Written evidence submitted by Chartered Institution of Highways and Transportation (RSM0095)

CIHT is a charity, learned society and membership body with over 14,000 members spread across 12 UK regions and four international groups. We represent and qualify professionals who plan, design, build, manage and operate transport and infrastructure networks. Our vision is for world-class transportation infrastructure and services. Our values are to be Professional, Inclusive, Collaborative and Progressive.

Introduction

1. CIHT position (29 Jan 2020) on Smart Motorways (SM) stated: "Recent concerns surrounding smart motorways highlight many of the complexities associated with these motorways. CIHT has always maintained that improving road safety should be based around engineering, enforcement and education. Whilst we welcome the on-going review by Highways England, we believe that several factors would give users of smart motorways greater confidence and re-assurance whilst driving on them. These include; installation and use of appropriate technology, clear and accurate communication with drivers, greater understanding of smart motorways by customers and guidance on how we should safely use them and appropriate spacing of refuges would all help."[1]

2. It is important that the multiple forms of SM are all recognised (Controlled Motorway; Dynamic Hard Shoulder; All Lane Running) and the term SM is not used when ALR is specifically being discussed.

The benefits of smart motorways, for instance to reduce congestion on busy sections of motorway, and how necessary they are;

3. CIHT's Climate Change Pledge believes that the impact of induced traffic should be addressed by government and the highways and transportation sector including Highways England. Smart motorways are essentially about delivering improved capacity of the concept of 'predict and provide' i.e., you predict an increase in car miles travelled and you

[1] Urgent call to boost smart motorway safety (ciht.org.uk)

provide more road capacity to accommodate this.

4. The Predict-and-Provide approach to transport has led to increased traffic and thereby increased carbon emissions from transport resulting in it being the largest emitting sector of greenhouse gases in the UK. This concept must be challenged by 'vision and validate' or 'decide and provide' approaches with policy measures to support a healthier and a Net Zero compliant transport system. This includes measures to support modal shift to public transport, reducing car miles travelled, and reducing the need to travel overall.

5. CIHT believes that any organisations making interventions that will increase carbon emissions from transport must make sure that these interventions are still compliant with achieving Net Zero by 2050.

The safety of smart motorways, the adequacy of safety measures in place and how safety could be improved;

6. CIHT advocates the Safe System approach, which recognises the contribution of five aspects to road safety performance: road users; vehicles; road environments, speed/network management, and post-crash response. All five factors are relevant to the causation of crashes, and their outcome. The Safe System approach recognises the inevitability of human error, illness and fatigue and seeks to create a highway form and operation that both minimises the likelihood of collisions, and reduces the severity of injury when incidents do occur. For example, highway authorities cannot prevent drivers falling asleep, or misjudging others' actions, but by acting to manage speed of traffic, and protect users from roadside hazards (buildings, water; highway infrastructure) the outcome of a crash can be minimised.

7. In the context of Smart Motorways, design features provide risk reduction benefits in line with the Safe System both by preventing incidents and reducing adverse outcomes. For example mandatory variable speed limit reduces excess speed which contributes to collision frequency and severity; incident detection, driver information messages and lane control technologies all alert drivers to an incident ahead and use speed reduction to smooth flow and direct drivers to avoid an incident in a live lane, or protect users leaving emergency refuge areas. Stopped Vehicle Detection technology, currently being rolled out, can reduce the time for a control centre to identify an incident (including

stops due to mechanical breakdown; driver illness or fatigue, or collisions) and reduce speed limits and give messages to alert drivers.

8. CIHT supports the development and roll-out of beneficial technologies which reduce the number and severity of collisions buy creating an inherently safe network as well as addressing congestion and the queues that contribute to shunt collisions. Vehicle safety improvements which are becoming mandatory, such as autonomous emergency braking, lane-keeping assistance and intelligent speed assistance, are also important and will provide additional benefits in line with the Safe System in coming years.

9. The critical question that needs to be asked is: 'how do smart motorways differ in deaths per mile from other motorways'. Through analysing motorway risk (for workers and users), looking at the data, and understanding the behavioural aspects provides a view from CIHT that increased capacity can be had with an improvement in safety (with technology bringing speed control, lane control and driver information).

10. It is important to have rigorous monitoring of incidents and crashes, and not just crashes. For new schemes, we should be looking at behaviour, before and after implementation, to be able to compare how any interventions changes behaviour, incidents and crashes.

11. There needs to be analysis of incidents (near misses and collisions) to understand the extent to which Smart Motorway design and operation affects operational safety. This should consider both causation of the event, and underlying factors which contributed to its causation and/or the severity of the outcome. Collisions and other incidents may be categorised as:
    - Entirely unrelated to SM form.
    - Partly/potentially relevant.
    - Directly relevant.

    Any individual collision may be affected by many factors. Two examples illustrate the complexity:

    a. For example, if a driver falls asleep, their vehicle collides with the central barrier, collides with a second vehicle, and then rebounds into the nearside verge striking a tree. The primary factor

causation in this case would be driver fatigue, not relevant to SM. The collision may have involved other factors such as speed which affects distance travelled while drivers to react to an event, as well as the physical energy involved in a collision which affects injury severity.

SM has two effects: at busy times mandatory variable speed limits (MVSL) enable lower limits to be set consistent with the conditions. In addition, enforcement of speed limits affects driver behaviour, reducing excess speed. These effects beneficially affect injury severity by reducing the energy involved in the collision and reducing trauma injuries to those people in the two cars involved. The severity of injury may also reflect vehicle factors (primary and secondary protective features as reflected in EuroNCAP scores) and highway factors (unprotected trees or lamp columns for example may cause sudden deceleration and severe injuries in the event of a collision).

b. A vehicle sustains a mechanical defect and makes a complete halt, unable to coast to a place of safety, so makes a live lane stop. The causation is mechanical failure and not affected by SM form. However, technology can reduce the risk involved, for example Stopped Vehicle Detection reduces the time to attend and recover the vehicle, reducing the period of it being unexpected by other drivers and reducing the likelihood of another vehicle colliding with the stricken vehicle. The presence of a hard shoulder is not relevant in this case because the vehicle cannot 'limp'. Even if a hard shoulder is available, many rear end shunt collisions occur on hard shoulders (permanent and dynamic) so the possibility of a shunt is not prevented entirely by hard shoulder but may be reduced. MVSL can set reduced speeds; lane control can close a lane with 'red x' and message signs can display an explanation to alert drivers of the hazard, all reducing both the likelihood of a collision and its speed of impact if it happens. Complex behavioural factors can be relevant, for example drivers make many discretionary stops on hard shoulders, every one of which is potentially subject to a shunt by another vehicle that drifts out of

its running lane. These stops largely cease to occur when hard shoulders become a running lane, representing a beneficial factor in network safety. Large numbers of stops result from vehicles running out of fuel, or tyre failures due to incorrectly inflated or bald tyres – all of these are avoidable events, and if drivers are aware no hard shoulder is present, it may lead them to attend more to vehicle maintenance and avoid these events.

12. Analysis of incidents should consider the various factors to determine the aspects of SM which might have contributed to an incident or affected its outcome – beneficially and adversely. This should include driver and passenger behaviour in the event of an emergency: whether drivers may choose to stop in a live lane rather than continue to an emergency refuge, or to stand in lane rather than move to a place behind the barrier where that is possible for example.

13. This analysis can then inform evaluation of the benefits of changes to design standards for new or altered schemes. It should assess the current evidence base for closer refuges being better in actual risk terms is not yet clear. There is clear public support but what percentage can limp 500m but not 800m or 1000m for example? We don't seem to know, and additional refuges many encourage discretionary stops which increase risk.

14. Smart motorways do not cause live lane breakdowns, most of which result from driver action/inaction such as running out of fuel, or tyres that are worn or incorrectly inflated. However, when such an incident occurs, a live lane stop can increase risk of collision with that vehicle. CIHT understand that early findings of operational performance were that live lane stops increased (unsurprisingly) but live lane collisions fell (counter-intuitively) because drivers attend more to their lane when a hard shoulder is not present.

15. The benefits are counter-intuitive but real; similar lessons learned from street lighting removal on rural roads and urban pedestrian guardrail removal, both predicted to worsen safety and both reduced collisions when properly planned and implemented.

16. Human behaviour is what causes crashes not the presence of a 'safety feature' which in the case of a hard shoulder is not a safe place but people think it is (hence standing in it when they should be moving to a place of safety for example behind a barrier; if that is not possible, remaining in the car with seatbelt on is preferable, but many drivers are not aware of this).

17. Driver behaviour and ensuring that drivers are equipped to drive on all roads including smart motorways is critical. Often, it is the technology that gets blamed for crashes when it is in fact poor driver behaviour, violations of the Highway Code, that are causing the crashes. This is not about blame, but about recognising what the actual issues are, to be able to address them effectively. CIHT believes that improving driver behaviour and drivers understanding of how new interventions on roads affect them is a critical task.

18. Further, it is also important that coroners' assessments of smart motorways crashes recognise the role of driver behaviour both in causing avoidable motorway stops and in their actions when one occurs, to ensure an accurate assessment of these.

19. There might be cases where it can be tolerable to decrease safety on certain roads to achieve other benefits such as improved traffic flows. The key point here is that it would only be very small increases in risks and that motorways in the UK would still be among the safest in the world including safer than Germany's, a country that it is reasonable to compare the UK to in this regard. These are called tolerable risks and communicating a deliberate but measured decrease in safety to the public will be challenging.

20. The fatality rate on smart motorways is less than those with a hard shoulder[2]. Dual carriageways and single carriageways have higher death rates than motorways with or without hard shoulders. These are the parameters used which show All Lane Running (ALR) is safer than motorway with hard shoulder:

    - deaths per mile (compared to motorways of similar traffic volume);
    - deaths per mile travelled,

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936811/smart-motorway-safety-evidence-stocktake-and-action-plan.pdf 2

- FWI (fatal and weighted injury, the default method of giving highest priority to highest severity injuries by rating a fatality as ten times worse than a serious injury which might be a broken little finger and not life changing.)
- Hazard log numerical assessment (the way smart motorways are evaluated before implementation through quantifying 130+ hazards by frequency of occurrence; probability of a collision occurring; and severity of resultant injury compared to typical proportions on injury severities on motorways)

21. Fatalities often result from causes that are unaffected by hard shoulder, e.g. drivers taken ill at the wheel drifting into other lanes; drivers going to sleep and crashing through the central reserve into oncoming traffic; drivers on their phone and hitting a queue of traffic etc. There will also always be fluctuations on all roads; collisions are rare random multi-factor events and therefore numbers change in a random way, but trends and aggregate data over multiple schemes and networks is meaningful.

22. The table attached is data from https://www.gov.uk/government/publications/smart-motorway-evidence-stocktake-and-action-plan - underpinning this is that people describe hard shoulders as a safety refuge but persistent catastrophic crashes happen there of exactly the same type that recent inquest reporting suggested were caused by All Lane Running. If the hard shoulder were as safe a refuge as described, we would not have those identical crashes on them, but we do.

Casualty rates on motorways with hard shoulders but no technology	Comparison with smart motorways		
	Controlled Motorway	Dynamic Hard Shoulder	All Lane Running
Fatal casualty rates (0.16 per hmvm)	Lower (0.07 per hmvm)	Lower (0.07 per hmvm)	Lower (0.11 per hmvm)
Serious casualty rates (1.1 per hmvm)	Slightly higher (1.2 per hmvm)	Slightly higher (1.2 per hmvm)	Slightly higher (1.3 per hmvm)
Slight casualty rates (10 per hmvm)	Higher (14 per hmvm)	Higher (15 per hmvm)	Slightly higher (11 per hmvm)
Fatal Weighted Injury rates (0.38 per hmvm)	Lower (0.33 per hmvm)	Lower (0.33 per hmvm)	Lower (0.35 per hmvm)

SMP summary

23. 90% of stops on hard shoulders are illegal discretionary stops, so without hard shoulders almost all those events stop. When there is a hard shoulder, eye-tracking analysis has shown that people's eyes are drawn to the hard shoulder even when there is nothing there, so they spend too little time focusing on their lane, meaning when a vehicle stops there or changes lane they don't notice it.

24. CIHT understands that investigation of driver behaviour on regular motorway versus ALR has been undertaken, for example where drivers look and how effectively they attend to a stationary vehicle. This information should be collated and used to determine the extent to which the operational performance might be improved counter-intuitively because driver behaviour changes in beneficial ways. This should include assessing the beneficial effect of deterred illegal/discretionary stops which we are advised comprise the majority of motorway stops – on hard shoulder and in emergency refuges.

25. Measures to improve safety on smart motorways include installation and use of appropriate technology and appropriate spacing of refuges – these would all help.

26. CIHT advocates an evidence review to determine the extent to which closer spacing of refuges would reduce risk as we appreciate that this may be a complex issue, for example deterring discretionary stops. This review should determine the distance over which vehicles can 'limp' in

different circumstances (fuel run out; tyre failure; mechanical faults such as clutch or engine defect). This would answer the question: 'what proportion of vehicles than can limp 500m [for example] but cannot limp 1000m or 1500m [for example] at a speed that avoids likelihood of shunts.' It should also assess the consequence of longer limping distances for example tyres shed from wheels and presenting a threat to other road users.

27. CIHT supports the implementation of stopped vehicle detection technology to reduce the period between a vehicle becoming stationary (especially if the driver is injured or ill and unable to call for help) provided it is reliable and does not create false negative alerts that may lead to slower response times.

28. CIHT largely agrees with the Transport Select Committee's framing of the issues: 'In March 2020, the Department for Transport published an in-depth evidence stocktake of smart motorway safety. This concluded that "in most ways, smart motorways are as safe as, or safer than, conventional motorways", although it recognised that the risk of breaking down in a live lane is significantly increased.' CIHT would add to this that while some risks increase on all lane running motorways others decrease. The final point is important, in framing the issues – other risks need to be factored in – that are important – risks of lane change collisions or risks of speed differentials being reduced on smart motorways: a fully informed awareness of this is important for public confidence in their use.

Whether All Lane Running is the most suitable type of smart motorway to roll out or if there are better alternatives;

29. There are three types of 'smart motorways': controlled motorway (hard shoulder), dynamic hard shoulder, and All Lane Running. Terminology is important, there should be clarity around different forms as they have different impacts on traffic.

Public confidence in using smart motorways and how this could be improved;
• the impact of smart motorways on the usage and safety of other roads in the strategic road network;

30. All motorways in the UK are among some of the safest in the world, including all types of smart motorways. They are also safer than the A-

roads that some people choose to use as they falsely believe that these are safer. It is important that both the government and Highways England inform road users and make these facts clear.

31. Public confidence in using smart motorways will improve with education on how to use them. Improving the safety of smart motorways will include measures to educate people about how to use them:

    - To ensure the vehicle is never driven with low fuel, low tread depth or incorrect tyre inflation which together account for most motorway emergency stops, all preventable and amount to driver negligence putting others at risk regardless of whether there is a hard shoulder.
    - Have a mobile phone which is always charged and which passengers know how to use for example if a driver is taken ill. Authorities should encourage users to use online tools to assist in their location being defined. This would quickly and reliably tell the emergency services where the vehicle is, enabling response to the stranded vehicle, and setting appropriate message signs to inform drivers on the approach.
    - Clarify key actions in the event of an emergency: Don't stop if you can 'limp' to a place of safety (e.g. layby); if you must stop get to a place of safety well away from the road (not sit on barrier); if you can't get behind barrier (e.g. by high wall) stay in car on passenger side if possible, and keep seatbelt on, and call 999 immediately.

32. This advice holds true for all roads in all conditions and refreshed driver guidance will provide the maximum road user benefit for the widest range of emergencies.

33. The benefits of an education campaign of how to use motorways, (not just smart motorways) should result in an overall improvement in how drivers adopt safe behaviours on the Strategic Road Network.

34. We should be assessing the impact on elderly drivers and nervous drivers who may chose not to drive on motorways but instead travel on 'A' roads and therefore face higher injury risks. Improving confidence in motorway driving is an important step and training on motorway driving could be one measure to support this.

The effectiveness of Highways England's delivery of the smart motorways programme, the impact of construction works, and the costs of implementation.

35. The effectiveness of smart motorway delivery should be about the cost effectiveness of achieving the outcomes i.e. improved traffic and safety. As mentioned earlier, any transport intervention also needs to assess its carbon impacts and make sure that it is compliant with achieving Net Zero by 2050 at latest.

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