respective measures.	+
Safety	Accidents	A reduced number of road casualties from road safety infrastructure improvements and lower speeds as well as increased safety awareness and training. The Edinburgh 20mph scheme has seen a statistically significant reduction in average speed of 1.34mph across the 66 speed survey locations where the speed limit was reduced.	++
	Security	Measures will include safety and town and street scape enhancement schemes, creating a more secure transport network and reducing the opportunity for crime.	++
Economy	Transport Economic Efficiencies (TEE)	Based on the observed changes in median speeds, a recent study on the effectiveness of 20mph signed only speed limits, estimated a minimal increase in journey time[17]. According to the study journey times within residential areas are forecasted to increase by 3% and those within city centre areas are estimated to increase by 5%. This adds less than half a minute to a two-mile trip and less than a minute to a five-mile trip[18].	++
	Reliability	As TEE above.	++

[17] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/757302/20mph-technical-report.pdf

[18] IBID

Objective	Sub-Objective	Qualitative Impact	Score
	Wider Economic Impacts	Road casualties and fatalities have a serious detrimental impact on the economy. The emergency and health costs along with the lost economic output are significant. The Department for Transport estimates of the wider costs to society that can be attached to road traffic collisions involving personal injury are as follows per incident: Fatal - £2,053,814; Serious - £237,527; and Slight - £ 24,911. Accident-related congestion and the subsequently reduced reliability and resilience of the transport network also contribute significantly to the wider economic costs.	++
Integration	Transport / Modes	Measures to improve road safety will address prevalent concerns about road safety. With the latter representing an important argument for people to decide against walking, cycling and public transport use. Reduced speeds and potentially reduced volumes of car-based traffic, would encourage more people to use active and sustainable modes more often.	+
	Land-Use Policy	Links with National Planning Framework 4 (NPF4) and the shift in land-use policy to focus on more compact communities that encourage greater levels of walking, cycling and public transport use, with less reliance on private motor vehicles, integrated with the provision of safe walking and cycling Infrastructure.	+
	Other Policies	Supports national and local policy for road safety, Vision Zero, where there are zero fatalities and injuries on Scotland's roads by 2050	+
Accessibility Social Inclusion	Severance	Interventions should result in positive effects for access and accessibility. Providing safe and convenient options to walk and cycle will encourage public transport use. They may also increase accessibility to people who may otherwise have not felt safe. Interventions will result in an increase in accessible places, and opportunities for interaction. The groups most likely to feel the benefits are older people (65+) and those who are socially isolated, have a disability, or are from low-income households.	+
	Accessibility	As above.	+

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	Implementable without any significant disruption to the transport network. Required works likely to comprise signage and localised traffic calming measures to ensure compliance. Small infrastructure projects.	Moderate consideration
	Deliverability Risk	As above.	Moderate consideration
Affordability	Costs	Edinburgh City Council estimated the total costs of the implementation of Edinburgh's 20mph network to be £2.2m over three financial years (2015-18). This comprised £465k from Edinburgh's Transport Capital budget and £675k from Scottish Government's Cycling Walking Safer Streets (CWSS) funding. A further £1.08m was expected to be available from Scottish Government's Community Links Programme, subject to successful annual funding bids[19]. Actual costs totalled £2.96m, comprising £1,957k for construction, £713k for design, contract and project management, £230k for marketing and communications and, £60k for monitoring.	Moderate consideration
	Financial Risks	Ongoing constraints in public funding may mean that constraints in respective funding programmes and reduced allocations to regions and local authorities.	Moderate consideration
Public Acceptability		A recent study on the effectiveness of 20mph signed only speed limits, showed high support both amongst residents (on average 75%) and non-residents (on average 66%)[20]. Support amongst residents further increased after the implementation of the schemes[21].	Moderate consideration

[19] https://democracy.edinburgh.gov.uk/documents/s9492/Item%207.3%20Evaluation%20of%2020mph%20with%20appendices.pdf

[20] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/757302/20mph-technical-report.pdf

[21] IBID

Objective	Sub Objective	Qualitative Impact	Score
		A representative sample of the Tactran region shows that 80% of people support measure to reduce speeds on roads, 85% support the improved provision of road safety education. Improving rest and welfare facilities for hauliers is supported by 73%[22].	

[22] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.

2. Influencing travel choices and behaviour

Potential interventions include:

I. Promoting Smarter Choices

i. Campaigns to promote active and sustainable travel in Travel to Work Areas
ii. Develop and deliver Travel Plans and School Travel Plans
iii. Promoting LiftShare / Ride Sharing schemes

II. Parking Controls, Road Space Re-Allocation and Traffic Management

The attractiveness of car use compared to public transport and active travel modes can be influenced by:

i. Workplace Parking Levy / Congestion Zone Charging
ii. Public parking charges
iii. Reallocation / Reduction of the numbers of both on-street and off-street parking spaces within town centres
iv. Reallocation of carriageway, giving more space to active and sustainable modes
v. Re-routing motorised traffic on longer and/or less direct routes for the benefit of the wider network

III. Road User Charging

Road users could be charged either for the length of trip made or for entering a specific area, such as a city centre, to encourage the use of sustainable modes to make the trip

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	Increased and more readily available information on Smarter Choices and a greater awareness of walking and cycling and public transport and its benefits through marketing could lead to more people to travel by active and sustainable modes more often, with an associated reduction in emissions and subsequent improved air quality. Reduced traffic levels and subsequently reduced carbon emissions and air pollutants, with increased bus, rail and active travel use. In Nottingham, for example, there has been a 15% rise in public transport use since 2004, a 9% decline in traffic since 2004, a 33% increase in cycle trips since 2010 and a 33% reduction in carbon emissions since 2005 since the Workplace Parking Levy scheme was introduced in 2012. All planned transport improvements identified to accompany the introduction of the workplace parking	++

Objective	Qualitative Impact	Score
	levy have been introduced within 3 years from the introduction of the scheme. In Vienna, Austria, the introduced parking management scheme has shown to decrease traffic that is seeking parking from 10 million passenger car km per year to 3.3 million passenger car km per year. The Congestion Charge in London has helped London to become the only major city in the world to see a considerable shift from private car use to public transport, walking and cycling[23]. Less polluting and likely reduced vehicles in the city centre and an associated reduction in tail-pipe carbon emissions and air pollution. Preliminary results from the introduction of the Ultra LEZ in London shows that approximately 13,500 fewer polluting cars enter the zone each day[24], with 77% of vehicles entering the zone now meeting the clean emissions standards. This resulted in: • Nitrogen dioxide (NO_2) pollution being reduced by 36% within the zone • Carbon dioxide (CO_2) emissions from road transport in the central zone being 4% (9,800 tonnes) lower than if there was no scheme. There was an 89% increase in the proportion of vehicles detected in the central zone that were compliant from February 2017 (pre scheme implementation) to September 2019 (post scheme implementation). A potentially negative impact on air quality elsewhere if journeys are redistributed away from the zone. However, preliminary results from the introduction of the London Ultra LEZ show no increase in pollution around the ULEZ boundary. There was a reduction in traffic movements into central London in May 2019 and September 2019 of between three and nine per cent when compared to 2018, indicating the wider benefits of the London ULEZ in	

[23] http://content.tfl.gov.uk/congestion-charge-factsheet.pdf

[24] https://www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/central-london-ulez-six-month-report

Objective	Qualitative Impact	Score
	encouraging people to shift to walking, cycling or using public transport instead of driving.	
PO2: Improving Health and Wellbeing	More people to travel by active and sustainable modes more often with subsequent positive health impacts. Reduced noise levels due to reduced traffic levels. Reduce accidents, particularly within centres due to reduced traffic levels and reduced traffic seeking parking.	+
PO3: Reducing Inequalities	Some population segments may benefit from being made aware of active and sustainable travel options, and hence social, training, educational or employment opportunities that they were previously unaware of. Reduced parking availability in town and city centres, may reduce the accessibility to services. Inequality in access as those being better off will find it easier to afford to pay more for parking. With regards to the introduction of a Workplace Parking Levy scheme employers can mitigate against this by not passing the charge on to employees. In Nottingham, however, 8 out of 10 employers have been passing the levy onto their employees. Inequality in accessing town centres and opportunities as the better off will find it easier to afford a new compliant vehicle so lower income groups may be disproportionately affected. However, evidence shows that lower income groups can be disproportionately affected by air pollution. Conversely, they are the least likely to own a car themselves and thus contribute less to the pollution problem. Air pollution particularly affects the very young and elderly and those with existing respiratory and cardiovascular condition. Improvements in air quality are therefore likely to have a greater impact on these more vulnerable groups.	-
PO4: Delivering Sustainable and Inclusive Economic Growth	People within the region may take up job opportunities which they were unaware they could access. Subsequently expanding the labour market. Potentially positive impact on the regional labour market – in Nottingham, there is evidence that the Workplace Parking Levy hasn't impacted on economic growth as the	++

Objective	Qualitative Impact	Score
	number of businesses has increased by approximately 25% since 2012. This has been accompanied by a net increase of 23,400 jobs[25]. Demand management will help to increase use of bus and Park and Choose sites within the region due to a shift to public transport for trips to town and city centres, also resulting in improved punctuality of public transport services due to reduced traffic levels. Potential negative impact on tourism due to a potential perception of reduced accessibility. However, evidence from Barcelona shows that although on-street parking was reduced to approximately a quarter of spaces, with subsequent public realm improvements, there were no negative impacts on tourist activities at all. Tourist activity increased in the period 2003 – 2007. Additionally, the consequent removal of parking spaces within Gent's historic city centre saw a growth in new businesses of 25% above the regional average. While the economic success cannot be attributed solely to the quality improvements of the public realm due to the conversion of on-street parking, this was part of the suite of measures used to deliver economic benefits as a result of the car-free city centre. Constrained business operations due to the fees and reduced parking levels. This may impact on deliveries, distribution etc. and overall business performance. However, between 1927 and 2001, studies of cruising in congested cities have found that it took between 3.5 and 14 min to find an on-road parking space, and that between 8 and 74 percent of the traffic was cruising for parking. Parking charges strongly influence drivers' decisions to cruise for parking. The failure to charge market rates for on-street and off-street parking causes congestion, generates a lot of unnecessary carbon emissions and, wastes time.[26] Drivers motoring about seeking parking waste a lot of time and money, while also generating lots of unneeded carbon dioxide Reduced costs to the National Health Service due to reduced public exposure to air pollution and hence	

[25] https://www.forbes.com/sites/carltonreid/2019/10/17/nottinghams-workplace-parking-levy-creates-jobs-cuts-car-use-and-slashes-pollution/#34d6d0fa39fb

[26] Cp. SHOUP, D., 2005. The High Cost of Free Parking. Planners Press, Chicago.

Objective	Qualitative Impact	Score
	reduced numbers of air pollution related diseases such as asthma, dementia and certain types of cancer.	

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	No positive or significant negative effects on biodiversity have been identified.	0
	Population and Human Health	Overall improved health and wellbeing outcomes because of reduced pollution, improved air quality and increased levels of active travel use. Transport for London established that with the introduction of the congestion charge in London, levels of cycling within the congestion zone increased by 66% after implementation of the scheme with the associated health benefits. It should be noted, though, that the implementation of the congestion zone was supplemented with significant investment in cycling infrastructure. The charging scheme that was introduced in Durham in 2012 resulted in a 10% increase of pedestrians[27] [28]. The introduction of the congestion zone in London resulted in a 25% increase in bus patronage entering the zone[29].	+
	Soil	No positive or significant negative effects on soil have been identified.	0
	Water	No positive or significant negative effects on water have been identified.	0
	Air Quality	Considerable improvement of air quality within the region. Transport for London have outlined that the introduction of the London Congestion Charge has reduced traffic entering the zone by 27%. This equates to approximately 80,000 fewer cars entering the zone every day[30] [31].	++

[27] https://www.ciht.org.uk/media/8057/durham_city_centre_road_charging_scheme.pdf
[28] https://www.durham.gov.uk/article/3437/Durham-Road-User-Charge-Zone-congestion-charge
[29] IBID
[30] http://content.tfl.gov.uk/congestion-charge-factsheet.pdf.pdf
[31] https://www.wsp.com/-/media/Insights/Canada/Documents/doc-Congestion-Charging-Report.pdf?la=en-GL&hash=ADE02366CDA806EB17ACB7A018E8A6AED624A5A2

Objective	Sub-Objective	Qualitative Impact	Score
		The charging scheme that was introduced in Durham in 2012 resulted in an 85% reduction in car traffic. Potential that congestion and subsequent traffic related pollution is simply displaced because of redistributed journeys away from the congestion zone.	
	Climatic Factors	As above. With the clear advice from the Scottish Government to avoid public transport during the pandemic, there may be a resurgence in traffic levels as the private car offers a safe low risk of transport. Charging mechanisms have the potential to deter people from indiscriminate use and address any associated negative impacts both on the indicators relating to the climate crisis.	++
	Material assets	Without significant improvements to both the public realm and transport networks, it is likely that a range of improvements. would not be delivered. This would jeopardise the region's vision of creating an effective and integrated transport system which meets the needs of all those living in, working in, and visiting the region. Charging mechanism may provide the required local and regional funding.	+
	Cultural heritage	Improved setting of heritage assets. Townscapes, streetscapes and heritage conversation will benefit from less car dominated public realms.	++
	Landscape	No positive or significant negative effects have been identified.	0
Safety	Accidents	A reduction in traffic volumes and subsequent car kilometres is likely to reduce the number of road accidents. Increased levels of traffic and traffic cruising in areas outside the charging zone may result in a greater number of accidents in those areas.	+
	Security	Less car dominated streetscapes and townscapes would help to improve both formal and informal surveillance including a higher number of people using the public realm.	++

Objective	Sub-Objective	Qualitative Impact	Score
		Increased pedestrian activity in public space can improve perceptions of safety through passive surveillance that naturally aids the prevention of crime, with more 'eyes on the street' Durham's review of the charging scheme introduced in 2012, established a 10% increase in the number of people considering Durham City Centre to be a safe place to visit[32] [33].	
Economy	Transport Economic Efficiencies (TEE)	66% of car journeys made within the Tactran region in 2019 were under five km long and could have been made by active travel modes or public transport. Discouraging indiscriminate car use within the region can help to minimise traffic and realise TEE benefits.	+
	Reliability	As above.	+
	Wider Economic Impacts	Higher costs to local businesses to operate in areas where charging mechanism are in place. This may impact on deliveries, distributions etc. Investment in better streets and public spaces for people can boost footfall and trading by up to 40%[34], and can help to reduce retail vacancy in high streets and town centres[35]. Less car dominated environments with highly connected active and sustainable transport networks are more likely to make a positive contribution to labour productivity[36]. Keeping investment local through community wealth-building can develop the skills of local people and create stable, well paying jobs for local people[37].	++

[32] https://www.ciht.org.uk/media/8057/durham_city_centre_road_charging_scheme.pdf
[33] https://www.durham.gov.uk/article/3437/Durham-Road-User-Charge-Zone-congestion-charge
[34] Health Matters: Air Pollution. Guidance. Public Health England, Nov. 2018. https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution
[35] Street Appeal: The Value of Street Improvements. University College London, for Transport for London, 2018. http://content.tfl.gov.uk/street-appeal.pdf
[36] M Rohani and G Lawrence: The Relationship between Pedestrian Connectivity and Economic Productivity in Auckland's City Centre. Technical Report 2017/007-2. Auckland Council, Nov. 2017. https://static1.squarespace.com/static/58e441d2f7e0abde3be51110/t/5a559d50085229d58dfed85b/1515560335402/TR2017-007-2-Pedestrianconnectivity-economic-productivity-Auckland-city-centre-scenarios.pdf
[37] How We Built Community Wealth in Preston: Achievements and Lessons. Centre for Local Economic Strategies (CLES), Jul. 2019. https://cles.org.uk/publications/how-we-built-community-wealth-in-preston-achievements-and-lessons/

Objective	Sub-Objective	Qualitative Impact	Score
		Investment in better place-making can boost land values by up to 25%.[38] Less car dominated environments enabling active and sustainable transport links sustain and increase their value because they are popular places in which to live and do business. This can be beneficial in that it could bring investment and jobs[39].	
Integration	Transport / Modes	Potentially increased use of local Park & Ride sites because of a shift towards public transport for accessing town and city centres within the region.	++
	Land-Use Policy	Supports the links to wider national, regional, and local policy developments, including the Review of the Town Centre Action Plan, Place Principle, and the National Planning Framework 4.	+++
	Other Policies	Proposed interventions align with the Sustainable Transport Hierarchy at the core of the National Transport Strategy (NTS2). Integrated with the Scottish Government's Climate Change Bill as well as regional and local policies to encourage more people to travel more actively and sustainably more often. Subsequent mode shift towards active and sustainable modes will help work towards a 20% reduction in car kilometres.	+++
Accessibility Social Inclusion	Severance	Using any income from parking demand management measures to improve public transport within the region will help reduce severance and increase the accessibility of services and opportunities across the region via public transport, and therefore, the accessibility of services and opportunities to a wider range of user groups. Potential for increasing inequality in accessing employment opportunities and services and facilities residents will need to access on a regular basis.	-

[38] Development: The Value of Placemaking. Savills, 2016. https://pdf.euro.savills.co.uk/uk/residential—-other/spotlight-the-value-of-placemaking-2016.pdf

[39] Walkability and Mixed-Use: Making Valuable and Healthy Communities. The Prince's Foundation, Dec. 2020. https://princes-foundation.org/journal/walkability-report

Objective	Sub-Objective	Qualitative Impact	Score
	Accessibility	Potential for increasing inequality in accessing employment opportunities and services and facilities residents will need to access on a regular basis. Those better off will find it easier to afford more for parking. With regards to the potential introduction of Workplace Parking Levies, employer can mitigate against this by not passing the respective charge on to their employees.	-

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	Local authorities hold discretionary powers enabling them to introduce road user charging under Part 3 and Schedule 1 of the Transport (Scotland) Act 2001. This enables a local authority to make a charging order provided it directly or indirectly facilitates the achievement of their local transport strategy. In addition, the proceeds from a charging scheme must be spent for the purpose of facilitating the achievement of policies in the local transport strategy.	Moderate consideration
	Deliverability Risk	The introduction of any charging mechanism would require strong political will as it may be met with strong public and business opposition. The only precedent in Scotland is the experience in Edinburgh where £9m was spent developing the proposals before they were abandoned after a local referendum.	Major consideration
Affordability	Costs	Dependent on scheme and scale. There is an initial investment required in the technology to implement a road charging scheme. The London charging scheme, for example, uses automatic number place recognition with overhead gantries, cameras at all entrance points, pavement marking and street signage. While the initial outlay is high, annually, the scheme makes a revenue.	Moderate consideration

Objective	Sub Objective	Qualitative Impact	Score
		The Nottingham workplace parking levy brings in about £10 million a year. These funds have been used to pay for an extension to Nottingham's tram network, upgrade of Nottingham station to create a hub for buses, trams and trains as well as supporting subsidised bus services. It costs around £500,000 per year to operate which equates to about 5% of the revenue raised[40]. Non workplace parking charges schemes typically do not require large investments so changes can be made relatively quickly and more affordably than mechanisms like road user charging and workplace parking levies.	
	Financial Risks	As above. Ongoing constraints in public funding.	Moderate consideration
Public Acceptability		Workplace Parking Levies that can be introduced incrementally, rather than road user changing – which could be seen as a significant intervention – is more likely to be publicly acceptable. East Midlands Chamber of Commerce were originally opposed to Nottingham City Council introducing the Workplace Parking Levy but have in the past been reported to be neutral on the issue saying employers accept the levy as a cost of doing business. It also does not seem to have been politically damaging with the administration in Nottingham being re-elected with an increased number of seats since introduction of the workplace parking levy[41]. In Vienna, evidence suggests that public acceptance of parking management improves following implementation. It is, however, recognised that the public and businesses are likely to be resistant,	Moderate consideration

[40] https://www.edinburghnews.scotsman.com/news/politics/workplace-parking-tax-how-uks-only-levy-scheme-works-140569

[41] https://www.edinburghnews.scotsman.com/news/politics/workplace-parking-tax-how-uks-only-levy-scheme-works-140569

Objective	Sub Objective	Qualitative Impact	Score
		at least in the planning and early implementation stages, to the introduction of any charging mechanism. A representative sample of the Tactran region shows that 82% of people support measure to promote walking, cycling and public transport, 57% support wider parking controls with 22% neither agreeing nor objecting to this proposal. Reallocating road space and other traffic management measures are supported by 61% (21% of are neither supporting nor objecting to this proposal) and, 39% are supportive of the implementation of road user charging mechanisms - 17% neither supported nor objected to this proposal[42].	

[42] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.

3. Improving access to public transport

Potential interventions include:

I. Improved Public Transport Interchange

i. Strategic Park and Ride sites to transfer to coach or rail those long-distance car trips heading to Scotland's cities outwith the region.
ii. Local Park and Choose sites to provide interchange facilities at railway stations, bus stations and on public transport corridors serving towns to enable transfer to train, bus or bike into our larger towns and cities.
iii. Mobility Hubs link a number of transport services within a community to improve access via different modes to enable your onward journey. This usually means improving the ability to access bus services by, e.g. car and bicycle parking; bike hire; walking and cycling links; demand responsive bus services. But they could also help accessing car club & car sharing facilities.
iv. Passenger facilities along strategic bus corridors: ensuring accessible waiting facilities with information along strategic bus corridors. Campaigns to promote active and sustainable travel in Travel to Work Areas.

II. New and Improved Rail and Bus Stations

i. New and improved bus stations
ii. New and improved rail stations on existing lines

III. Easier Planning and Booking of Journeys

i. Journey planning tools to help people be aware of all the choices they have to make a journey
ii. Smart and integrated ticketing whereby tickets are stored electronically, usually on a smart card or other forms of smart media, enabling a person to use a single 'ticket' on different modes of transportation, such as bus and rail, or across different operators.

MaaS products can provide both improved journey planning and provide smart, integrated ticketing

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	Strategic Park and Ride intercept trips where people are reliant on private car at an early viable point in their journey and hence reduces the distance driven and carbon emissions. Park and Choose facilities will largely reduce the volume of trips going into our centres, and therefore have a bigger impact on air quality than carbon emissions. Local users may drive to a park and ride. This would be a consequence of those drivers not having an alternative bus service to	+

Objective	Qualitative Impact	Score
	access the town centre. Nonetheless their trip to a park and ride site remains preferable to a car trip into a centre. By improving the opportunities to access the public transport network at the early stage of a journey, mobility hubs will reduce car trips and emissions. Any shift from the private car to bus or rail (for the length of the full trip) will reduce traffic volumes and respective emissions. However, there may be an increase in car trips to both new and improved stations to catch buses and/or trains from there. Providing new and improved opportunities to encourage a shift from road to rail for freight movements within the region is likely to reduce the number of HGVs on road and will reduce respective emissions. Depending on the fleet there is the risk of increased emissions due to diesel buses and trains. New bus and railway stations will improve accessibility of the bus and rail network and hold the potential to help the region move towards a zero carbon transport system. Respective construction work may result in negative environmental impacts which will need to be mitigated. Cheaper and simpler overall fares for public transport could lead to more people switching to public transport from the car, with an associated reduction in tail-pipe emissions and subsequent improved air quality.	
PO2: Improving Health and Wellbeing	By reducing the number of trips travelled by private car, they would result in reductions of congestion levels, thus, contributing to a reduction in air pollution, thus contributing to improved public health. Any shift from the private car to bus or rail (for the length of the full trip) will reduce traffic volumes and respective emissions. However, there may be an increase in car trips to both new and improved stations to catch buses and/or trains from there. A reduction in the share of HGVs will result in also result in reduced emissions. This will be particularly beneficial with regards to a reduction of particulate emissions and the impact this will have on air quality and human health.	+

Objective	Qualitative Impact	Score
	A reduction in traffic volumes and subsequent car kilometres is likely to reduce the number of road accidents. Smart integrated ticketing options may encourage people to make short bus trips at the expense of walking or cycling with associated health impacts.	
PO3: Reducing Inequalities	All forms of interchange will improve the ability of people without cars to access public transport to access jobs, services, and opportunities. The more a site is served by sustainable modes of transport, the more this will apply. A reduction in traffic volumes will reduce congestion levels and subsequently improve journey times and punctuality. This also applies for those already travelling by bus along the respective corridors. Improved access to the economic centres within the region and beyond will increase access to a greater number of employment opportunities. Equally, improved and more direct access to the public transport network will also widen the labour market for local / regional businesses. Improved connectivity within the region and beyond may improve the perception of the region for businesses and encourage investment as well as unlock latent development potential. Journey planning tools and Smart ticketing can help people find the cheapest fares available. Lower fares (if achieved) could provide greater opportunities for those on lower incomes to use public transport. Smart integrated ticketing has the potential to make it simpler and easier, particularly for people with disabilities, to book and pay for transport with a single transaction, ensure best value for money and support journeys that combine several modes. Technology may allow targeted assistance to key groups to tackle inequality, such as free or cheap travel for apprentices, or those on minimum / living wage. However, smart integrated ticketing needs to allow all citizens to access benefit from them, and not perpetuate existing access barriers to mobility and opportunities. Especially when it comes to digital access, innovative mobility services need to be inclusive in order to avoid the	+

Objective	Qualitative Impact	Score
	further exclusion of segments of the society with limited or no access to digital services.	
PO4: Delivering Sustainable and Inclusive Economic Growth	Interchanges will support inclusive economic growth by: • Reducing the number of car trips and hence reducing congestion • Improving access to public transport to access jobs and training A reduction in traffic volumes will reduce congestion levels and subsequently improve journey times and punctuality. This also applies for those already travelling by bus along the respective corridors. Improved access to the economic centres within the region and beyond will increase access to a greater number of employment opportunities. Equally, improved and more direct access to the public transport network will also widen the labour market for local / regional businesses. Improved connectivity within the region and beyond may improve the perception of the region for businesses and encourage investment as well as unlock latent development potential. Likely to be highly welcomed by the public in those communities where new bus and rail stations will be located and existing stations will be improved. Those communities will benefit from increased mode choice and improved journey times. There may be concern among current bus users in those rural communities not being served by rail that bus services might be reduced as a result of reduced bus passenger numbers. However, without detailed work identifying the potential schemes to be implemented it is difficult to estimate feasibility and costs. Integrated ticketing could lead to cheaper overall fares for public transport with an increase in disposable income. Greater passenger convenience will likely lead to increased trip making with associated benefits. Revenue impact on operators would have to be determined – this may affect commercial viability of routes, although a move away from cash-based payments provides an inherent cost saving with operators incurring	+

Objective	Qualitative Impact	Score
	over 3.5 times more expenditure on physical fare collection as compared to digital fare collection[43].	

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	The COVID-19 pandemic has placed severe financial burden on public transport operators, with passenger demand having fallen dramatically since the start of the pandemic. While Scotland has seen an overall 85% drop in passengers since lockdown began[44], Lothian Buses has seen a 90% reduction in passenger numbers, resulting in a £30 million loss[45]. Similarly, Stagecoach has experienced a fall in passenger numbers leading to operating profit of £119.4m compared to £161.3 million the previous year[46]. The legacy of Covid-19 is also impacting on an increasing shortage in bus drivers across Scotland. According to a recent survey of the Confederation of Passenger Transport (CPT), 28% of bus operator respondents have cut the number of services operated. 38% have reduced frequencies. According to the CPT, the 'real time' bus driver shortage is greatest in Scotland. Without significantly improved access to public transport, demand for road transport within the region is projected to increase. There would likely be a requirement for new and significant transport infrastructure above planned levels to cope with this increasing demand. Construction of such infrastructure could put pressure on biodiversity, including the loss and fragmentation of habitats, while increases in traffic and noise could disturb sensitive species.	+

[43] www.railwayage.com/passenger/smart-ticketing-smart-cities
[44] https://www.dailyrecord.co.uk/news/local-news/covid-19-lockdown-long-term-22333665
[45] https://www.edinburghnews.scotsman.com/news/transport/lothian-buses-count-ps30m-cost-covid-19-passenger-collapse-2937253
[46] https://www.heraldscotland.com/business_hq/18637352.scottish-transport-giant-lays-bare-extent-covid-impact-annual-report

Objective	Sub-Objective	Qualitative Impact	Score
	Population and Human Health	Improved public transport will enable the region to address the projected increase of both the resident and workplace population within the Tactran region and meet demand for transport without exceeding supply. With the improvements being made to the walking and cycling, and public transport infrastructure, the region will ensure that most of the of the new demand for transport will not be for car journeys but for active and sustainable modes, encouraging transport modal shift to walking, cycling and public transport. This will enable the region to realise additional health benefits. Such improvements will also help to address poor air quality, improving the situation for the local population, improving ill-health and addressing issue around a reduction in life expectancy due to air pollution. Developmental pressures for new transport infrastructure beyond planned levels to cope with the increased demand for road traffic could lead to the loss of areas of open space, reducing opportunities for physical activity. Measures to improve public transport will help to address this.	+
	Soil	Without significantly improved access to public transport and if demand for road transport within the region increases as projected, it may be necessary to construct further large-scale transport facilities, such as new roads and bridges, to cope with demand. Construction and use of such facilities could lead to land contamination and soil erosion.	+
	Water	As above. The need to construct further large-scale transport facilities could contribute to the pollution of the local water environment.	+
	Air Quality	Without improvements to public transport, it is likely that demand for, and use of, road transport would increase unchecked as further development occurs across the region, whilst opportunities to encourage transport modal shift to walking, cycling and public transport will be lost.	+

Objective	Sub-Objective	Qualitative Impact	Score
		In the absence of a shift to use more public transport more often, the resulting increase in road traffic would increase local atmospheric pollution, in particular greater release of particulate matter. This would act against wider policy efforts to decarbonise transport within the region to mitigate climate change. It could also lead to worsening air quality. As a result, constituent councils could fail to meet statutory duties in relation to climate change mitigation and adaptation and could be required to designate further Air Quality Management Areas (AQMAs) to address areas of poor air quality.	
	Climatic Factors	As above under Air Quality.	+
	Material assets	Without significant improvements to public transport, it is likely that a range of sustainable transport facilities, such as public transport hubs would not be delivered. This would jeopardise the region's vision of creating an effective and integrated transport system which meets the needs of all those living in, working in, and visiting the region.	+
	Cultural heritage	Without significantly improving access to public transport, demand for road transport and parking likely increases as projected. This could put development pressure on areas of historic and/or archaeological interest and undermine the character or conservation areas.	+
	Landscape	As above. If traffic levels increase and projected, this is likely to necessitate the construction of new transport facilities beyond planned levels, which could have a significant negative impact on the landscape character of the region, especially if additional new facilities are developed outwith the urban areas.	+
Safety	Accidents	Any net reduction in car kilometres within the region because of improved access to public transport would lead to reduced road casualties. CAVs?!!	+

Objective	Sub-Objective	Qualitative Impact	Score
		Opportunities to include or improve rest and welfare facilities for hauliers as part of the development of a network of strategic Park and Ride sites within the region. This would provide safety benefits to haulage drivers as well as other road users.	
	Security	It is acknowledged that access improvements to public transport systems can generally help to improve perceptions of safety and security, however direct effects of these policies are likely to be limited. Improved information can also lead to increased perceptions of safety and security.	0
Economy	Transport Economic Efficiencies (TEE)	Increased frequency and improved integration between public transport services will generate TEE benefits to bus users. Those making new journeys because of improved connectivity would also experience TEE benefits.	+
	Reliability	While reduced traffic volumes would improve efficiency and reliability to a certain degree, no notable reliability benefits are associated with the respective measures.	0
	Wider Economic Impacts	No significant impact on the wider economy. Revenue impact on operators would have to be determined – this may affect commercial viability of routes, although a move away from cash-based payments provides an inherent cost saving with operators incurring over 3.5 times more expenditure on physical fare collection as compared to digital fare collection[47].	+
Integration	Transport / Modes	Improved access to public transport would be key to increase integration between rail, bus, walking and cycling within the region by providing interchange opportunities to allow for multimodal journeys and trip chains.	++
	Land-Use Policy	Supports sustainable land use patters by improving access to sustainable transport infrastructure and local services. Supports local housing developments within the region.	+

[47] www.railwayage.com/passenger/smart-ticketing-smart-cities

Objective	Sub-Objective	Qualitative Impact	Score
	Other Policies	Supports respective policies at local, regional, and national level, including Scottish Government's Climate Change Bill.	+
Accessibility Social Inclusion	Severance	Improving access to public transport will help reduce severance and increase the accessibility of services and opportunities across the region via public transport, and therefore, the accessibility of services and opportunities to a wider range of user groups. It is not anticipated that this scheme will have an inequitable impact on any particular group.	+
	Accessibility	As above.	+

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	No significant technical risks related to the implementation of respective measures have been identified.	Moderate consideration
	Deliverability Risk	Shifted political priorities with subsequent impact on available financial support to implement major transport schemes, such as Park and Ride sites.	Moderate consideration
Affordability	Costs	Dependent on scale and whether existing or dedicated services are used. The costs to operate strategic Park and Ride sites with buses departing every 10 minutes, for example, range from £800,000 to £1m per site. For a site to break even in financial terms, about 1,200 passengers per day on a typical weekday would be required. This highlights the importance of optimising the site location to achieve a robust financial case[48]. Evidence suggests about 20,000 daily vehicles must pass the site to attract the required demand[49].	Moderate consideration

[48] TRANSPORT SCOTLAND (2012): The effects of park and ride supply and pricing on public transport demand https://www.transport.gov.scot/media/30102/j253322.pdf

[49] IBID

Objective	Sub Objective	Qualitative Impact	Score
	Financial Risks	Shifted political priorities with subsequent impact on available financial support to implement major transport schemes, such as Park and Ride sites.	Moderate consideration
Public Acceptability		Likely that respective schemes would be welcomed by the public. However, success of respective schemes is reliant on increased public transport patronage. Schemes are likely to be more successful if complementary measures are implemented to improve the public transport network within the region and, to discourage the indiscriminate use of cars by managing demand. A representative sample of the Tactran region shows that 85% of people support proposals to improve public transport links within the region, 88% support proposals for new and improved rail and bus stations and, 84% support proposals to make the planning and booking of public transport journeys easier[50].	Minor consideration

[50] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.

4. Improving sustainable travel options

Potential interventions include:

I. Improved Active Travel Opportunities

i. Connected neighbourhoods, enabling people to access local facilities by walking and cycling
ii. Active freeways, cycle priority routes into our town and city centres
iii. Strategic active travel network, providing village-town active travel connections; connecting towns by active travel; and supporting the long-distance active travel network
iv. Ensuring secure cycle parking at homes, workplaces, schools, interchanges and other destinations
v. Cycle hire schemes, increasing the number of conventional and electric cycle hire scheme

II. Promoting Active and Sustainable Travel to School

i. Safer routes to schools - improving walking and cycling routes to schools, including reducing traffic speeds around schools
ii. School exclusion zones - limiting traffic around schools at peak times to improve safety and air quality for children
iii. Cycle parking; cycle training and improving access to bikes

III. Improved Public Transport

i. Strategic Bus Priority Corridors, improving journey time and reliability through bus priority measures, traffic management etc.
ii. Increasing Bus Services, improving the frequency and coverage of public transport through fixed routes and feeder services (including DRT and Community Transport)
iii. Improved rail services

IV. Demand Responsive, Community and Shared Transport Services

i. Demand Responsive Transport (DRT): on demand (rather than timetabled services) to link to existing traditional fixed route bus services, and to cover areas where fixed route services are not viable
ii. Community Transport Services: Support for community and volunteer transport services
iii. Car Clubs: to provide access to a car without the need to own one

V. Promote Fair Fares

Fare structures are typically set in a way to make travel during peak times more expensive, with off-peak travel fares offered at lower rates.

Encourage and support public transport providers to review fares to:

a) Enhance social inclusion by providing a realistic alternative to a wider range of people, including disadvantaged communities

b) Help balance demand for public transport throughout the day and reduce pressure on services at peak times

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	Modal shift from the private car to active travel modes will reduce traffic related carbon emissions and traffic related levels of pollutants. This will have a greater impact in areas within the city and town centres where there are air quality issues and declared Air Quality Management Areas. Localised improvements in local communities will help to target daily short distance trips. The latter account for a significant proportion of daily trips within Scotland. According to the 2020 Scottish Transport Statistics, 17% of journeys made are less than 1 km, and a further 24% of journeys made are under 3 km. Therefore, over 40% of all journeys made in Scotland are less than 3 km and could be made by active travel if suitable routes and facilities were available. Implementation of smaller scale cycle hire schemes in town centres or other suitable locations within the region hold the potential to target shorter distance trips (as noted above). Seven out of ten users of the London Cycle Hire Scheme noted that the scheme had prompted them to start cycling in the city or to cycle more often[51]. Subsequently, such a scheme can act as a catalyst to modal shift and behavioural change. 95% of trips were also noted to have been made by another mode or not at all i.e., only 5% of users were shifting from using their own bike to a hire bike. Most users also noted seeing their health and fitness improve. A well-integrated comprehensive bus network of high-quality bus services offering frequent reliable services has the potential to significantly alter perceptions of bus travel. This could significantly help towards achieving the ambitious mode share target for sustainable transport, subsequently reducing car kilometres and hence carbon emissions. COVID-19 has severely impacted on both bus passenger numbers and the number of services operating. Developing an integrated network of freight hubs to encourage a shift from road to railways and waterways for freight movements will remove HGVs from the regional road network and will reduce the respective particulate matter emissions and carbon emissions. Potential for shift dependent on the	++

[51] https://www.centreforpublicimpact.org/case-study/londons-cycle-hire-scheme

Objective	Qualitative Impact	Score
	consignment, and suitability of the offer from rail freight providers. Potentially limited impact overall – DRT (Demand Responsive Transport) is typically aimed at providing connections for more vulnerable groups than encouraging modal shift from car. Demand responsive transport can, however, form a key component of a more attractive overall public transport offer, meeting the needs of both urban and rural communities. There is potential to reduce emissions through people switching from car to DRT where they were previously requiring a lift to / from their destination, which often can involve double journeys. There is the potential to increase emissions if new DRT services commence operation.	
PO2: Improving Health and Wellbeing	More trips made by active travel modes will have a considerable positive impact on people's health and well-being[52]. Modal shift from private car to active travel modes will reduce traffic related levels of pollutants, including within the city and town centres where there are air quality issues and declared Air Quality Management Areas. Safety and the individual perception of safety in relation to travel actively is likely to improve as a critical mass is established and such travel behaviour is being increasingly mainstreamed. Improved public transport links may result in a reduction in those travelling by active travel with an associated reduction in active travel related health benefits. People going to use public transport instead of using the private car would gain health benefits, though, from the need to walk to and from the appropriate stops. Reduction in particulate matter emissions both within urban areas and communities on trunk roads will have a positive impact on air quality and subsequently on human health. Regarding reducing the negative impacts which (road) transport has on the health and wellbeing of people and pollution impacts on the environment, it is worth noting that	++

[52] Chief Medical Officers (2011): Start Active Stay Active, A report on Physical Activity for Health from the Four Home Countries' Chief Medical Officers, and Hamer and Chida (2008): Active commuting and Cardiovascular Risk: A Meta-Analytic Review in: Preventive Medicine 46(1): p. 9-13

Objective	Qualitative Impact	Score
	there are social impacts of road-based transport of hazardous materials, particularly for residents of poor and disadvantaged communities. Those individuals are more at risk of exposure to hazardous materials spills due to their location along trunk roads. A shift from transporting freight on roads towards railways and waterways will minimise this impact. Shift from car to sustainable travel would reduce road accidents with less cars being on the road, although this is anticipated to be minor	
PO3: Reducing Inequalities	Improved access to local services by walking and cycling. Higher quality active travel routes and facilities are likely to remove barriers which prevent some groups in society using active travel. Less likely to have a material impact on inequities associated with deprivation although cycling can provide a cost-effective alternative to the private car. The Transport Scotland (Act) 2019 offers local authorities greater opportunity to operate socially necessary services enabling rural communities to be better connected by bus and therefore reducing social isolation and improving well-being. Improved regulatory control could improve connectivity within the region as well as during the day and the week. Public transport connectivity could therefore be transformed within the region, depending on the scale of change. This would benefit those without access to a car and also those that own a car but would prefer to use their car more often. Additionally, greater regulation could be used to target the needs of areas and groups which are currently failed by the commercially orientated bus market. Cheaper fares could also assist in tackling inequality and deprivation, through reduced transport costs. Greater control over vehicle specification could ensure more accessible vehicles throughout the bus fleet, resulting into increased mode choice for those without access to a private car but who would like to travel more sustainably as well as for those with access to a car but do not want to use it. Increased number of direct connections, removing the need to interchange. Bus Service Improvement Partnership's (BSIPs) would allow local authorities to specify minimum frequencies leading to better served rural communities. Improved DRT services would provide connectivity where it is not provided by the regular bus network. As such, it would provide an increase in public transport network coverage and	+++

Objective	Qualitative Impact	Score
	improved access to local services. This is potentially more pertinent post COVID-19 pandemic where services are likely to have been reduced and may take time to recover in the short to medium term. Greater access to services and opportunities (employment and education) for those without access to a car or those unable to drive. Potentially will reduce social isolation in rural communities currently not served by public transport or by suitable (accessible) services. Improved access to healthcare – a particularly important point given the higher than Scottish average proportion of people in retirement within the region and the overall ageing population across all four Council areas in general.	
PO4: Delivering Sustainable and Inclusive Economic Growth	Improved active travel routes, and new active travel routes, will most likely be generating journey time benefits for pedestrians and cyclists. Increased physical activity with associated health improvements would lessen the economic cost to the NHS. The total cost of physical inactivity to Scotland was estimated at £77million in 2015 (cp. University of Bristol, Valuing Physical Activity and the Economic Impact of Inactivity) and is estimated at around £1 higher per person in Scotland than in England. It has also been estimated that business could save up to £6.6 billion through improved employee productivity each year if there were a higher level of physical activity among employees, including reduced levels of absenteeism. Reduction in journey times, resulting from fast, frequent and reliable services. Improved punctuality. Increased frequency and improved integration between public transport services will generate TEE benefits to bus users. Those making new journeys because of improved connectivity would also experience TEE benefits. Connectivity improvements could lead to a more resilient labour markets, providing access to new or better jobs for people who could not previously access those. Integration with (strategic) Park and Ride facilities will lead to increased use of those sites and will help to unlock the investment made.	++

Objective	Qualitative Impact	Score
	Improved regional connectivity may improve the business perception of an area and encourage inward investment within the region. May also help unlock latent development potential. Potentially a (limited) labour market impact if those excluded from public transport are now able to travel independently and participate in the local / regional labour market. Potentially a (limited) impact in reducing forced car ownership for those living in communities currently not served by public transport services.	

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	Most recommendations are anticipated to result in a in minor positive effect on biodiversity as minimal hard infrastructure is required for most of required infrastructure for the inventions proposed. There will be opportunities to introduce blue-green infrastructure as part of any infrastructure required.	+
	Population and Human Health	Proposed interventions are anticipated to result in positive effects on quality of life and human health, as the interventions proposed will improve quality of life and human health and increase sustainable access to essential services, employment, as well as the natural environment.	++
	Soil	There are not expected to be any significant effects regarding soil resources or contaminated land from measures proposed to improve sustainable travel options.	0
	Water	Reducing transport related emissions indirectly has the potential to improve water quality. Opportunity to adopt sustainable drainage options and incorporate blue-green infrastructure to the active and public transport networks within the region.	+
	Air Quality	More walking, cycling and public transport use will also have associated air quality benefits regarding NO_2. Modal shift to walking and cycling will improve air quality but a significant proportion of PM	++

Objective	Sub-Objective	Qualitative Impact	Score
		pollution from vehicles is generated through tyre wear etc. This will be addressed by encouraging more people to travel by public transport, provided public transport is decarbonised. Air quality benefits will be enhanced in areas with high levels of air pollution or congestion levels.	
	Climatic Factors	Indirect alignment. By encouraging active travel journeys, fewer journeys by car will be made which will contribute to mitigating climate change. Increasing the appeal of public transport would also support modal shift.	+
	Material assets	Neutral. While measures are anticipated to result in minor negative effects on reducing the use of natural resources as several of the interventions proposed may require materials and construction related trips, a minor positive effect is anticipated as a result of the more sustainable use of the transport network.	0
	Cultural heritage	Whilst not explicitly addressing cultural heritage issues, respective measures to improve sustainable travel options provide a suitable platform to improve the setting of heritage assets within the region. Townscapes, streetscapes, and heritage conversation will benefit from less car dominated public realms.	+
	Landscape	No positive or significant negative effects have been identified. Interventions are likely to require only minimal hard infrastructure.	0
Safety	Accidents	A reduction in traffic volumes and subsequent car kilometres is likely to reduce the number of road accidents.	++
	Security	Measures will help to improve both formal and informal surveillance including a higher number of people using public transport and the public realm as well as improvements to public transport infrastructure and the public realm to help visibility etc.	++
Economy	Transport Economic Efficiencies (TEE)	66% of car journeys made within the Tactran region in 2019 were under 5 km and could have been made by active travel modes or public transport. Discouraging indiscriminate car use within the region can help to minimise traffic and realise TEE benefits.	+
	Reliability	As above.	+

Objective	Sub-Objective	Qualitative Impact	Score
	Wider Economic Impacts	Investment in better connected communities and public spaces for people can boost footfall and trading by up to 40%[53], and can help to reduce retail vacancy in high streets and town centres[54]. Communities with highly connected active and sustainable transport networks are more likely to make a positive contribution to labour productivity[55]. Keeping investment local through community wealth-building can develop the skills of local people and create stable, well paying jobs for local people[56]. Investment in better place-making can boost land values by up to 25%.[57] Communities enabling active and sustainable transport links sustain and increase their value because they are popular places in which to live and do business. This can be beneficial in that it could bring investment and jobs[58].	++
Integration	Transport / Modes	Positive impact. Integration of transport is a major aspect to be addressed by the proposed measures, especially the lack of accessible and well-connected transport links.	++
	Land-Use Policy	Supports the links to wider national, regional, and local policy developments, including the Review of the Town Centre Action Plan, Place Principle, and the National Planning Framework 4.	+++
	Other Policies	Proposed interventions align with the Sustainable Transport Hierarchy at the core of the National Transport Strategy (NTS2).	+++

[53] Health Matters: Air Pollution. Guidance. Public Health England, Nov. 2018. https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution

[54] Street Appeal: The Value of Street Improvements. University College London, for Transport for London, 2018. http://content.tfl.gov.uk/street-appeal.pdf

[55] M Rohani and G Lawrence: The Relationship between Pedestrian Connectivity and Economic Productivity in Auckland's City Centre. Technical Report 2017/007-2. Auckland Council, Nov. 2017. https://static1.squarespace.com/static/58e441d2f7e0abde3be51110/t/5a559d50085229d58dfed85b/1515560335402/TR2017-007-2-Pedestrianconnectivity-economic-productivity-Auckland-city-centre-scenarios.pdf

[56] How We Built Community Wealth in Preston: Achievements and Lessons. Centre for Local Economic Strategies (CLES), Jul. 2019. https://cles.org.uk/publications/how-we-built-community-wealth-in-preston-achievements-and-lessons/

[57] Development: The Value of Placemaking. Savills, 2016. https://pdf.euro.savills.co.uk/uk/residential—-other/spotlight-the-value-of-placemaking-2016.pdf

[58] Walkability and Mixed-Use: Making Valuable and Healthy Communities. The Prince's Foundation, Dec. 2020. https://princes-foundation.org/journal/walkability-report

Objective	Sub-Objective	Qualitative Impact	Score
		Integrated with the Scottish Government's Climate Change Bill as well as regional and local policies to encourage more people to travel more actively and sustainably more often. Subsequent mode shift towards active and sustainable modes will help work towards a 20% reduction in car kilometres.	
Accessibility Social Inclusion	Severance	Proposed inventions to improve the sustainable transport network within the region will improve access to different services. Examples include health and social care services, hospitals, libraries, shops, and schools. Accessibility benefits are to be realised in both urban and rural communities. The Transport (Scotland) Act 2019 offers local authorities the opportunity to operate socially necessary services to meet the needs of those communities currently failed by commercially run service networks. Improved DRT services would also help to reduce gaps in a commercially orientated bus network.	++
	Accessibility	As above.	++

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	Proposed interventions require tried and tested infrastructure.	Minor consideration
	Deliverability Risk	Any option that applies the newly available powers set out in the Transport (Scotland) Act 2019 will be breaking new ground. Whilst legally feasible, there would be an inherent risk in any of such approaches. Requires further evaluation of the commercial market to establish whether the demand unmet by the commercial market makes it economically viable. Demand Responsive Transport Services are potentially more feasible to be implemented under the Act. Requires	Moderate consideration

Objective	Sub Objective	Qualitative Impact	Score
		further evaluation to establish areas where such services could be implemented successfully.	
Affordability	Costs	Dependent on the scope of the scheme, potentially ranging from moderate to high.	Moderate consideration
	Financial Risks	Would require both capital and revenue funding from local authorities. Public finances currently constraint to support bus services in the region, as are the finances of commercial operators to invest in new vehicles and increase their service offer.	Moderate consideration
Public Acceptability		Improvements in active travel provision, enabling safe access to key employment areas and healthcare facilities, are highly likely to be accepted by the public. Improved bus services and an improved bus network is highly likely to be publicly acceptable if bus operations across the region are improved considerably, offering a realistic alternative to the private car. Attitudes of the local bus operators to any such improvement would need to be established at an early stage to gather support. Improved community and demand response transport services are likely to be highly accepted by those in rural areas if greater accessibility is achieved. A representative sample of the Tactran region shows that 80% of people support proposals to improve active travel opportunities within the region, 84% support proposals to improve active travel to school. Proposals to improve public transport across the region are supported by 91%, with 77% supporting the implementation of community and demand responsive transport services. Fare fares are supported by 92%[59].	Moderate consideration

[59] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.

5. Decarbonising transport and a just transition

Potential interventions include:

I. Promoting and Enabling Electric and Low Emission Vehicles for Individuals, Public Sector, Business and Bus Fleets

   i. Supporting electric vehicle uptake through adoption of Ultra Low Emission Vehicles (ULEV) in public sector, business and bus fleets; and supporting a just transition through the availability of electric vehicles through car clubs and parking and charging tariffs
   ii. Developing charging infrastructure through deployment and maintenance of public infrastructure; home charging and fleet charging
   iii. Promoting electric mobility, communicating the benefits of low emission vehicles

II. Rail Decarbonisation

   Support the decarbonisation of the rail network by 2035 through

   i. Electrification of Dunblane to Perth / Dundee / Aberdeen
   ii. Battery Electric Trains from Edinburgh to Perth / Dundee (short term)
   iii. Electrification from Edinburgh to Perth / Dundee (long term)
   iv. Electrification from Perth to Inverness (cp. STPR2)
   v. Battery Electric Trains on the West Highland Line

III. Behaviour Change and Modal Shift for Freight

   Freight transfer and consolidation hubs within the region to reduce road freight and also allow freight to be moved by rail and water

   i. Freight hubs
   ii. Timber transfer facilities
   iii. Consolidation centres
   iv. First and last mile distribution services, such as vans, drones, cargo bikes etc.

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	Increased availability of electric charging points facilitates a greater uptake of electric vehicles with a reduction in vehicle emissions and increased air quality. Carbon emissions would reduce at point of use, but overall carbon emissions would only be reduced if the electricity utilised were generated from green sources. Increased investment in hydrogen infrastructure would increase the potential for this market to grow with the vehicles only emitting water vapour, reducing carbon emissions and air pollution and are quieter to run reducing noise pollution.	++

Objective	Qualitative Impact	Score
	Increased city centre air quality, helping to tackle the existing Air Quality Management Areas within the region. Reduced journey times reduce the number of respective emissions. With reduced journey times also holding the potential to encourage more people to travel by rail if travel times are competitive with the private car, this would impart further environmental benefits. Furthermore, electric trains create less emissions than their diesel equivalents which will also realise reductions in respective carbon and particulate emissions. Additionally, there is a reduction in noise pollution as electric trains are much quieter.	
PO2: Improving Health and Wellbeing	Increased city centre air quality due to implemented measures to decarbonise transport, helping to tackle the existing Air Quality Management Areas within the region. Electric and hydrogen vehicles are much quieter than standard petrol and diesel cars. This presents a potential safety issue as it will be harder to tell if a vehicle is approaching. However, a European Union Directive means that all new electric vehicles must be fitted with a noise-emitting device (from July 2019) to warn other road users of their presence. From 2021, all electric cars must have an acoustic vehicle alert system, not just new models. The device is to be activated when a vehicle is reversing or travelling below 12mph. Electric trains create less emissions than their diesel equivalents which will also realise reductions in respective carbon and particulate emissions. Additionally, there is a reduction in noise pollution as electric trains are much quieter.	+
PO3: Reducing Inequalities	At present, the cost of an electric vehicle makes it considerably more difficult for those on lower incomes to purchase such a vehicle. Although the Scottish Government offers a subsidy to encourage first adopters to purchase an electric vehicle, this presents a financial challenge to those wishing to purchase a vehicle. However, the prevalence of electric vehicles in car showrooms is anticipated to rise and the affordability of such vehicles will increase dramatically as the market grows, enabling a greater number of people to afford them. Does not benefit those unable to drive, or those who choose not to drive. As the option to decarbonise rail will enhance existing rail lines there will be no net improvement in accessibility and social inclusion, resulting in a neutral impact. The same applies to efforts to decarbonise bus fleets within the region.	-

Objective	Qualitative Impact	Score
PO4: Delivering Sustainable and Inclusive Economic Growth	Unknown. If electric / hydrogen vehicles were to prove cheaper to run on an out-of-pocket basis, as EVs currently are, this would be a benefit to the car user. This would also undermine policies aimed at encouraging modal shift. Cheaper car travel would likely lead to increased traffic congestion. It has been assumed that in the medium term, alternative tax arrangements will be implemented to achieve broad parity with current car operating costs and maintain tax revenues to HM Treasury. Journey time disbenefits given the time required to charge a car battery compared to that required to fill a tank with fuel (cp. also the current coverage of electric vehicle chargers compared to petrol stations). Reduced journey times will increase the time people can spend actively engaging in other activities leading to an increase in productivity.	0

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	No significant effects identified.	0
	Population and Human Health	Reduced emissions and improve air quality and in turn have a positive effect on health on everyone, particularly of those most at risk of respiratory illness including older people and children (including unborn children). This is the most significant positive impact of the introduction of EV charging infrastructure and will have health and wellbeing benefits for a large population of residents, workers, and visitors to the region over a long period of time therefore, the magnitude of the effect is substantial.	++
	Soil	ULEVs have a disproportionate negative impact on land use. Both with regards to the materials used in ULEV making and to refuelling. ULEVs will increase land take by approximately 130 %. This is mainly due to the land required for producing the electricity required. With regards to ULEVs the required	--

Objective	Sub-Objective	Qualitative Impact	Score
		land take to produce clean fuels increases by a factor of 10 for each kilometre travelled.	
	Water	No significant effects identified.	0
	Air Quality	One of the main reasons for promoting EV uptake and use through the efficient deployment of effective infrastructure is to improve air quality. Improved air quality within the regional city and town centres makes them a more pleasant places to work particularly for those working outdoors (such as market traders, street cleaners etc) including staff of restaurants/ and cafes with outdoor seating areas.	++
	Climatic Factors	One of the main reasons for promoting EV uptake and use through the efficient deployment of effective infrastructure is to reduce carbon emissions.	++
	Material assets	No significant effects identified.	0
	Cultural heritage	Potential significant negative effects on cultural heritage due to possible impacts on nationally significant assets, although effects are reversible	--
	Landscape	As above.	--
Safety	Accidents	ULEVs range from pure electric vehicles and fuel cell electric vehicles to plug-in hybrids and extended range electric vehicles. They are much quieter than conventional cars. This presents a safety issue as people find it much harder to tell if a vehicle is approaching. However, European Commission Delegated Regulation (EU) 2017/1576 mandates that all new types of electric and hybrid cars to be fitted with a new safety device as from 1 July 2019, the acoustic vehicle alerting system (AVAS). The device will automatically generate a sound from the start of the car up to the speed of approximately 20 km/h, and during reversing. The sound-emitting device will be obligatory in all new e-cars as of 1 July 2021.	0
	Security	As above under ‘Safety’.	0

Objective	Sub-Objective	Qualitative Impact	Score
Economy	Transport Economic Efficiencies (TEE)	Net time and operating costs savings are dependent on the charging network.	0
	Reliability	Range anxiety — whether real or perceived — is still a primary industry barrier and EV drivers need ample options to build range confidence, particularly to enable longer distance travel.	-
	Wider Economic Impacts	The installation and operation of EV charging infrastructure can also have regional and local economic benefits. These include: • Increasing patronage of local businesses, improving access to employment, and improving public health. • Ensuring new-build houses are fit for the future, retaining value as the region transitions towards clean fuelled vehicles. • Enabling fleets to use EVs, generating operational cost savings that can support growth and create jobs. • Increasing demand for skilled labour to install and maintain EV charging infrastructure. • Developing an environmentally friendly image, attracting eco-conscious individuals and businesses to visit and trade. • Encouraging and facilitating organisations of the future to invest in the local area by providing infrastructure essential to operating EVs. This is key to ensuring the region keeps pace with UK policy and the wider UK transport network and is not left behind.	++
Integration	Transport / Modes	Infrastructure should also be integrated with other transport modes and e-mobility services where appropriate to provide an important element of the regional transport mix. Installing charge points together in hubs or mini-hubs will increase opportunities to provide other services at the hub for example e-bike hire or EV car clubs, where this is	+

Objective	Sub-Objective	Qualitative Impact	Score
		deemed appropriate. Locating electric vehicle charging infrastructure at park and ride sites will allow EV users to access the region's public transport network. Locations adjacent to or integrated within, other land uses that generate activity throughout the day and evening such as leisure / shopping destinations, community centres or local centres will help to ensure charging infrastructure can be utilised safely and conveniently by different EV users at different times.	
	Land-Use Policy	Supported by wider spatial strategy.	+
	Other Policies	Will support work towards improving air quality and addressing the AQMAs in Dundee, Perth and Crieff. Supports the Scottish Government's Climate Change Bill and regional policy on supporting the transition to cleaner fuels and phasing out petrol and diesel cars.	+
Accessibility Social Inclusion	Severance	Current business models for EV ownership and the transition to net-net zero emissions are not working for households in the lowest income brackets. However, low-income communities bear the brunt of environmental and health illnesses from transport air pollution caused by those living in relatively more affluent areas.	0
	Social Inclusion	A recent set of figures from the Society of Motor Manufacturers and Traders (SMMT) in the UK shows that registrations for ULEVs in the first 9 months of 2021 were up to 174% compared to 2020[60]. However, this growing market comprises higher-income consumers, with over half of EV owners still primarily concentrated among the top 20% wealthiest income earners[61]. Most private EV owners are still middle-aged, male, well-educated, affluent, and live	--

[60] Electric car market statistics (https://www.nextgreencar.com/electric-cars/statistics).
[61] Electric car market statistics (https://www.nextgreencar.com/electric-cars/statistics).

Objective	Sub-Objective	Qualitative Impact	Score
		in urban areas with households containing two or more cars and the ability to charge at home[62]. Indeed, those in the lowest two income brackets made up just 4% of EV owners from 2015 to 2017[63].	

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	The feasibility of installing the different types of chargers is highly dependent on the location of electricity substations: • Rapid 'super chargers' (125kv to 300kv) require to be located close to 33kv and 132kv substations to facilitate recharging during short stays during long distance journeys and at taxi ranks (rapid chargers will charge a car up to 80% from flat in 30 minutes). • Fast chargers (20kv – 50kv) require to be close to 11kv substations for use as destination chargers in car parks where the vehicle is being left for a longer period. • Standard chargers can connect into standard 3-phase connections.	Moderate consideration
	Deliverability Risk	Early engagement with the electricity Distribution Network Operator(s) to establish the feasibility of the different charging types at the various locations whilst considering what is required given the types of journeys being made. The development of hydrogen vehicle refuelling infrastructure is far behind compared to the infrastructure for electric vehicles and there is no hydrogen fuel infrastructure in the UK that currently would allow hydrogen	Minor consideration

[62] Lyndhurst B. Uptake of Ultra Low Emission Vehicles in the UK, A Rapid Evidence Assessment for the Department for Transport. London: Department For Transport Brook Lyndhurst Ltd; 2015.
[63] Electric car market statistics (https://www.nextgreencar.com/electric-cars/statistics).

Objective	Sub Objective	Qualitative Impact	Score
		fuelling at an equivalent scale to petrol forecourts. Spatial planning would also be needed to fully consider 'blast zones' for any storage facility.	
Affordability	Costs	Standard chargers (dual outlet 7kW or 22kW) smart post solutions range in price from £2,000 to £3,000 ex-VAT depending on specification and power requirements. Rapid chargers range in price from around £20,000 ex-VAT for a triple outlet 50kW charger, to £40,000 for a 150kW version. Higher powered rapid chargers allow shorter charge times but only on compatible vehicles. In addition to the charging infrastructure, additional civil groundworks are likely to be required as well as DNO works. The introduction of a monetary charge for use of the electric charging points as progressed under the Transport Scotland's EV Infrastructure Investment Fund could stimulate the provision of commercial provision across the region.	Moderate consideration
	Financial Risks	A recent study[64] showed less than 0.1% EV uptake in rural areas, which means those regions are less likely to attract investors due to the risk in installation and management of charging infrastructure. However, rural areas do not just connect regions but attract tourists with their visitor attractions. Respective business models need to be applied to enable business opportunities to deliver charging	Moderate consideration

[64] Kai Sheng, Mahdieh Dibaj, Mohammad Akrami (2021): Analysing the Cost-Effectiveness of Charging Stations for Electric Vehicles in the U.K.'s Rural Areas (https://www.mdpi.com/2032-6653/12/4/232)

Objective	Sub Objective	Qualitative Impact	Score
		infrastructure to be delivered in such rural places with lower risk and higher Return on Investment compared to other models.	
Public Acceptability		Public likely to be highly supportive. Given the increasing number of residents purchasing ULEVs, there is the potential for disappointment if the available infrastructure does not support this. A representative sample of the Tactran region shows that 80% of people support proposals to promote and enable the further uptake of electric and low emission vehicles, 72% support proposals to decarbonise rail. Proposals to encourage and support mode shift for freight movements within the region are supported by 74%[65].	Minor consideration

[65] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.

6. Improving accessibility and security of our transport networks

Potential interventions include:

I. Improved Accessibility and Security of the Street Environment

This option seeks to make our settlements places where everyone, especially people with mobility difficulties, can confidently and easily walk, cycle or wheel around

i. Step free routes and appropriate crossing facilities, informed by accessibility audits around the 20min neighbourhoods
ii. Seating
iii. Lighting and reviewing the design of the public realm to improve security
iv. Signage and wayfinding
v. Number and location of disabled car parking spaces
vi. Reducing severance & improving active travel on trunk roads through communities
vii. Promoting changes to our transport networks to people with learning difficulties

II. Improved Accessibility and Security for All across Public Transport

i. Improving access for all public transport users and particularly for those who are mobility impaired, including:
ii. Improvements at interchanges, step free access, improved seating, improved lighting, security improvements
iii. Improved accessibility of buses and trains
iv. Improved information provision for people with mobility issues/passes
v. Assistance to public transport users

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	A greater number of people travelling independently as well as more sustainably has the potential to reduce car kilometres if car lifts are no longer required and the public's experience of walking, cycling and using public transport is improved and fewer trips by car are encouraged. This would reduce the associated emissions, carbon emissions and improve air quality.	+
PO2: Improving Health and Wellbeing	Physical inactivity and sedentary lifestyles are creating one of the most serious public health challenges of our time. The easiest way for most people within the region to stay active is by walking or cycling as part of their daily routine. The short periods of active travel have also been shown to be beneficial to mental health and reducing stress. Shift from car to sustainable travel would reduce road accidents with less cars being on the road, although this is anticipated to be minor.	+

Objective	Qualitative Impact	Score
PO3: Reducing Inequalities	Improving the accessibility of streets for older and disabled people through measures including removing obstacles, widening pavements for wheelchair access, introducing tactile paving, raising sections of roadway to make crossing easier, providing seating, mitigating the impact of street works and, where possible, ensuring on-street cycling facilities cater for the wide range of cycles used by disabled people will help to reduce inequalities and issues around social inclusion. Major impact, enabling equality of access to opportunities and public services across a range of disadvantaged groups, enabling more people to travel independently.	++
PO4: Delivering Sustainable and Inclusive Economic Growth	If public realm improvements succeed in attracting more visitors to a previously less attractive high street or city / town centre, increased footfall will boost sales and in turn, existing businesses will benefit. There is a realistic potential that new businesses and shops might be attracted to the area. It is also possible that public realm improvements can have indirect economic benefits by reducing costs or delivering efficiencies. Potentially also a (limited) labour market impact if those excluded from public transport are now able to travel independently and participate in the local / regional labour market.	+

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	As part of improvements to both the public transport Network and public realm there will be opportunities to realise a net gain in biodiversity.	+
	Population and Human Health	Changes in access to health and leisure facilities. Changes in air quality and emissions.	0
	Soil	As part of improvements to both the public transport Network and public realm there will be opportunities to and introduce blue-green infrastructure.	+
	Water	As above.	+
	Air Quality	No positive or significant negative effects on air quality have been identified.	0
	Climatic Factors	As part of improvements to both the public transport Network and public realm there	+

Objective	Sub-Objective	Qualitative Impact	Score
		will be opportunities to and introduce blue-green infrastructure. By making public transport and active travel more accessible car use would reduce.	
	Material assets	Without significant improvements to both the public realm and transport networks, it is likely that a range of improvements. would not be delivered. This would jeopardise the region's vision of creating an effective and integrated transport system which meets the needs of all those living in, working in, and visiting the region.	+
	Cultural heritage	Improved setting of heritage assets. Townscapes, streetscapes and heritage conversation will benefit from improved public realms. Especially if such improvements are place-based.	+
	Landscape	No positive or significant negative effects have been identified.	0
Safety	Accidents	A reduction in traffic volumes and subsequent car kilometres is likely to reduce the number of road accidents. This is anticipated to be minor, though.	0
	Security	Respective schemes will improve lighting and visibility across the public transport network and public realm and will ensure that all stops and routes to/from public transport stops are well lit. Wider measures will help to improve both formal and informal surveillance including a higher number of people using public transport and the public realm as well as improvements to public transport infrastructure and the public realm to help visibility etc.	++
Economy	Transport Economic Efficiencies (TEE)	No significant effects identified.	0
	Reliability	No significant effects identified.	0
	Wider Economic Impacts	May have a limited impact on the regional labour markets if those currently excluded due to accessibility issues are now able to travel, to travel independently and access the regional labour markets.	+
Integration	Transport / Modes	Improved accessibility would be key to increase integration between rail, bus, walking and cycling within the region by	+

Objective	Sub-Objective	Qualitative Impact	Score
		providing interchange opportunities to allow for multimodal journeys.	
	Land-Use Policy	Supports the links to wider national, regional, and local policy developments, including the Review of the Town Centre Action Plan, Place Principle, National Planning Framework 4.	+
	Other Policies	Supports the Scottish Government's Climate Change Bill as well as respective regional and local policies. Supports the Scottish Government's aim to build a fairer and more equal society.	++
Accessibility Social Inclusion	Severance	Respective projects will improve the public realm and raise design quality in the area with scope to address poor legibility and severance.	+
	Accessibility	Improved information on public transport services including real time journey information will improve knowledge around route choice and help support travel planning. Significant positive impacts with regards to equality, enabling equity of access to services and opportunities for disadvantaged groups.	++

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	Dependent on the scale of public realm improvements. The Transport (Scotland) Act 2019 provides local authorities with an instrument to widen the scope of partnerships with local bus operators to ensure respective accessibility standards are implemented.	Moderate consideration
	Deliverability Risk	As above.	Moderate consideration
Affordability	Costs	Costs are dependent on the measures being implemented	Moderate consideration
	Financial Risks	Ongoing constraints in public funding may mean that constraints in respective funding programmes and	Moderate consideration

Objective	Sub Objective	Qualitative Impact	Score
		reduced allocations to regions and local authorities. Inflation risks, with actual inflation differing from assumed inflation rates.	
Public Acceptability		Measures to improve accessibility and security to the public realm and transport networks are likely to be highly welcomed by the public, especially by disadvantaged groups for whom access at present is difficult, such as those with mobility and visual impairments. A representative sample of the Tactran region shows that 90% of people support proposals to improve accessibility and security of the street environment and, 91% support proposals to improved accessibility and security for all across public transport[66].	Minor consideration

[66] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.

7. Reducing the need to travel by car through the location of development and services

Potential interventions include:

I. Reduce car dependency of new developments

Reduce car dependency of new developments by

i. Development plans promoting land use patterns that reduce the need to travel, and enable travel by sustainable modes
ii. Development management processes ensuring that new development is realistically accessible by a range of modes

II. Locate new and existing services within communities

Locate new and existing services within communities - all public services to work together to improve the range of local services that can be available at a neighbourhood level to support the 20min / liveable neighbourhood principle

III. Measures in neighbouring authorities that reduce car use

The ease and ability to make many trips will be influenced by the sticks and carrots being applied in neighbouring areas. Where applicable we could work with neighbouring authorities on measures that can reduce the number of vehicular trips.

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	Reduces the need to travel by encouraging people to live and work locally will positively affect the emissions generated by new developments. Supporting the use of active and sustainable transport modes for new developments rather than the use of private cars will further contribute to reducing respective emissions. The extent of the above will be relatively local to new developments although given the scale of development proposed within the Tactran region this will likely result into a moderate impact. Higher densities to provide a critical mass of population to support local services etc. manifest as taller buildings or terraced housing. This may reduce overall land take on development schemes, allowing for enhanced blue and green infrastructure.	++
PO2: Improving Health and Wellbeing	Research has shown that larger settlements with higher densities can provide a critical mass of population to support local services, improve economic productivity, reduced	++

Objective	Qualitative Impact	Score
	transport emissions, better public health, and greater social interaction (cp. RTPI (2018): Settlement Patterns, Urban Form and Sustainability).	
PO3: Reducing Inequalities	This option will improve public transport connectivity of new developments as well as their local centres and amenities. Good active travel and public transport links will also ensure disadvantaged groups have improved access to essential services.	++
PO4: Delivering Sustainable and Inclusive Economic Growth	People are more likely to reinvest in local areas and small businesses rather than driving to larger urban hubs for amenities.	+

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	Consolidation of development served by sustainable transport reduces the use of greenfield land, offering opportunities to improve biodiversity, particularly when considering street connectivity and the movement of flora and fauna across landscapes[67].	+
	Population and Human Health	Likely to realise significant positive impacts. People become more active, improving their mental and physical health; traffic is reduced, and air quality improved; local shops and businesses thrive; and people see more of their neighbours, strengthening community bonds and social networks. Supports a move back to more community-based services, correcting the trend of the last 30 years to centralise services. NHS, for example, is increasingly trying to provide healthcare services close to where people live, subsequently reducing the need to travel to hospitals. Hubs, or other local centres that bring together traditional healthcare services and voluntary groups, nurseries and libraries, can be co-located in	+++

[67] M Brierley and P Cockett: 'Urban biodiversity as strategy for walkability (breakout presentation)'. Journal of Transport & Health, 2017,Vol 7, Dec. (Supplement), S28-S29. https://doi.org/10.1016/j.jth.2017.11.046

Objective	Sub-Objective	Qualitative Impact	Score
		high streets and other sites that already have good public transport links[68].	
	Soil	Consolidation of development is at the core of integrated land use and development planning.	+
	Water	Likely to contribute to better environmental outcomes. Traditional low-density developments will use greenfield land, make less efficient use of land overall and promote car dependence. It is important to protect greenspace water management and carbon capture as well as for biodiversity.	+
	Air Quality	The location of services and employment, and the policy of providing car-based solutions to transport problems has led to the creation of an overly car-dependent region. The consequences of this include issues such as congestion, air pollution, severance, unattractive urban environments, and a public transport system which is significantly compromised by the requirement to serve travel patterns which are dispersed and complex. Measures to reduce the need to travel will, therefore have a significant positive impact.	++
	Climatic Factors	As above.	++
	Material assets	Potential for significant positive effects for material assets because of sustainable regeneration of communities. The concept encapsulates the ideas of connected neighbourhoods with sustainable, convenient and equitable access to quality living and supporting services.	+++
	Cultural heritage	Higher density development, with a critical mass of people and more potential for local venues, are more likely to enable participation in cultural activities. It was also important to maintain local heritage.	++
	Landscape	Positive impact as consolidated developments will take less greenfield land, will make far more efficient use of the land overall.	+

[68] M Wood and S Finlayson: Health on the High Street. NHS Confederation, Dec. 2020. https://www.nhsconfed.org/resources/2020/12/health-on-the-high-street

Objective	Sub-Objective	Qualitative Impact	Score
Safety	Accidents	Investment in safe streets can reduce the number of traffic-related pedestrian injuries and deaths.[69]	+
	Security	Increased pedestrian activity in public space can improve perceptions of safety through passive surveillance that naturally aids the prevention of crime, with more 'eyes on the street'[70].	+
Economy	Transport Economic Efficiencies (TEE)	Road congestion: XX% of car journeys made within the Tactran region in 20XX were under five miles long and could have been made by active travel modes or public transport. Making active travel and public transport within the region safer and more inviting can help to minimise traffic and unproductive congestion.	+
	Reliability	As above.	+
	Wider Economic Impacts	Local businesses: Investment in better streets and public spaces for people can boost footfall and trading by up to 40%[71], and can help to reduce retail vacancy in high streets and town centres[72]. Productivity: Walkable environments with highly connected active and sustainable transport networks are more likely to make a positive contribution to labour productivity[73]. Jobs: Keeping investment local through community wealth-building can develop the skills of local people and create stable, well paying jobs for local people[74].	++

[69] The Economic Case for Investment in Walking.Victoria Walks, Nov. 2018. https://www.victoriawalks.org.au/Assets/Files/Arup-economic-case-for-walking_Final.pdf

[70] Cities Alive: Towards a Walking World. Arup, Jun. 2016. https://www.arup.com/perspectives/publications/research/section/cities-alive-towards-a-walking-world

[71] Health Matters: Air Pollution. Guidance. Public Health England, Nov. 2018. https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution

[72] Street Appeal: The Value of Street Improvements. University College London, for Transport for London, 2018. http://content.tfl.gov.uk/street-appeal.pdf

[73] M Rohani and G Lawrence: The Relationship between Pedestrian Connectivity and Economic Productivity in Auckland's City Centre. Technical Report 2017/007-2. Auckland Council, Nov. 2017. https://static1.squarespace.com/static/58e441d2f7e0abde3be51110/t/5a559d50085229d58dfed85b/1515560335402/TR2017-007-2-Pedestrianconnectivity-economic-productivity-Auckland-city-centre-scenarios.pdf

[74] How We Built Community Wealth in Preston: Achievements and Lessons. Centre for Local Economic Strategies (CLES), Jul. 2019. https://cles.org.uk/publications/how-we-built-community-wealth-in-preston-achievements-and-lessons/

Objective	Sub-Objective	Qualitative Impact	Score
		Land value: Investment in better place-making can boost land values by up to 25%.[75] Environments enabling active and sustainable transport links sustain and increase their value because they are popular places in which to live and do business. This can be beneficial in that it could bring investment and jobs[76].	
Integration	Transport / Modes	A central aspect of consolidated developments addresses how people move around and interact with their communities. Integration of transport is a major aspect to be addressed, especially the lack of accessible and well-connected transport links. Public transport needs to be more interconnected to link different services together. Examples include health and social care services, hospitals, libraries, shops, and schools.	++
	Land-Use Policy	As above. Supports the links to wider national, regional, and local policy developments, including the Review of the Town Centre Action Plan, Place Principle, and the National Planning Framework 4.	++
	Other Policies	Supports the Scottish Route Map to achieve a 20% reduction in car kilometres by 2030. Feeds into discussions surrounding renewal and recovery post pandemic[77].	+
Accessibility Social Inclusion	Severance	Creating a well-designed, more place-based environments provide opportunities to support inclusive design of the public realm. Older people are more likely to engage in walking than in other forms of exercise, which can help to prevent ageing conditions such as arthritis, and child-friendly streets allow for informal play and increased independence, which is important for child development[78].	++

[75] Development: The Value of Placemaking. Savills, 2016. https://pdf.euro.savills.co.uk/uk/residential—-other/spotlight-the-value-of-placemaking-2016.pdf

[76] Walkability and Mixed-Use: Making Valuable and Healthy Communities. The Prince's Foundation, Dec. 2020. https://princes-foundation.org/journal/walkability-report

[77] Cp. If not now, when? - Social Renewal Advisory Board report: January 2021

[78] The Economic Case for Investment in Walking.Victoria Walks, Nov. 2018.

Objective	Sub-Objective	Qualitative Impact	Score
	Accessibility	As above. There is a potential risk that there is an inequality in where those respective neighbourhoods are located. Needs action to also establish respective neighbourhoods within areas experiencing disadvantage.	++

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	Implementation is likely to be easier in settlements that pre-date the 20th century, as they were created in an era when most journeys were made on foot and development was compact. Places designed in the second half of the 20th century, when transport planning prioritised motorised vehicles, will present different challenges. Similarly, urban areas and rural areas will require different approaches. In market towns, for example, it can be possible to ensure that the town itself is a 20-minute neighbourhood, so that people in nearby villages only need to get to one place for most of their needs. In distinctively rural areas, linking groups of villages by good active and public transport networks need to be considered. Timescales to adjust the planning framework need to be considered.	Moderate consideration
	Deliverability Risk	Councils are struggling financially, have reduced staff and expertise, and have competing priorities for their shrinking resources. There remains, however, a great appetite for change and a widespread	Moderate consideration

https://www.victoriawalks.org.au/Assets/Files/Arup-economic-case-for-walking_Final.pdf

Objective	Sub Objective	Qualitative Impact	Score
		desire to improve the places in which people live to improve their lives and life chances within the region.	
Affordability	Costs	High. In Paris, for example, 5% of the city budget was delegated to local communities to invest in what they wanted in their local areas as part of the 15-Minute City Project. Building on the successful participatory budget model, 25% of the budget for Paris will now be allocated for participation until 2026 – a measure seen as being key for building trust among residents and allowing them to play a more active role in shaping their neighbourhood[79]. This level of financial commitment goes far beyond the 'community consultation' that is too often the norm, and genuinely empowers local communities to shape their neighbourhoods as they see fit.	Major consideration
	Financial Risks	As above under 'Costs'.	Major consideration
Public Acceptability		Likely to be highly accepted by the public. Approach needs to be designed to empower communities to make positive changes to their places. A representative sample of the Tactran region shows that 76% of people support proposals to reduce the car dependency of new developments and, 83% support proposals to bring back services into local communities. 73% agree that partnership working with neighbouring authorities is required to achieve such proposals[80].	Moderate consideration

[79] P Yeung: 'How Paris's participatory budget is reinvigorating democracy'. City Monitor, 8 Jan. 2021. https://citymonitor.ai/government/civic-engagement/how-paris-participatory-budget-is-reinvigorating-democracy

[80] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.

8. Improving strategic connectivity

Potential interventions include:

I. Address pinch points on strategic roads

Measures focused on road improvements on the key strategic network within the region, focussed on improving journey time reliability and road safety.

i. Kingsway Dundee A90/A972
ii. Broxden and Inveralmond, A9 Perth
iii. Craigforth, M9 Stirling
iv. Grade separation of the A9 between Kier and Inverness (Kier, Auchterader)
v. Dualling of the A9 north of Perth
vi. A82 Inverannan – Tarbert

II. Improve Rail Connectivity

i. Physical and operational improvements to reduce journey times and improve resilience of routes from and through the region to/from Edinburgh; Glasgow; Aberdeen; Inverness; including

- Highland Mainline rail corridor enhancements
- Perth-Dundee-Aberdeen rail corridor enhancements
- Edinburgh/Glasgow – Perth/Dundee rail corridor enhancements

ii. Improved frequency and capacity of services to Edinburgh and Glasgow, including consideration of intermediate stations
iii. Improved resilience of West Highland line

III. Improve Connectivity to Freight Destinations

i. Improving journey time reliability to major freight destinations
ii. Improving freight capacity on the rail network

IV. Improve Access to Airports

Promoting sustainable access between the region and Scotland's airports

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	More reliable and safer trunk road network may encourage more car trips, dependent on the scale of the scheme(s) implemented. This could subsequently increase car kilometres and respective emissions and sue to increased traffic levels may undermine any initial accident benefits of the scheme(s).	-

Objective	Qualitative Impact	Score
	May contradict objectives and policies aimed at encouraging modal shift, although this will be also dependent on attractive and realistic non-car alternatives en route. Any potential construction work will require appropriate environmental mitigation measures. Improvements reduce traffic and therefore emissions in Perth, Dundee and Stirling city centres and other connected centres (i.e. Edinburgh, Glasgow, Aberdeen and Inverness). Reduced traffic volumes may allow priority to be given to active and sustainable modes. Lower carbon emissions and reduced air pollution through reduced traffic levels. Increased noise and vibration impact from increased freight trains on the lines. Construction impacts on biodiversity, soils and water courses, although these can be mitigated through the design process. The COVID-19 pandemic has severely impacted on both rail passenger numbers and the number of operating services. Improved inter-city rail connections have the potential to help the region to emerge from the pandemic with a clear focus on sustainable transport. Additional rail capacity to encourage a shift from road to rail for freight movements will remove HGVs from the regional road network and will reduce the respective particulate matter emissions and carbon emissions. However, dependent on the technical advances to decarbonise road freight, it is likely that a shift to rail may only have a minor to moderate impact on emissions.	
PO2: Improving Health and Wellbeing	Reduced traffic and therefore emissions in Perth, Dundee and Stirling city centres and other connected centres (i.e. Edinburgh, Glasgow, Aberdeen and Inverness). Reduced accidents on trunk roads (A90(S), M8, M9, A85 etc.) and in the city centres due to reduced traffic. Reduced number of accidents and a reduction in the severity of occurring accidents. Reduction in particulate matter emissions both within urban areas and communities on trunk roads will have a positive impact on air quality and subsequently on human health.	++

Objective	Qualitative Impact	Score
	On the subject of reducing the negative impacts which (road) transport has on the health and wellbeing of people and pollution impacts on the environment, it is worth noting that there are social impacts of road-based transport of hazardous materials, particularly for residents of poor and disadvantaged communities. Those individuals are more at risk of exposure to hazardous materials spills due to their location along trunk roads. A shift from transporting freight on roads to rail movements will minimise this impact.	
PO3: Reducing Inequalities	Limited impact on accessibility although potential for localised accessibility improvement. However, accessibility and social inclusion benefits are only accrued by those with access to a car if not accompanied by complementary measures. Increased rail frequencies would improve public transport network connectivity, particularly for those residents within a walk-in catchment of the stations Potential loss of passengers from existing bus services to rail may mean a reduction in bus services along the road corridors if services lose commercial viability. This would impact on smaller communities who were served by bus but for whom the rail network is still not accessible Residents within the walking catchment area of stations would see the greatest benefit. The socio-economic characteristics of this area would determine the impact on comparative accessibility. There is likely to be an increase in access to opportunities and public services for those without access to a car. Increased access to Aberdeen, Dundee, Stirling, Inverness, Edinburgh and Glasgow and further afield. The potential to travel by rail rather than car may mean that the car for that household to be used by another member of the household allowing additional opportunities for travel for work or social purposes. Forced car ownership would be reduced for those communities with walking access to the rail network. Additional capacity for freight on the regional rail network will enable a shift from road freight to rail freight. Reduced HGV volumes may help to address the severance within communities	0

Objective	Qualitative Impact	Score
	along freight routes, improving road safety and reducing noise and disturbance.	
PO4: Delivering Sustainable and Inclusive Economic Growth	Reduction in journey times will realise TEE benefits. Improved connectivity – both for road and rail - between the economic centres of Aberdeen, Inverness, Dundee, Edinburgh and Glasgow, potentially resulting in greater economic integration and realising agglomeration benefits. Respective measures will help to reduce the relative peripherality of the Tactran region. Improved productivity, resulting from reduced and more reliable journey times. Particular benefits to sectors relying on time sensitive shipments, such as livestock. Wider catchment of the local/regional labour market, and improved access to employment and services. Provision of a competitive alternative to road-based travel. In terms of the region in general, rail journey times within the region are currently significantly less time competitive when compared with travel by car. Strengthened connectivity between the economic centres of Aberdeen, Dundee, Inverness, Edinburgh, and Glasgow, as well as onwards to Newcastle, Leeds and London, promoting greater economic integration and bringing agglomeration benefits. Improved business efficiencies from increased connectivity. This includes the continuation and improvement of air services connecting the region to the rest of the UK and further afield with the ultimate aim of being able to travel between the region and any major city in the world either directly or with, at most, only one stop. Such improvements in international connectivity support regional business and stimulate new markets for inbound tourism. Increased rail freight opportunities. Additional capacity for freight on the regional rail network will allow goods to be transported more efficiently within the region and beyond. Long distance freight services, in particular, will be benefitting from reductions in journey times. They are especially suited to be transferred to rail.	++

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	Use of land for new transport infrastructure may cause disturbance of habitats and species and result in negative effects because of human activities (such as recreational activities outdoors, noise from transport etc.). It may also result in coastal squeeze[81] and pollution of other environmental media (water, soil and air).	--
	Population and Human Health	Changes in access to health and leisure facilities. Changes in air quality and emissions.	0
	Soil	Use of land for new transport infrastructure, and an associated increase in impermeable surfaces. Land that is sealed no longer performs many of its former ecological functions. Rain no longer stays were it falls to be used by plants but runs off the impervious surface causing problems of flooding, erosion, and sedimentation. Less soil water available for evaporation means that the impermeable areas get hotter and there is a reduction in the humidity of the area affected.	--
	Water	Use of land for new transport infrastructure, and an associated increase in impermeable surfaces. Risk of significant flooding events is also likely to increase in the future, particularly because of climate change. Pollution from transport related infrastructure such as roads and rail lines, areas of parking etc.) discharging into waterbodies can result in exceedances of water quality standards.	--
	Air Quality	Interventions could potentially seek to improve air quality by supporting highway schemes designed to reduce traffic congestion. This includes the application of intelligent transport systems and other innovative technical solutions to reduce	-

[81] The loss of natural habitats or deterioration of their quality arising from anthropogenic structures or actions, preventing the landward transgression of those habitats that would otherwise naturally occur in response to sea level rise in conjunction with other coastal processes.

Objective	Sub-Objective	Qualitative Impact	Score
		congestion on the regional strategic road network. There is potential for a future increase in traffic volumes during operation of the project, because of improved connectivity and resilience, though this is unlikely to have a significant effect on air quality. There are opportunities to explore integration of green infrastructure in project design to remove air pollution, though any effects this would have on air quality would be unlikely to be significant.	
	Climatic Factors	Loss of potentially designated lands during construction and operation has the potential for permanent, minor negative or uncertain effects on the climate. Manufacture of materials and construction activities would release emissions which would add to the atmospheric concentration of greenhouse gases. Schemes would improve the resilience of the strategic road network to the anticipated impacts of climate change and reduce the need for closures during bad weather, resulting in long-term positive effects after completion.	--
	Material assets	Loss of land during construction and operation has the potential for permanent, long term negative or uncertain effects on natural material assets. Land-use within the corridors could potentially change as a result of the project. Construction of the project would consume energy and finite resources, as well as generate demolition and construction waste, resulting in long-term negative or uncertain effects on built material assets. Resilient infrastructure would positively contribute towards adapting the road network to climate change impacts, resulting in a permanent, positive effect on built material assets.	--
	Cultural heritage	Use of land for new infrastructure may cause disturbance of heritage assets and their settings	--

Objective	Sub-Objective	Qualitative Impact	Score
		because of human activity (such as recreation, transport related noise pollution etc.) and more direct pollution of environmental media (water, soil, and air).	
	Landscape	Effects can arise within the landscape and/or townscape and visual baseline context. Considerable potential to cause irreversible harm.	--
Safety	Accidents	Anticipated to reduce accidents due to the high-quality routes and modern design standards.	+
	Security	As above.	+
Economy	Transport Economic Efficiencies (TEE)	Anticipated to improve freight links within the region, and to reduce the time to market for goods. Any reduction in journey times will generate TEE benefits.	++
	Reliability	Improved congestion levels would improve journey time reliability for road users.	++
	Wider Economic Impacts	Improved business efficiencies from increased connectivity. Improved connectivity between the economic centres of Aberdeen, Dundee, Edinburgh, Inverness, and Perth, enabling agglomeration benefits. The continuation and improvement of air services connecting the region to the rest of the UK and further afield with the ultimate aim of being able to travel between the region and any major city in the world either directly or with, at most, only one stop. Such improvements in international connectivity support regional business and stimulate new markets for inbound tourism.	++
Integration	Transport / Modes	Supports national, regional, and local policy to regenerate and support the economy.	+
	Land-Use Policy	Supports national, regional, and local planning policies. Land-use within the corridor, however, could potentially change as a result of the improvements to the strategic network.	+
	Other Policies	Scheme dependent. May not support elements of the National Transport Strategy (NTS2) Sustainable Travel Hierarchy in terms of reducing the need to travel unsustainably; maintaining and safely operating existing assets; or making best use of existing capacity.	-

Objective	Sub-Objective	Qualitative Impact	Score
		Supports transport policy to improve the safety of transport networks. Supports regional and local economic development strategies. Does not necessarily support the Scottish Government's Climate Change Bill.	
Accessibility Social Inclusion	Severance	The construction of new road infrastructure roads may cause severance, or the separation of residents from local amenities or social networks. On the other hand, construction of new road infrastructure may also reduce severance. An example is the A90/A972 through Dundee, currently causing significant severance to local communities and neighbourhoods.	-
	Accessibility	Improved access to the ports at Dundee, Montrose and Perth. Improved access to Grangemouth. Minor positive impact on improving accessibility of disadvantaged communities. Benefits would be accrued only by those with access to a car.	+

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	Interventions require further assessment with regards to feasibility and detailed design. Interventions on the strategic road network are likely to be feasible, land-take may be required to construct, operate, maintain and mitigate the scheme.	Moderate consideration
	Deliverability Risk	As above.	Moderate consideration
Affordability	Costs	Without further appraisals, it is impossible to include realistic and comprehensive cost estimates.	Moderate consideration
	Financial Risks	Inflation risks, with actual inflation differing from assumed inflation rates.	Moderate consideration
Public Acceptability		Likely to be accepted by the public given the potential safety and journey time improvements benefits.	Moderate consideration

Objective	Sub Objective	Qualitative Impact	Score
		A representative sample of the Tactran region shows that 82% of people support proposals address congestion hotspots on the strategic road network and, 84% support proposals to improve rail connectivity within the region. 73% agree that measures to improve connectivity to freight destinations are important, while 77% supported proposals to improve access to airports[82]. However, the construction of new road schemes may result in some opposition.	

[82] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.

9. Improving network resilience

Potential interventions include:

I. Improving Network Resilience

To maintain a transport network within the region which is resilient to disruptive events resulting from the increased risk of extreme weather and flooding, maintaining access for people and resources

i. Winter maintenance
ii. Diversion routes
iii. Protection of vulnerable sites to flooding / landslips
iv. Meet environmental standards in construction and maintenance
v. Blue-Green Infrastructure
vi. Strategic road renewal for reliability, resilience and safety

Qualitative Impacts on RTS Policy Objectives

Objective	Qualitative Impact	Score
PO1: Taking Climate Action	Support the transition to greater climate resilience within the region. Reduce atmospheric carbon through sequestration (carbon offsetting). Mitigate the urban heat island effect. Green sustainable urban drainage solutions (SuDS) such as swales and water gardens, increase the infiltration and slow the removal of rainfall into the drainage system, reducing the risk of surface water flooding. More reliable and safer road may encourage more car trips. This could increase car kilometres and carbon emissions.	++
PO2: Improving Health and Wellbeing	Part of the wider regional transport network, the priority given to a resilient network through maintenance and other measures to ensure that access to key services and necessary support to the economy are maintained during extreme weather.	++
PO3: Reducing Inequalities	Limited impact on accessibility although localised accessibility improvements during disruptive events.	0
PO4: Delivering Sustainable and Inclusive Economic Growth	Improved journey time reliability as a result of faster responses to and clearances of incidents. Preventing closure of facilities due to weather events, as well as reacting events quicker.	++

Qualitative Impacts on STAG Criteria

Objective	Sub-Objective	Qualitative Impact	Score
Environment	Biodiversity Fauna and Flora	Mandating biodiversity net gain could ensure that respective transport infrastructure schemes enhance the environment, contributes to our ecological networks and conserves biodiversity.	+
	Population and Human Health	The purpose of a resilient network is to maintain economic activity and access to key services during disruptive events. There are major benefit for the population within the region, in particular for those living remotely. Lifeline services during severe weather events.	++
	Soil	In recent years, rainfall intensity and frequency have increased resulting in severe landslide events within the region, affecting the trunk road network and to a lesser degree, the roads which act as diversion routes.	++
	Water	Route resilience across the regional trunk road network is important to ensure continuation of local and strategic travel. The trunk road network has well documented road resilience issues. Flooding is also an issue across the region, with several watercourses classified by SEPA's flood mapping as having a high likelihood of flooding. Measures to improve the resilience of the regional transport network will, therefore have a significant positive impact.	++
	Air Quality	No positive or significant negative effects on air quality have been identified.	0
	Climatic Factors	Improving the resilience of the trunk road network within the region to the anticipated impacts of climate change and reduce the need for closures during adverse weather, results in long-term positive effects.	++
	Material assets	Resilient infrastructure will positively contribute towards adapting the road network to climate change impacts, resulting in a permanent positive effect on built material assets.	++
	Cultural heritage	No positive or significant negative effects on cultural heritage have been identified.	0
	Landscape	No positive or significant negative effects on the landscape have been identified.	0

Objective	Sub-Objective	Qualitative Impact	Score
Safety	Accidents	Road Traffic Accidents are also likely to impact route resilience with full closure possibly implemented until such accidents are cleared.	++
	Security	As above.	++
Economy	Transport Economic Efficiencies (TEE)	Given the strategic link of the Tactran region within Scotland, issues on the trunk road could cause wider impact due to disruption and delays. Measures to improve the resilience of the regional transport network will, therefore have a significant positive impact.	+++
	Reliability	As above. Resilient networks will be identified to which priority is given through maintenance and other measures to maintain economic activity and access to key services during extreme weather.	+++
	Wider Economic Impact	Realising savings to public sector budgets if maintenance of strategic assets is managed in line with the resilient network designations to mitigate the risk posed by climate change. Wider benefits to the economy to be realised, e.g. rail services not disrupted means better connectivity to from and within region.	++
Integration	Transport / Modes	Supports Transport Scotland's National Transport Strategy National Transport Strategy and Second Delivery Plan: 2022 to 2023 to maintain a safely and resiliently operate publicly owned assets.	++
	Land-Use Policy	Supports national, regional and local policies to provide a vital contribution towards the economic, social and environmental well-being of the region.	+
	Other Policies	Supports national, regional and local policies to adapt to and mitigate the impacts on Climate Change.	++
Accessibility Social Inclusion	Severance	Improving the resilience of the trunk road and rail network within the region to the anticipated impacts of climate change and reduce the need for closures during adverse weather. Network is of strategic importance and disruption to the road network can have	++

Objective	Sub-Objective	Qualitative Impact	Score
		significant consequences for communities and the wider economy.	
	Accessibility	As above. Network is of strategic importance and disruption to the road network can have significant consequences for communities and the wider economy.	++

Implementability

Objective	Sub Objective	Qualitative Impact	Score
Feasibility	Technical Risks	Further assessments would be required to identify the range of schemes that need to be implemented to establish the resilient network across the region. Localised schemes are likely to be more feasible.	Moderate consideration
	Deliverability Risk	As above.	Moderate consideration
Affordability	Costs	Dependent on scheme. Significant cost savings if a resilient network is to be identified to which priority is given through maintenance and other measures to maintain economic activity and access to key services during extreme weather. The WEATHER project estimated that the total costs from extreme weather events currently, noting these are dominated by road transport (ENEI ET AL., 2018[83]). The project estimated climate change could increase current costs by 20% by 2040-2050 (EEA, 2017[84]), although, the costs from heat stress and flooding are large, but are offset by a large reduction in winter maintenance cost.	Moderate consideration

[83] ENEI, R., ET AL. (2018): Escalating impacts of climate extremes on critical infrastructures in Europe. General Environmental Change, 48, January 2018, 97-107, https://doi.org/10.1016/j.gloenvcha.2017.11.007.
[84] EEA (2017). Climate change, impacts and vulnerability in Europe 2016: an indicator-based report. European Environment Agency. https://doi.org/10.2800/534806.

		For the rail sector, heat stress and heavy rainfall were estimated to increase costs by 72%. The impacts on air transport are very uncertain because they result from extreme wind and fog, but are estimated to increase by 38% (PRZYLUSKI, ET AL. 2012). For inland waterways, the main issues are low river flows, from drier summers. The PESETA II study (CISCAR ET AL., 2014[85]) considered impacts on the road and rail network in Europe, estimating a 50% increase from the current baseline damage under a 4°C pathway, but around half of this under a 2°C scenario.	
	Financial Risks	As above.	Moderate consideration
Public Acceptability		Likely to be highly accepted by the public as a resilient network will to maintain economic activity and access to key services during disruptive events. A representative sample of the Tactran region shows that 85% of people support proposals to improve network resilience[86].	Minor consideration

[85] CISCAR JC, ET AL (2014). Climate Impacts in Europe. The JRC PESETA II Project. JRC Scientific and Policy Reports, EUR 26586EN

[86] TAYLOR MCKENZIE RESEARCH LIMITED (2022): Tactran – Quantitative Research.