Detailed Appraisal	**D6 - Using Intelligent Transport Systems on Parts of the Road Network to Enhance Capacity and Operations**
Estimated total Public Sector Funding Requirement:	***Capital Costs/grant*** Phase 1 £250m - £500m Phase 2 £100m - £250m Phase 3 £100m - £250m
	Annual Revenue Support Present Value of Cost to Gvt -
	BCR/PVB Phase 1 £100 - £250m Phase 1 Estimated BCR of 1.75 - 2.25

Summary Impact on STAG Criteria

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Environment							
Safety							
Economy							
Integration							
Accessibility and Social Inclusion							

(Judgement based on available information against a 7pt. scale.)

Intervention Description:

This intervention supports the objectives of improving journey time reliability and journey times for prioritised users. It would involve the introduction of enhanced Intelligent Transport Systems (ITS), principally Active Traffic Management (ATM), on the motorway and trunk road network in Central Scotland:

- The M8;
- The M90 and A90 approaching Edinburgh;
- The A720 around Edinburgh; and
- The M74, M77 and M80 approaching Glasgow.

Phase 1 would consist of variable speed limits, variable message signs, ramp metering at key junctions and average speed enforcement measures as appropriate.

Phase 2 would consist of additional functionality through further provision of ramp metering and hard shoulder running within the existing road space.

Phase 3 would consist of improved functionality through targeted use of the hard shoulder as an additional 'managed lane' for priority vehicles – e.g. High-Occupancy Vehicles (HOVs), buses and, HGVs. In some cases, road widening could be used to generate an additional lane for this purpose.

Summary: Rationale for Selection

The implementation of an Intelligent Transport System (ITS), based on an expansion of the existing capabilities of the Traffic Scotland system, would have significant benefits for the movement of people and goods.

This would contribute to objectives on a number of corridors that link into the urban networks of Edinburgh and Glasgow, and in particular would contribute to the objective to improve the operation of the urban Glasgow motorway network.

This intervention would have moderate environmental benefits by minimising congestion and stationary traffic and safety benefits by reducing the potential for collisions.

This system would also be able to support the operation of the strategic Park-&-Ride / Park-&-Choose intervention by providing opportunities to use the hard shoulder on approach to the urban networks for priority vehicles.

Table D6.1.1 STPR Objectives

STPR Objectives	
National Objective 1: To promote 'competitive' inter-urban journey times.	**1: Positive -** Improvements to capacity would ultimately help to promote competitive journey times. Introduction of additional Variable Message Signs (VMS) displaying live journey time information would inform road user choice and improve driver confidence. This intervention could improve the efficiency of the strategic road network and at the same time improve journey time reliability.
National Objective 2: To reduce inter-urban journey time on public transport.	**2: Positive -** The provision of an actively managed hard shoulder would improve existing capacity and lane distribution. Utilising the increased road space to the benefit of public transport would further improve the attractiveness of more sustainable forms of travel. The provision of priority lanes would encourage the transfer of single occupancy car users to buses.
National Objective 3: Promote journey time reduction on the trunk road network for prioritised vehicles and users (e.g. HOV, freight, bus) or provide improvements to journey time reliability.	**3: Positive -** The provision of an actively managed hard shoulder would improve existing capacity and lane distribution. Utilising this increased road space to the benefit of public transport and HOVs would further improve the attractiveness of more sustainable forms of travel, penalising those who do not wish to change. Introducing Variable Speed Limits (VSL) would also contribute towards improving the reliability of journey times by smoothing the flow of traffic at congested times.
National Objective 4: To promote journey time reductions between the Central Belt and Aberdeen/Inverness primarily to allow business to achieve an effective working day between these centres. *(This objective is also relevant to Edinburgh and Corridor 9)*	**4: Positive -** Improvements to capacity would ultimately contribute to reduced journey times between the Central Belt and Aberdeen/Inverness primarily to allow business to achieve an effective working day between these centres. Introduction of additional VMS displaying live journey time information would inform road user choice and improve driver confidence. This intervention of measures could improve the efficiency of the strategic road network and at the same time improve journey time reliability.
National Objective 5: Maximise the labour catchment area in city regions (favouring PT and HOVs and balancing with other policy measures that promote education in need to travel).	**5: Slightly Positive -** The provision of an actively managed hard shoulder would improve existing capacity and lane distribution helping to maximise the labour catchment area in city regions (favouring Public Transport and HOVs and balancing with other policy measures that promote reduction in need to travel). Utilising the increased road space to the benefit of public transport would further improve the attractiveness of more sustainable forms of travel, penalising those who do not wish to change. The provision of priority lanes would encourage the transfer of single occupancy car users to buses.
National Objective 6: Support the development and implementation of the emerging national development interventions. *(This objective is also relevant to Edinburgh, Corridor 10, Corridor 13 and Corridor 17).*	**6: Slightly Positive** - This intervention would support the development of national development sites such as Edinburgh and Glasgow Airports and Grangemouth which are all located close to the existing strategic transport network.
National Objective 7: Reduce CO_2e emissions per person km.	**7: Positive -** The provision of an actively managed hard shoulder would improve existing capacity and lane distribution. Utilising this increased road space to the benefit of public transport and HOVs would further improve the attractiveness of more sustainable forms of travel, penalising those who do not wish to change. The provision of priority lanes would encourage the transfer of single occupancy car users to buses and the introduction of VSL would smooth traffic flows. Both of these measures would contribute to a reduction in the CO_2e emissions per person km.
National Objective 8: Stabilise total CO_2e emissions.	**8: Positive -** It is likely that there will be reduced congestion levels on the major road network in Scotland as well as promoting a small modal shift from the car to bus, reducing CO_2e emissions.
National Objective 9: Reduce CO_2 emissions in line with expectations from the emerging	**9: Positive -** There would be reduced congestion levels on the strategic road network in Scotland as well as promoting a small modal shift from the car to bus, reducing CO_2e emissions.

climate change bill.	
National Objective 10: To promote continuing reduction in accident rates and severity rates across the strategic transport network, supporting the work of the Strategic Road Safety Plan. *(This objective is also relevant to Edinburgh, Corridor 9, Corridor 10 , Corridor 13, Corridor 15, Corridor 17 and Corridor 18)*	**10: Slightly Positive -** Running on hard shoulders could impact on safety; however this intervention would contribute towards improved road safety. Emergency refuge areas would provide safe places for road users in the event of them breaking down or requiring assistance. Responding to incidents occurring more efficiently should also reduce the potential for secondary incidents thus contributing towards improved road safety.
National Objective 11: To promote seamless travel.	**11: Neutral -** This intervention will not have any significant effect on this objective.
National Objective 12: Improve the competitiveness of public transport relative to the car.	**12: Slightly Positive -** The provision of an actively managed hard shoulder would improve existing capacity and lane distribution. Utilising this increased road space to the benefit of public transport would further improve the attractiveness of more sustainable forms of travel, penalising those who do not wish to change. The provision of priority lanes would encourage the transfer of single occupancy car users to buses thus helping to improve the competitiveness of public transport relative to the car.
National Objective 13: To improve overall perceptions of public transport.	**13: Slightly Positive -** The provision of an actively managed hard shoulder would improve existing capacity and lane distribution. Utilising this increased road space to the benefit of public transport would further improve the attractiveness of more sustainable forms of travel. The provision of priority lanes would encourage the transfer of single occupancy car users to buses thus helping to improve overall perceptions of public transport.
IN ADDITION TO THE NATIONAL OBJECTIVES ABOVE THIS INTERVENTION WOULD ALSO POSITIVELY CONTRIBUTE TO THE FOLLOWING SELECTED URBAN NETWORK AND CORRIDOR OBJECTIVES:	
STPR Objective Edinburgh 1: To maintain the 60-minute commutable labour market area at the current level, with a particular focus on linking areas of economic activity.	**E1: Positive -** By introducing innovative measures (variable speed limits) on the Edinburgh City Bypass, it is possible that the capacity of the road would be increased so as to prevent the road from reaching saturation point. This could help maintain the 60-minute commutable labour market area around Edinburgh by reducing delays and congestion on the main route around the city.
STPR Objective Edinburgh 2: To enhance public transport interchange opportunities, where feasible to do so.	**E2: Slightly Positive -** Priority and greater road space for public transport could improve connections to public transport interchanges.
STPR Objective Edinburgh 3: To increase public transport capacity and frequency between Fife and Edinburgh.	**E3: Slightly Positive -** ITS and ATM would assist in providing opportunity to improve public transport connections between Fife and Edinburgh.
STPR Objective 9.1 (Glasgow to Perth): To address current and forecast rail overcrowding into Glasgow;	**9.1: Slightly Positive -** The provision of an actively managed hard shoulder would improve existing capacity and lane distribution. Utilising this increased road space to the benefit of public transport would further improve the attractiveness of more sustainable forms of travel. The provision of priority lanes would encourage the transfer of single occupancy car users to buses thus helping to introduce an alternative mode of transport to rail and helping to address current and forecast rail overcrowding into Glasgow**.**

STPR Objective 9.2 (Glasgow to Perth): To improve the efficiency and reliability of the operation of the southern sections of the M80 on approach to Glasgow, particularly for priority vehicles.	**9.2: Positive -** This intervention would improve the efficiency of the strategic road network and at the same time improve journey time efficiency and reliability of the operation for the southern sections of the M80 on approach to Glasgow, particularly for priority vehicles. The provision of an actively managed hard shoulder would improve existing capacity and lane distribution. Utilising this increased road space to the benefit of priority vehicles would further improve the attractiveness of more sustainable forms of travel. The provision of priority lanes would encourage the transfer of single occupancy car users to buses and HOVs.
STPR Objective 10.1 (Edinburgh to Stirling): To improve access to Grangemouth port and freight hub.	**10.1: Neutral -** This intervention will not have any significant effect on this objective.
STPR Objective 10.2 (Edinburgh to Stirling): To address shortfalls in the provision of public transport to and from Edinburgh and increase public transport modal share.	**10.2: Positive -** The provision of an actively managed hard shoulder improves existing capacity and lane distribution. Utilising this increased road space to the benefit of priority vehicles would further improve the attractiveness of more sustainable forms of travel. The provision of priority lanes would help buses avoid increasing delays from the forecast increase in congestion in and around Edinburgh.
STPR Objective 13.1(Glasgow to Edinburgh): To increase public transport capacity and reduce journey time between Edinburgh and Glasgow.	**13.1: Positive -** Improvements to capacity would ultimately contribute to reduced journey times between Edinburgh and Glasgow primarily to allow business to achieve an effective working day between these centres. Introduction of additional VMS displaying live journey time information would inform road user choice and improve driver confidence. Giving priority to buses, and other priority vehicles, promotes sustainable travel by encouraging people to car share or take the bus, thus helping to promote efficient and effective transport links.
STPR Objective 13.2 (Glasgow to Edinburgh): To make best use of the available road space and better manage peak demand.	**13.2: Positive -** The provision of an actively managed hard shoulder would improve existing capacity and lane distribution. Utilising this increased road space to the benefit of priority vehicles would further improve the attractiveness of more sustainable forms of travel. Introduction of additional VMS displaying live journey time information would inform road user choice and improve driver confidence.
STPR Objective 13.3 (Glasgow to Edinburgh): To increase public transport capacity and frequency between Livingston and Edinburgh.	**13.3: Slightly Positive -** The provision of priority lanes would help buses avoid increasing delays from the forecast increase in congestion in and around Edinburgh ensuring journey times become more reliable.
STPR Objective 13.4 (Glasgow to Edinburgh): To contribute to both a reduction in emissions per person kilometre and a reduction in overall emissions.	**13.4: Slightly Positive -** Utilising increased road space to the benefit of public transport and High Occupancy Vehicles would further improve the attractiveness of more sustainable forms of travel. The provision of priority lanes would encourage the transfer of single occupancy car users to buses and the introduction of VSL would smooth traffic flows. Both of these measures contribute to a reduction in the CO_2e emissions per person km.
STPR Objective 15.1 (Glasgow to Stranraer and southwest): To increase rail capacity between Ayrshire and Glasgow including the Kilmarnock line.	**15.1: Neutral -** This intervention will not have any significant effect on this objective.
STPR Objective 15.2 (Glasgow to Stranraer and southwest): To ensure efficient and effective freight access to the port facilities at Loch Ryan.	**15.2: Neutral -** This intervention will not have any significant effect on this objective.
STPR Objective 15.3 Glasgow to Stranraer and southwest): To reduce the conflict between longer distance and local traffic with a focus on identified key constraint points.	**15.3: Positive -** Introduction of additional VMS displaying live journey time information and strategic incident warnings would inform road user choice, encouraging long distance travellers to reroute around the strategic transport network in adverse conditions thus reducing conflicts with local traffic.
STPR Objective 17.1 (Glasgow to Inverclyde and Islands): To increase capacity and reduce journey times by public transport	**17.1: Slightly Positive -** The provision of priority lanes on A77/M77/M80 would help buses avoid increasing delays from the forecast increase in congestion in and around Glasgow ensuring journey times become more

between Glasgow and Inverclyde. STPR Objective 17.2 (Glasgow to Inverclyde and Islands): To facilitate freight access to Greenock port. STPR Objective 17.3 (Glasgow to Inverclyde and Islands): To improve the efficiency of the A8/M8 during periods of peak demand with a focus on reducing the conflict between longer distance and local traffic. STPR Objective 18.1 (Glasgow to northwest England and beyond): To make best use of the available road space and better manage peak demand taking into account the need to contribute to emissions reduction. STPR Objectives 18.2.(Glasgow to northwest England and beyond): To contribute to emissions reduction by facilitating an increase in the proportion of freight passing through the corridor that is carried by rail.	reliable. **17.2: Neutral -** This intervention will not have any significant effect on this objective. **17.3: Positive -** Introduction of additional VMS displaying live journey time information and strategic incident warnings would inform road user choice, encouraging long distance travellers to reroute around the strategic network in adverse conditions thus reducing conflicts with local traffic. **18.1: Slightly Positive -** Utilising increased road space to the benefit of public transport and High Occupancy Vehicles would further improve the attractiveness of more sustainable forms of travel. The provision of priority lanes would encourage the transfer of single occupancy car users to buses and the introduction of VSL would smooth traffic flows. Both of these measures contribute to a reduction in the CO_2e emissions per person km. **18.2: Neutral -** This intervention will not have any significant effect on this objective.

Table D6.1.2 STAG Criteria

STAG Criteria		
Criteria:	**Assessment Summary:**	**Supporting Information:**
Environment:	**Minor Benefit**	The implementation of a managed motorway network would contribute towards reduced congestion and would have an overall minor positive impact on CO_2e emissions as traffic flow speed is smoothed across the network with benefits to local air quality.
Safety:	**Moderate Benefit**	Implementing a managed motorway network across the Central Belt could significantly reduce the accident rate on the trunk road network. This would reduce the number of accidents occurring in and around Glasgow and Edinburgh especially.
Economy:	**Moderate Benefit**	**Transport Economic Efficiency (TEE):** The implementation of a managed network across the Central Belt would result in travel time savings for those travelling between Glasgow, Edinburgh and the south, especially during peak hours. **Wider Economic Benefits (WEB's):** The implementation of a managed motorway network across the Central Belt could provide the facilities for increased and more reliable movement of goods and people between Glasgow, Edinburgh and the south. Journey times could be reduced, resulting in improved productivity. Furthermore, reduced and more reliable journey times would contribute towards an effective working day . **Economic Activity and Location Impacts (EALIs)**: The implementation of a managed motorway network across the Central Belt is likely to assist in the progression of the development areas throughout the region and improve access to the airport. This is likely to assist in developing both the local economies of Glasgow/Edinburgh as well as improving the national economy. This intervention would have no effect on transport and land-use integration.
Integration:	**Minor Benefit**	**Transport Integration:** This intervention would have no effect on transport integration. **Transport and Land-Use Integration:** The implementation of a managed motorway network, giving priority for high occupancy vehicles and reducing congestion, will assist in the progression of development areas throughout the region. **Policy Integration:** This intervention could have a negative effect on road traffic reduction aspirations.
Accessibility and Social Inclusion:	**Minor Benefit**	**Community Accessibility:** This intervention would provide a minor benefit in terms of community accessibility through providing an improved, more reliable public transport system. **Comparative Accessibility:** This intervention would not affect any individual group of people. This intervention could improve public transport priority.

Table D6.1.3 Key Strategic Outcomes

Key Strategic Outcomes (KSOs)		
Objective:	**Assessment Summary:**	**Supporting Information:**
Improve Journey Times and Connections:	**Major Benefit**	In providing actively managed road space, journey times and their variability would be reduced. Improved roadside information would inform road user decision making. In turn, this would improve connections for public transport across the network leading to an improved, more reliable service.
Reduce Emissions:	**Moderate Benefit**	The environmental impact of introducing this intervention is minimal compared to other more traditional solutions. The benefits of introducing variable speed limits to smooth traffic flows can contribute towards a reduction in vehicle emissions.
Improve Quality, Accessibility and Affordability:	**Moderate Benefit**	Improvements in road safety would contribute towards improving the quality of the trunk road network. Benefits of providing improved connectivity for public transport would offer improved accessibility and affordability thus encouraging social inclusion. Encouraging car sharing through introduction of HOV lanes would lead to improved affordability as travel costs can be spread.

Table D6.1.4 Scottish Government's Strategic Objectives

Scottish Government's Strategic Objectives		
Objective:	**Assessment Summary:**	**Supporting Information:**
Safer and Stronger	**Moderate Benefit**	The provision of a Managed Motorway Network (MMN) could result in a significant reduction of the accident rate in the Central Belt. It would not affect the quality, accessibility and affordability of public transport.
Smarter	**Minor Benefit**	This intervention would result in reduced journey times and improved public transport reliability throughout the Central Belt, improving access to further education and opportunities.
Wealthier and Fairer	**Moderate Benefit**	This intervention could increase productivity by reducing the time wasted through encountering unexpected delays on the road. Reduced fuel costs should also contribute towards reduced journey costs. This intervention would support improved development of the surrounding area.
Greener	**Moderate Benefit**	This intervention would largely be delivered within the existing road space and would result in smoother traffic flows which would reduce emissions and fuel consumption. There could also be modal shift to bus travel through improved connections for public transport.
Healthier	**Neutral**	Implementation of a MMN is not considered to have any affect on access to health services. Monitoring of an actively managed hard shoulder would be required to assess the effect on emergency services etc. There could be some modal shift to bus services from cars.

Table D6.1.5 Implementability Appraisal

Implementability Appraisal	
Technical:	There are some technical risks associated with this intervention. To implement hard shoulder running and variable speed limits regulations may need to be amended to make provision for their introduction. Current regulations state that gantry intervals should be no more than 500 metres apart to implement a 40mph speed limit. Alternatively the intervention for gantries at one kilometre spacing is now under consideration. Although the existing communication network of gantries covers most of the trunk road network in the Central Belt, further investigation may be required to complete the communication loop (M9/M876/M80/A80) to provide a robust system.
Operational:	Careful planning and co-ordination is required and would provide a technical challenge to the construction plan. It would be necessary to provide additional control facilities/environment to monitor the network and provide an appropriate level of resilience while supporting an efficient response to incidents i.e. closure of hard shoulder in event of accident, breakdown etc. Monitoring of an actively managed hard shoulder would be required to assess the effect on emergency services etc. The results of such monitoring could impact on the operation of part of the intervention during its projected life.
Public:	The prevailing congestion levels and safety issues are well known. This is an important intervention to the economy of Glasgow and Edinburgh and the Central Belt, with significant public interest at both local and regional levels. Previous experience in implementing these measures and the subsequent improvements show that they are well received.