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**GB LSAV Approval Scheme: Work Package
4 - Non-ADS requirements**

D7.1 Overview report

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Executive Summary

The UK Government is bringing forward legislation to allow the safe and secure deployment of self-driving vehicles. The Department for Transport's (DfT's) objective of the project, which forms part of the CAVPASS programme, is to develop a safety assurance scheme for Low-Speed Automated Vehicles (LSAVs). The work is structured into five work packages (WPs) delivered by different contractors.

TRL was commissioned to develop proposals for technical, administrative and procedural requirements for the approval scheme under WP4. The scheme should allow approval of vehicles of the design and use case detailed in Table 1-1. Only those requirements which do not relate to the Automated Driving System (ADS) are considered in this WP.

Table 1-1: Scope of use cases and vehicle designs considered

Characteristic	Scope
Body shape	To include novel vehicle designs
Purpose	Carriage of goods or passengers (seated, standing or mixed)
Level of automation	Driverless (no user in charge)
Powertrain	Fully electric (no internal combustion, range-extended hybrids or hydrogen)
Maximum speed	20 mph
Maximum mass (GVW)	5,000 kg (for passenger-carrying vehicles); 3,500 kg (for goods vehicles)
Operating environment	Roads with a speed limit up to 30 mph with mixed traffic (including Vulnerable Road Users); Areas which may include high density of pedestrians; Dedicated roadways (which may or may not have segregation barriers); Operating on a fixed route or within a fixed geographical area

Low-speed vehicles are not in widespread use today, which means no directly relevant real-world collision data was available to base safety recommendations on, although current collision data provided some limited insights. The guiding principle applied in this study was to provide 'at least equivalent safety', i.e. to offer safety levels relating to non-ADS aspects, which, based on the limited data available and expert judgement, are comparable or better than those of current vehicles used in similar scenarios. The proposed requirements in many areas exceed those for minibuses.

A proposal for the GB approval process was developed based on the UK National Small Series Type Approval (NSSTA) and UK Individual Vehicle Approval (IVA) schemes. The process consists of six steps:

1. Scheme selection
2. Requirements definition
3. Gathering and submission of evidence of compliance
4. Compliance decision
5. Additional checks
6. Granting of vehicle approval

Additionally, modifications were suggested for the 'Information document template' in Regulation (EU) 2020/683 to accommodate the non-ADS part of the GB scheme.

The project also proposed the introduction of two new vehicle categories (Passenger LSAV and Goods LSAV) to allow approval of designs not compatible with the M- and N-category definitions, such as passenger shuttles with six seats and space for standing passengers, or goods vehicles without any seats.

The technical work involved selection and adaptation of existing pre-deployment and in-use regulation to enable it to be applied to LSAVs. A main part was the adaptation of the technical regulations for M- and N-category vehicles, laid down in GB's Road Vehicles (Approval) Regulations 2020, which implement retained Regulation (EU) 2018/858. An analysis to identify major safety considerations, a market review of LSAV designs and expert judgement was used to underpin the development of an approach and adaptation of the technical regulations to self-driving vehicles. Of 132 technical items collated from the existing body of regulations, 66 are proposed to be applied for pre-deployment approval of Passenger LSAVs and 54 for Goods LSAVs (which do not carry any occupants). Technical clarifications and adaptations for regulations were developed relating to references to the driver or driver's seat, controls, warnings and tell-tales. The possibility of vehicles with bi-directional driving capability made additional modifications necessary.

The project further found that a general permission to carry standing passengers in light vehicles could present unreasonable risks to occupants in braking manoeuvres or collisions, but that it could be safely possible in some operating environments. A concept was proposed which offers manufacturers a choice between two Crashworthiness Approval Levels (CALs). The less demanding CAL allows spaces for standing passengers but restricts the subsequent operating environments of the vehicles.

Full analysis of the regulatory texts of GB's in-use regulations relevant for non-ADS requirements, namely the Road Vehicles (Construction and Use) Regulations 1986 and Road Vehicles Lighting Regulations 1989 was performed. 19 of the 68 applicable items (regulations and schedules) within Construction & Use and 7 of the 45 applicable items within Lighting were found to be unsuitable for LSAVs in their current form. Proposals for modifications for these regulations were developed to ensure that vehicles type-approved to the set of requirements proposed will continue to be compliant with in-use regulations,

and to remove other potential barriers to compliance with in-use regulations, for instance related to the lack of a driver in LSAVs.

Seven expert stakeholders from industry, research and test houses were consulted and given the opportunity to comment on the main project outputs including the proposed scheme outline, approach for vehicle categorisation, and technical requirements and test procedures. TRL would like to acknowledge the stakeholders who supported us in this project. Thank you for your time, effort and insightful contributions. Parts of the proposals were adapted based on the comments received.

A number of items have been identified which require further work. These include:

- Elements which fall outside the scope of this WP but need consideration for the LSAV scheme as a whole. These items include things such as, speed measurement accuracy, precisely how the functional safety case should be formulated and approved, how the ADS should react to emergency stop requests by passengers, how it can be verified that all functions of the ADS work correctly under all EMC immunity test conditions, whether wireless control/remote operation should be permitted and what technical requirements would be appropriate.
- Further development of overall GB AV approval scheme and consideration of how it aligns with the EU scheme. This should include:
 - Potential scope increases, for example to include use cases within current EU scheme, i.e.:
 - Higher speed AVs which operate in an urban or sub-urban environment.
 - Hub to hub: fully automated or dual mode vehicles for carriage of passengers or goods on a predefined route with fixed start and end points which operate in an urban, sub-urban or motorway environment.
 - Automated valet parking: dual mode vehicles with a fully automated mode for parking applications within predefined parking facilities
 - Integration of the LSAV new vehicle categories and alignment of requirements with EU scheme. This should include a review of the maximum speed permitted by LSAVs.
- Trial approval of a specified LSAV to check that processes and requirements are appropriate and complete.
- To help drive a 'vision zero' strategy, consider further development of safety requirements in the medium term including, among other things, a bespoke VRU impact regulation and crash test regulation with ATDs, more detailed safety belt reminder specifications, whiplash tests, bus interior impact tests, as well as other topics that might emerge from in-use safety monitoring experience. This could also include further consideration whether standing passengers should be prohibited.

-
- If deemed relevant, consider extension of the scheme in the medium term to include vehicles with criteria out of scope of the current WP, including pavement-based/micro-mobility vehicles, three-wheeled vehicles, vehicles with maximum speed of 10 mph or less, modular vehicles/road trains, or vehicles capable of towing trailers. This would require analysis of additional pertinent regulations and development of new approaches, for instance for modular vehicles.

1 Introduction

The Department for Transport’s (DfT’s) overall objective is to develop a safety assurance scheme to allow the safe and secure deployment of automated vehicles. The project, initially focussed on Low-Speed Automated Vehicles (LSAVs), is structured into five work packages (WPs), an overview of which is provided in Figure 1-1.

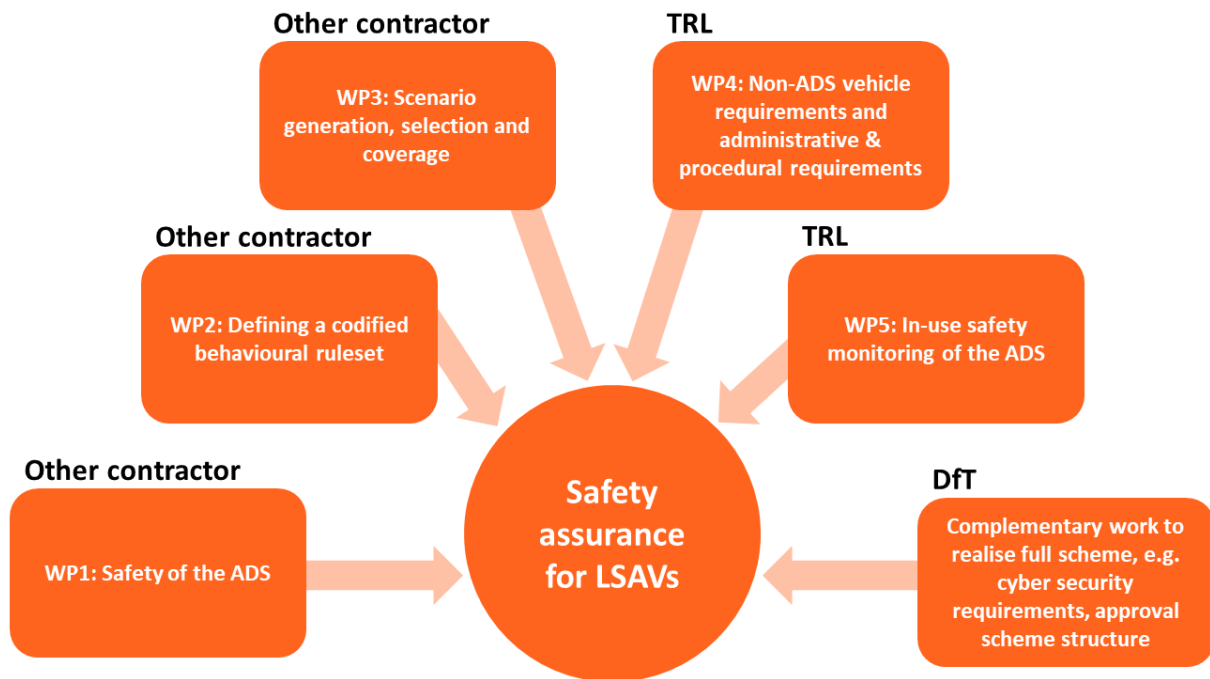


Figure 1-1: Project overview: Work package structure and lead providers

The aim of the current work package, WP4, was to develop proposals for technical, administrative and procedural requirements for approving automated vehicles of the design and use case detailed in Table 1-1 and referred to as ‘LSAV’ throughout this report. Only those requirements which do not relate to the Automated Driving System (ADS) are considered in this WP.

Table 1-1: Scope of use cases and vehicle designs considered

Characteristic	Scope
Body shape	To include novel vehicle designs
Purpose	Carriage of goods or passengers (seated, standing or mixed)
Level of automation	Driverless (no user in charge)
Powertrain	Fully electric (no internal combustion, range-extended hybrids or hydrogen)
Maximum speed	20 mph
Maximum mass (GVW)	5,000 kg (for passenger-carrying vehicles); 3,500 kg (for goods vehicles)
Operating environment	Roads with a speed limit up to 30 mph with mixed traffic (including Vulnerable Road Users); Areas which may include high density of pedestrians; Dedicated roadways (which may or may not have segregation barriers); Operating on a fixed route or within a fixed geographical area

Note: It was originally envisaged that the mass limit should be 3,500 kg for all vehicles and maximum passenger numbers should be limited to 16. However, to align better with current M₁ and M₂ vehicle categories and help prevent a discontinuity by defining technical requirements based on the number of seats in the vehicle (i.e. M₁ ≤ 9 seats; M₂ ≥ 10 seats), the mass limit for Passenger LSAVs was increased to include all vehicles which would be categorised as either M₁ or M₂ under existing definitions, without an explicit limit on the number of occupants.

During the project, the scope of vehicles was further detailed with the following criteria:

- No pavement-based/micromobility vehicles
- Only vehicles with four or more wheels
- Only vehicles with a maximum speed exceeding 10 mph
- Only separate vehicles, i.e. modular vehicles that can be joined together dynamically to form 'road trains' are out of scope
- No conventional driver controls (steering wheel, pedals, gear selector)
- Not expected to tow trailers
- Not expected to carry dangerous goods

The methodology applied for WP4 was structured into eight tasks, as specified in Figure 1-2.

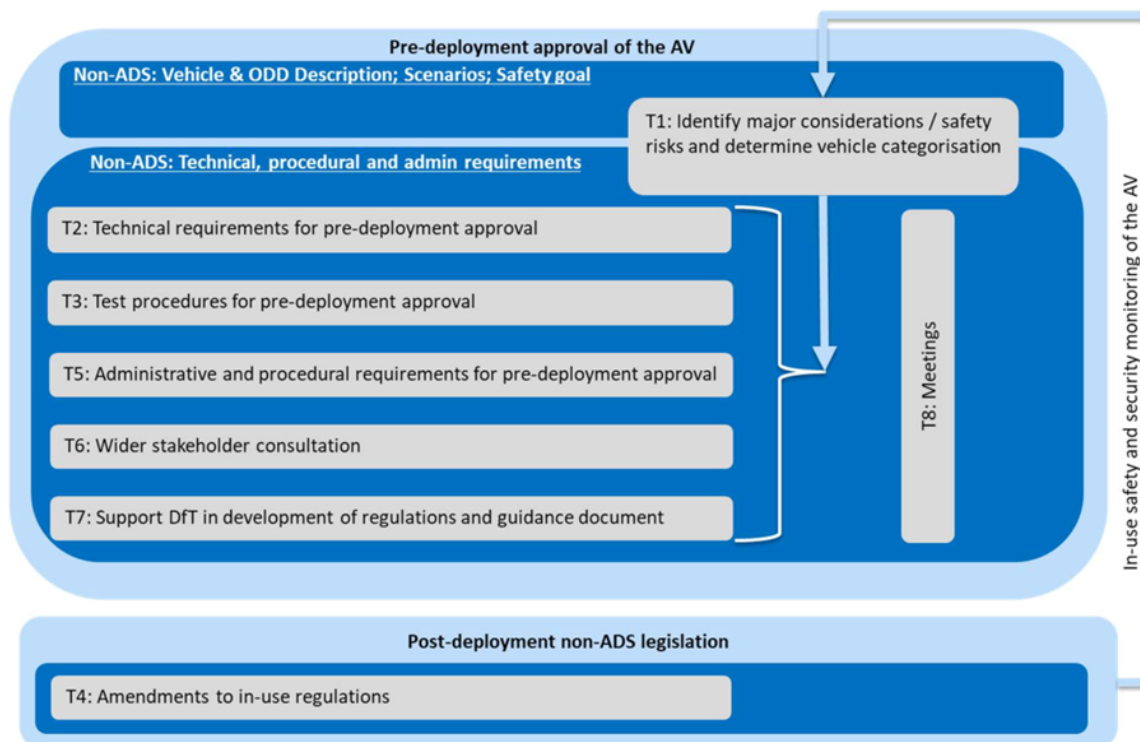


Figure 1-2: Task structure of Work Package 4 and indication of proposed feedback loop from post-deployment in-use safety monitoring to updating non-ADS related requirements in the future if found necessary

The work is based on the development of a proposal for a scheme outline which includes vehicle categorisation in the first task. This helped set a basis from which the detailed technical, administrative and procedural requirements were developed. The approach for development of the scheme outline was firstly to identify the major considerations and safety risks that are unique to and/or highlighted by LSAVs that will need to be addressed by legislation (Task 1). This was used to determine if the expected vehicles could fit into current vehicle type categories or new categories needed to be added for them.

The next steps (Tasks 2 and 3) used the developed scheme outline and the list of major considerations and safety risks identified for these new vehicles as a basis to develop proposals for technical requirements and test procedures starting from current approval legislation. Where no relevant requirements were available in current approval legislation an outline of contents for the requirements was developed. Relevant test procedures were assessed and amended so that they are applicable for LSAVs.

Following development of technical requirements and associated test procedures, the next step (Task 4) was to propose amendments to the in-use regulations. For a vehicle to be used legally on GB roads it must comply with these regulations. The Road Vehicles 'Construction

and Use' and 'Lighting' regulations were reviewed and amended to ensure that LSAVs that fulfil the technical requirements defined are compliant.

The final step (Task 5) was to develop proposals for administrative and procedural requirements for pre-deployment approval based on current schemes while taking into account different production volumes.

A two-step stakeholder consultation (Task 6) was performed during the course of the project to consult on the proposed scheme outline and technical requirements. TRL would like to acknowledge the stakeholders who supported us in this project. We thank you for your time, effort and insightful contributions.

Tasks 7 and 8 captured various project activities relating to reporting, preparing presentation materials and liaising with the DfT and other WP providers to ensure good alignment.

2 Proposal for LSAV approval scheme outline (Task 1)

The main objectives of the work reported (Task 1) were:

- To identify the major considerations and safety risks, in particular those unique to and/or highlighted by LSAVs and not mitigated appropriately by requirements in current type approval legislation.
- To develop a potential outline for the LSAV part of a GB Automated Vehicle approval scheme, in particular to determine vehicle categorisation.

In addition, an information gathering activity was undertaken to provide background data to help perform the study. This activity consisted of a literature review and a market review to identify LSAV designs to-be -expected and likely to fall within the scope of the scheme.

The results of the work performed in Task 1 is summarised under the following headings:

- Information gathering
- Identification of major considerations / safety risks
- LSAV approval scheme outline

2.1 Information gathering

The main results from the literature review included:

- A review of published literature with focus on regulatory developments. The main part of this work was reviewing the work of the European Commission to develop draft regulation for Automated Vehicles (AVs) which was on-going throughout the course of this project. Much of this work occurred within a subgroup on Automated and Connected Vehicles (ACV)¹, organised under the established Working Group on Motor Vehicles (MVWG)². The ACV subgroup work overlapped considerably with the scope of this project and hence its considerations and findings were highly relevant. Towards the end of this project, the outcome of ACV subgroup work was effectively published by the European Commission in the form of draft delegated³ and

¹ ACV: <https://circabc.europa.eu/ui/group/4273d650-b8a9-4093-ac03-18854fbba4b5/library/9cccc66-3fcd-4536-a643-39c06559439a>

² MVWG: <https://circabc.europa.eu/ui/group/4273d650-b8a9-4093-ac03-18854fbba4b5/library/689031d8-1786-4bf5-9c5c-c420a3877308>

³ Draft Delegated Act feedback period 22 March 2022 to 19th April 2022: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13291-Vehicle-safety-technical-requirements-for-unlimited-and-small-series-and-special-purpose-and-fully-automated-vehicles_en

implementing⁴ regulations for public consultation with feedback periods closing on 19th April 2022 and on 5th May 2022, respectively. The draft delegated regulation, inter alia, set out requirements for the EU whole vehicle type approval of fully automated vehicles produced in small series as regards the non-ADS parts of an AV by amending Annexes I, II, IV, and V of Regulation (EU) 2018/858. Similarly, the draft implementing act set out requirements for approval of the ADS parts of an AV. A description of the relevant parts of this draft legislation is given in Section 2.3 below.

- A market review of LSAV relevant designs that can be expected to enter the market. This overview, which includes details such as vehicle mass, dimensions, number of passengers, etc., is not reproduced in this overview report.
- A review of vehicle category definitions. This review revealed that barriers to classifying LSAVs exist within each category definition. The most common barrier consisted of references to a driver's seating position. A driver is not required for LSAVs and thus a driver's seat is not needed either. Depending on the specific characteristics of the LSAVs, other aspects were identified which could present barriers. These included:
 - Standing passengers: The M₁ vehicle category definition excludes standing passengers. To permit standing passengers an LSAV would need to be classified as either an M₂ or M₃ category vehicle. Whether a vehicle is classified as an M₁ or M₂/M₃ category is dependent on how many seats it is fitted with; ≤ 9 seats M₁ category, > 9 seats M₂/M₃ category.
 - Seating positions: L-category requires at least one seating position with the exception of the Motorcycle Single Vehicle Approval scheme (MSVA).
 - Low speed vehicles: The definition of a vehicle with respect to M and N categories includes a prerequisite that the vehicle has a maximum speed > 25 km/h. Thus, LSAVs with a maximum speed ≤ 25 km/h would fall outside the scope of the categories.

2.2 Identification of major considerations / safety risks

Major considerations / safety risks were identified, listed, categorised by current regulatory area where possible (e.g. braking, steering, VRU protection) and prioritised using a risk-based assessment. Following this, potential mitigations to help manage the risk were proposed and, if appropriate, taken forward into the development of technical requirements (see Tasks 2 / 3). Stakeholder consultation was used to help ensure all relevant major considerations / safety risks were identified.

⁴ Draft Implementing Regulation feedback period 7 April 2022 to 5 May 2022: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12152-Automated-cars-technical-specifications_en

2.3 LSAV approval scheme outline

As mentioned above, the objective of this activity was to develop a potential outline for the LSAV part of the GB Automated Vehicle approval scheme, in particular to determine vehicle categorisation.

The work was performed in two parts; firstly, initial ideas and a scheme were outlined, and secondly, the scheme outline was modified further throughout the project. The reason for this approach was to enable the scheme to be modified in response to:

- Stakeholder feedback including from industry, other connected Work Packages and the customer (DfT).
- Learnings gained during the project such as updates to draft EU legislation for Automated Vehicles.

The final scheme outline is described below. As background, a brief description of the draft EU legislation for Automated Vehicles is given to help understand how the proposed scheme for GB may align with it. This is an important issue for industry because it will influence the regulatory burden that the GB approval scheme will impose, e.g. if the GB approval scheme requires a different vehicle design to the EU legislation, this will increase regulatory burden compared to the situation in which a similar vehicle design can meet both sets of requirements.

2.3.1 *Background: European Commission draft delegated regulation amending Regulation (EU) 2018/858*

The European Commission has drafted a delegated regulation in order to, amongst other things, set out the requirements for the EU whole vehicle type approval of fully automated vehicles produced in small series as regards the non-ADS parts of an AVs. This draft regulation amends Annexes I, II, IV, and V of Regulation (EU) 2018/858. Requirements for the ADS parts of an AV will be introduced via an Implementing Act. The Motor Vehicle Working Group (MWVG) subgroup on Automated and Connected Vehicles (ACV)⁵ has helped the Commission draft the delegated and implementing regulations for AVs. The draft delegated regulation was published for public consultation, with the feedback period closing

⁵ MWVG ACV subgroup: <https://circabc.europa.eu/ui/group/4273d650-b8a9-4093-ac03-18854fbb4b5/library/9cccc66-3fcd-4536-a643-39c06559439a>

on 19th April 2022⁶. Similarly, the draft implementing regulation was published for public consultation with the feedback period closing on 5th May 2022⁷.

The non-ADS requirements for the approval of fully automated vehicles in small series are detailed in Annex II, Appendix 1, Table 2. The table is divided into seven columns as shown in Figure 2-1.

Item	Subject	Regulatory act(the scope of the regulatory act remains unchanged)	Fully automated vehicles of categories N ₁ , N ₂ and N ₃ without driver seat and without occupants	Fully automated vehicles of categories N ₁ , N ₂ , N ₃ , M ₁ , M ₂ , M ₃ without driver seat, with occupants	Dual mode vehicles: vehicles with a driver seat designed and constructed to be driven by the driver in the “manual driving mode” and to be driven by the automated driving system (ADS) without any driver supervision in the “fully automated driving mode”	Specific provisions to be applied if letter A is used (i.e. the approval is not possible under the regulatory act because it does not yet include specific requirements for fully automated vehicles) No provision shall apply if the vehicle category is not in the scope of the base regulatory act.
A	RESTRAINT SYSTEMS, CRASH TESTING, FUEL SYSTEM INTEGRITY AND HIGH VOLTAGE ELECTRICAL SAFETY					
A1	Interior fittings	Regulation (EU) 2019/2144	not in scope	A	X for manual driving mode. A for fully automated driving mode	All windows, roof-panels and partitions for use by occupants shall be equipped with an auto-reversing device in order to make a driver-controlled switch redundant. For bidirectional vehicles (i.e. vehicles with no distinguishable rear/front and that can be driven in both directions), requirements shall be met in both directions. Alternative requirements leading to an equivalent level of safety to the satisfaction of the type-approval authority are permitted if meeting all the requirements in both directions is incompatible with the bidirectional use.

Figure 2-1: Draft Delegated Act Table 2 layout

For each regulatory act applicable to M- and N-category vehicles, the table specifies whether or not the act is applicable for each of the following three categories of fully automated vehicles:

- Fully automated vehicles of categories N₁, N₂ and N₃ without driver seat and occupants
- Fully automated vehicles of categories N₁, N₂, N₃, M₁, M₂, and M₃ without driver seat, with occupants
- Dual-mode vehicles: vehicles with a driver seat designed and constructed to be driven by the driver in the “manual driving mode” and to be driven by the ADS without any driver supervision in the “fully automated driving mode.”

It also details any specific provisions in the right-hand column.

⁶ Draft Delegated Act feedback period 22 March 2022 to 19th April 2022: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13291-Vehicle-safety-technical-requirements-for-unlimited-and-small-series-and-special-purpose-and-fully-automated-vehicles_en

⁷ Draft Implementing Regulation feedback period 7 April 2022 to 5 May 2022: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12152-Automated-cars-technical-specifications_en

For the regulatory items which refer to the ADS, namely:

- E6: Systems to replace driver's control (in case of automated vehicles),
- E7: Systems to provide the vehicle with information on state of vehicle and surrounding area (in case of automated vehicles), and
- E9: Systems to provide safety information to other road users (in case of automated vehicles).

It is indicated whether these items are applicable, and a placeholder is inserted to reference the ADS (implementing) act when published.

Regarding LSAVs, from a detailed examination of the table, it was noted that an exemption for the following crashworthiness regulations is given for small (M_1 / N_1 category) passenger/goods-carrying AVs provided their maximum speed is less than 30 km/h:

- A20: UN R94 – Frontal offset impact
- A21: UN R137 – Frontal full-width impact
- A25: UN R95 – Side impact
- A26: UN R135 – Pole side impact

This was the only difference noted for low-speed vehicles compared to vehicles with higher speeds. Related to LSAVs, the authors made the following interpretations of the meaning of the delegated act:

- Vehicles with maximum speed ≤ 25 km/h are out of scope.
 - **Note:** Interpretation based on Article 2 'scope' and definition of a motor vehicle in Article 3.
- Standing passengers are not permitted in small (' M_1 category' type) vehicles.
 - **Note:** Interpretation based on Article 4, which states that M_1 type motor vehicles are '*without space for standing passengers*'
- Side-facing seats are not permitted in small (' M_1 category' type) vehicles.
 - **Note:** Interpretation based on UN R17, paragraph 5.1, which is applicable for passenger-carrying fully automated vehicles according to Table 2, A2 'Seats and head restraints.'
- Restraint requirements for small (' M_1 category' type) vehicles are three-point belts for forward-facing seating positions and lap belts for rear-facing ones, even if the vehicle has a maximum speed of < 30 km/h. Safety belt reminders which transmit signals to the ADS are also required to be fitted.
 - Interpretation based on UN R16, Annex 16 (safety-belt installation) and paragraph 8.4 (safety-belt reminder), which is applicable for passenger-

carrying fully automated vehicles according to Table 2, A5 'Safety-belts and restraint systems.'

2.3.2 LSAV GB approval scheme

As mentioned in Section 1 'Introduction', the scope of LSAV use cases and designs considered for the scheme was as outlined in Table 2-1 below.

Table 2-1: Scope of use cases and vehicle designs considered

Characteristic	Scope
Body shape	To include novel vehicle designs
Purpose	Carriage of goods or passengers (seated, standing or mixed)
Level of automation	Driverless (no user in charge)
Powertrain	Fully electric (no internal combustion, range-extended hybrids or hydrogen)
Maximum speed	20 mph
Maximum mass (GVW)	5,000 kg (for passenger-carrying vehicles); 3,500 kg (for goods vehicles)
Operating environment	Roads with a speed limit up to 30 mph with mixed traffic (including Vulnerable Road Users); Areas which may include high density of pedestrians; Dedicated roadways (which may or may not have segregation barriers); Operating on a fixed route or within a fixed geographical area

Note: It was originally proposed that the mass limit should be 3,500 kg for all vehicles and maximum passenger numbers should be limited to 16. However, to align better with current M₁ and M₂ vehicle categories and help prevent a discontinuity by defining technical requirements based on the number of seats in the vehicle (i.e. M₁ ≤ 9 seats; M₂ ≥ 10 seats), the mass limit for Passenger LSAVs was increased to include all vehicles which would be categorised as either M₁ or M₂ under existing definitions, without an explicit limit on the number of occupants.

Throughout the project, the scope of vehicles was further detailed with the following criteria in consultation with the DfT:

- No pavement-based/micro-mobility vehicles
 - If included within the vehicle approval regime, requirements for these vehicles are likely to be quite different to the road going vehicles being

considered within this project. Thus, they will require consideration as a separate entity and therefore they were excluded from the scope of the current scheme.

- Only vehicles with four or more wheels
 - Practically, technical requirements for LSAVs need to be based on those for current vehicle categories, namely the M, N and O category framework in The Road Vehicle (Approval) Regulations 2020⁸ and/or the L category framework in The Motorcycles (Type Approval) Regulations 2018⁹. Higher safety levels are generally required for M, N and O category vehicles than L category ones. Because high safety levels should be required for AVs to meet public expectations, it was decided to focus on the M, N and O category framework and thus the requirement for vehicles with four or more wheels, given that this is part of the definition of this category of vehicle. Note that requirements for three-wheeled vehicles could be added at a later date if deemed necessary and appropriate.
- Only vehicles with a maximum speed exceeding 10 mph
 - A lower bound for the maximum speed of an LSAV was set on the basis that it would be inappropriate to operate very slow vehicles in mixed traffic because it would likely disrupt the traffic flow and potentially encourage drivers of other vehicles to attempt undesirable overtaking manoeuvres. The lower bound speed chosen also aligns with requirements for VRU protection. From experience of pedestrian impact testing, the project concluded that it would be difficult to test for impacts below this speed without considerable modification of the test procedures and requirements.
- Only separate vehicles, i.e. modular vehicles that can be joined together dynamically to form 'road trains' are out of scope
 - On the basis that it is uncertain how prevalent modular vehicles may be (none were identified in the market survey of LSAV type vehicles) and to reduce complexity of the regulation being developed, modular vehicles were excluded from the scope.
- No conventional driver controls (steering wheel, pedals, gear selector)
 - Scope defined as driverless, so no requirement for conventional driver controls – note requirements have been introduced to permit manual operation of vehicle at very low speeds to, for example, help recovery in

⁸ The Road Vehicle (Approval) Regulations 2020: <https://www.legislation.gov.uk/ukxi/2020/818/contents>

⁹ The Motorcycles (Type Approval) Regulations 2018: <https://www.legislation.gov.uk/ukxi/2018/235/contents>

the event of breakdown and manoeuvre the vehicle around yards when needed.

- Not expected to tow trailers
 - On the basis that LSAVs within the current category definition are not expected to tow trailers and the substantial effort required to draft the ADS regulation to allow this, this was deemed out of scope, although it could be added at a later date.
- Not expected to carry dangerous goods
 - It is expected that adaptation of the ADR for AVs will be developed within WP.15 'Transport of Dangerous Goods' working groups in Geneva and thus was excluded from scope.

2.3.2.1 *Categorisation*

Following careful consideration, it was decided that two new categories of vehicle should be introduced for LSAVs namely:

- Passenger LSAV
- Goods LSAV

The main reasons for this decision included:

- There are no non-automated vehicle equivalents to LSAVs currently. Thus, they do not fit well into current vehicle categories and some associated technical requirements do not apply well, e.g. crashworthiness requirements (R94, 135, 137) are for more severe collisions than are likely to be experienced by an LSAV. New categories could help resolve these issues.
- A number of LSAVs identified by the market review do not fit within current M and N vehicle category definitions because their maximum speed is below 25 km/h. New vehicle categories could be used to help overcome this problem.
- In the future, many AVs are likely to be built by adapting current vehicles. This will definitely be the case for dual mode vehicles, i.e. those that can operate in specified Operational Design Domains (ODDs) in an automated mode and be driven in other operating environments, and may be the case for fully automated vehicles. Unlike LSAVs, these AVs will likely fit into current vehicle categories well and hence for these AVs, the better way forward would be to create AV sub-categories under existing vehicle categories.

The following definitions were proposed for the LSAV passenger and goods categories:

- 'LSAV' means any power-driven vehicle that is designed and constructed to be moved by its own means and to be driven, in normal operation, only by an automated driving system without a driver, that has at least 4 wheels, is complete,

completed or incomplete, has a maximum design speed of at least [10 mph] but not more than [20 mph].

- ‘Passenger LSAV’ means an LSAV intended to be used on public roads, with at least 1 occupant position (seated and/or standing), and having a maximum mass not exceeding [5000] kg.
- ‘Goods LSAV’ means an LSAV intended to be used on public roads, without occupant positions, and having a maximum mass not exceeding 3500 kg.

Brackets indicate parts of the definition which could be subject to change still.

2.3.2.2 Implementation strategy

As shown in Figure 2-2, it is proposed that the GB LSAV scheme could be initially introduced for small series (SSTA) and Individual vehicle approval (IVA) only, before the introduction of unlimited series at a later date.

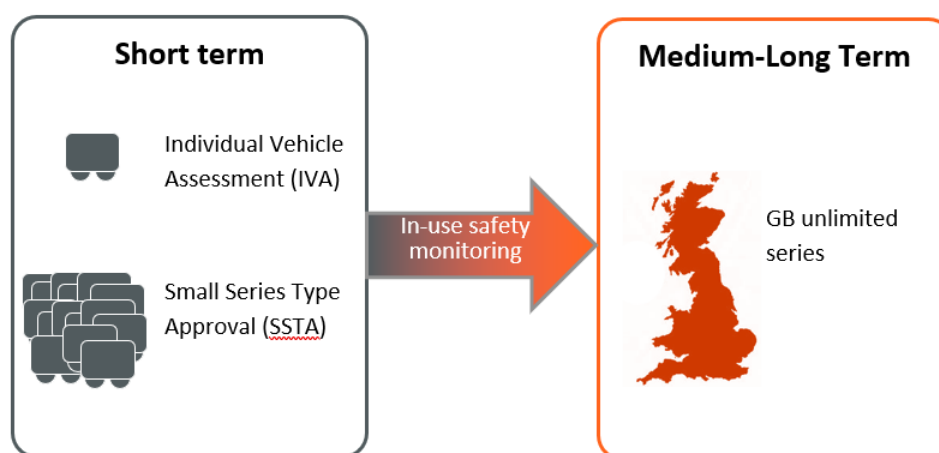


Figure 2-2: Staged introduction of IVA, SSTA and unlimited series

The main reason for this proposal is to restrict the number of LSAVs on the road until lessons from in-use safety monitoring have been learnt and hence reduce the risk of having to restrict the operation of in-use vehicles because of safety concerns.

However, it should be noted that the technical requirements derived for SSTA in this WP would be appropriate for unlimited series, although ideally test procedures defined in outline for items such as VRU impact protection should be defined in detail for unlimited series. Therefore, an alternative less cautious approach could be to introduce unlimited series from the start of the scheme. Some stakeholders have commented that an initial SSTA approach may result in too few LSAVs on the road to learn much from in-use safety monitoring, so a potential advantage of starting with unlimited series is that it would likely result in more LSAVs on the road and hence address this issue. If the IVA / SSTA approach is chosen, the limit on the number of vehicles permitted for SSTA will be defined at that point.

It is also proposed that the technical requirements for SSTA and IVA should be the same on the basis that:

- With respect to the ADS:
 - Currently, driver licensing requirements are the same regardless of the vehicle's approval volume
 - Risk of single rogue vehicle too high because operating in areas with many VRUs
- With respect to all other aspects:
 - Vehicles are mainly for public service use and thus need to have high safety levels to be commensurate with public expectations

2.3.2.3 *Approach for technical requirements*

The approach underpinning the development of the LSAV technical requirements was developed as part the task 2 / 3 work. Hence, it is described in the relevant task 2 / 3 report Section 3.2.1.

2.3.2.4 *GB compared to EU scheme*

Using the draft delegated¹⁰ and implementing¹¹ regulations for AVs published by the European Commission to obtain feedback, the authors made a comparison of the draft EU scheme and the recommendations of this report for the GB scheme (Table 2-2). It was seen that the scope of the draft EU scheme is similar in terms of concept with an initial focus on small series approval. However, the EU scheme is much broader in terms of vehicle maximum speed, category and ODD than considered by this report.

¹⁰ EC draft delegated regulation for, inter alia, automated vehicles: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13291-Vehicle-safety-technical-requirements-for-unlimited-and-small-series-and-special-purpose-and-fully-automated-vehicles_en

¹¹ EC draft implementing regulation for automated vehicles: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12152-Automated-cars-technical-specifications_en

Table 2-2: Comparison of scope of GB and EU approval schemes

GB scheme	EU scheme
Fully automated only	Fully automated & dual mode
Small series and IV approval only	Small series approval only
Max speed, 20 mph (32 km/h) - LSAV	Max speed, effectively no limit
Max gross mass, 5,000 kg (passenger vehicles); 3,500 kg (goods vehicles)	Max gross mass, effectively no limit
Carriage of goods or passengers, N ₁ , M ₁ & M ₂ , not pavement based micro-mobility	Carriage of goods or passengers, all M and N categories, not pavement based micro-mobility
Electric	Electric & ICE
ODD:	ODD:
Pre-defined area in urban or sub-urban environment	Pre-defined area in urban or sub-urban environment
	Fixed route hub-to-hub shuttle service in urban, suburban or motorway environment
	Automated valet parking within predefined parking facilities

A comparison of the technical requirements for the draft EU scheme and the proposed GB scheme in terms of VRU protection, standing passengers, seatbelts and crashworthiness (Table 2-3) shows that the GB scheme offers VRU protection over a wider category of LSAVs and permits standing passengers in small (M₁) LSAVs provided the operating environment has low enough injury risk to operate a vehicle approved to Crashworthiness Approval Level (CAL) ‘Reduced’ (see Section 3.2.1.1).

Table 2-3: Comparison of technical requirements for GB and EU schemes

Technical Requirements	Draft EU scheme			Draft GB scheme	
	‘M1 category’		‘M2 category’ (Class A)	LSAV (M1 & M2 class A)	
	Max speed < 30 km/h, (all ODDs)	Max speed > 30 km/h, (all ODDs)		Standard CAL, (all urban ODDs)	Reduced CAL, (reduced risk urban ODDs with exception for ‘M2 class A LSAVs’ which permits operation in all urban ODDs)
VRU protection	✓	✓	X	✓	✓
Standing passengers	X	X	✓	X	✓
Seatbelts	✓	✓	X	✓	X
Crashworthiness	X	✓	X	✓	X

The advantages and disadvantages of the proposed GB scheme compared to the draft EU scheme can be summarised as follows:

Advantages:

- New vehicle categories and two different Crashworthiness Approval Levels (CALs) enable:
 - Increased scope
Scope of GB scheme includes vehicles with maximum speed in the range 16 km/h to 25 km/h whereas EU scheme does not.
 - Standing passengers permitted
In small (M₁) AVs if deployed in low risk operating environments
 - Appropriate VRU impact protection
For larger (M₂) LSAVs
- For 'M₂ class LSAVs' an exception which permits their operation in all urban ODDs even with a reduced CAL enables:
 - Alignment of occupant restraint and crashworthiness requirements for Class A M₂ type LSAVs with those for current equivalent non-automated buses

Disadvantages:

- Not as simple and scope (as a whole) much smaller (at present)

2.3.2.5 *Integration of LSAV approval into wider GB AV Approval Scheme*

This section presents some initial thoughts on:

- How a wider GB AV approval scheme may align with the draft EU AV approval scheme
- How LSAV approval could be integrated into a wider GB approval scheme

Manufacturers will wish to sell their AVs into both the EU and GB markets and ideally be able to sell the same vehicles into both markets. To achieve this ambition, or at least minimise regulatory burden, the GB AV scheme would have to align somewhat with the EU one. There are two obvious ways to achieve this:

1. Adopt the EU scheme as is:

The main disadvantage of this option is associated safety issues for LSAVs, in particular:

- LSAVs with maximum speed ≤ 25 km/h out of scope, i.e. the EU scheme will not mandate technical requirements for these LSAVs whereas the GB scheme will for LSAVs with max speed between 16 km/h and 25 km/h
- VRU protection for M₂/M₃/N₂/N₃ category LSAVs, i.e. the EU scheme will not mandate VRU protection requirements for these categories of LSAVs whereas the GB scheme will
- No option to adapt technical requirements according to use case, i.e. the EU scheme will not permit the opportunity to allow standing passengers in small (M₁) LSAVs in low collision risk / consequences operating environments whereas the GB scheme will.

2. Adopt the EU scheme with modifications:

- The main advantage of this option is that it gives an opportunity to resolve the disadvantages of the EU scheme listed above.
- Implementation of this option could be achieved by integration of the approach developed in WP4, namely introduction of two new LSAV categories (passenger and goods) and adoption of the rest of the EU scheme for vehicles with maximum speed higher than the LSAV maximum speed (20 mph).
- Points to think if doing this include:
 - Max speed of LSAVs into the future – this could be increased to say 25 mph if ADS regulation developed for LSAVs within WP1, WP2 & WP3 appropriate for these speeds
 - Size of LSAVs into the future – current scheme could be expanded to include M₃, N₂ & N₃ category LSAVs – to achieve this, the ADS regulation will require updating to assess vehicles that tow, i.e. N₂ / N₃ LSAVs.
 - For M₃ LSAVs, advantages are that this could add VRU protection requirements and allows current occupant restraint and crashworthiness requirements for all operating environments on basis of exemption for vehicles similar to Class A and Class I buses
 - Categorisation of vehicle as LSAV must overrule M and N categories, i.e. be preferential and first choice of category
- Potential advantages include:
 - LSAVs with maximum speed between 16 km/h and 25 km/h within scope
 - VRU impact protection mandated for large LSAVs, i.e. M₂/M₃/N₂/N₃ size
 - More appropriate occupant restraint and crashworthiness requirements for LSAVs with maximum speed less than 32 km/h and

option to tailor them to associated risk within operating environment with 2 Crashworthiness Approval Levels (CALs). Note current EU scheme has no crash requirements for small (M₁) LSAVs with maximum speed less than 30 km/h but full M₁ crash requirements (i.e. UN R94, 95, 135, 137) for small LSAVs with maximum speed greater than 30 km/h.

- Also if the LSAV maximum speed was increased to 25 mph, this would also give more appropriate occupant restraint and crashworthiness requirements for LSAVs with maximum speed between 30 km/h and 40 km/h (25 mph). Note that if the LSAV maximum speed was increased to 30 mph, the crashworthiness requirements currently defined for LSAVs with a maximum speed less than 20 mph may not be appropriate because the severity may be too low. For a maximum speed less than 20 mph it was assumed that LSAV travelling speed will be small (because of short stopping distance), so speed of its impact partner was the main parameter in determining the crash severity. If LSAV maximum speed 30 mph, this assumption could be invalid, but for max speed 25 mph it is likely still valid.

In summary, this report section shows how the LSAV approval scheme proposed could be integrated into a wider GB AV approval scheme which in turn could be based on the draft EU AV approval scheme. Some of the advantages of this approach are highlighted and it is also cautioned that it needs to be checked that categorisation of a vehicle as an LSAV can be achieved without conflicting with categorisation of vehicles into the M and N vehicle categories.

3 Pre-deployment approval regulations (Tasks 2 & 3)

3.1 Approach

The objective of Tasks 2 and 3 was to develop proposals for technical requirements and test procedures for pre-deployment approval of non-ADS aspects of LSAVs, as far as possible by application and modification of existing regulations.

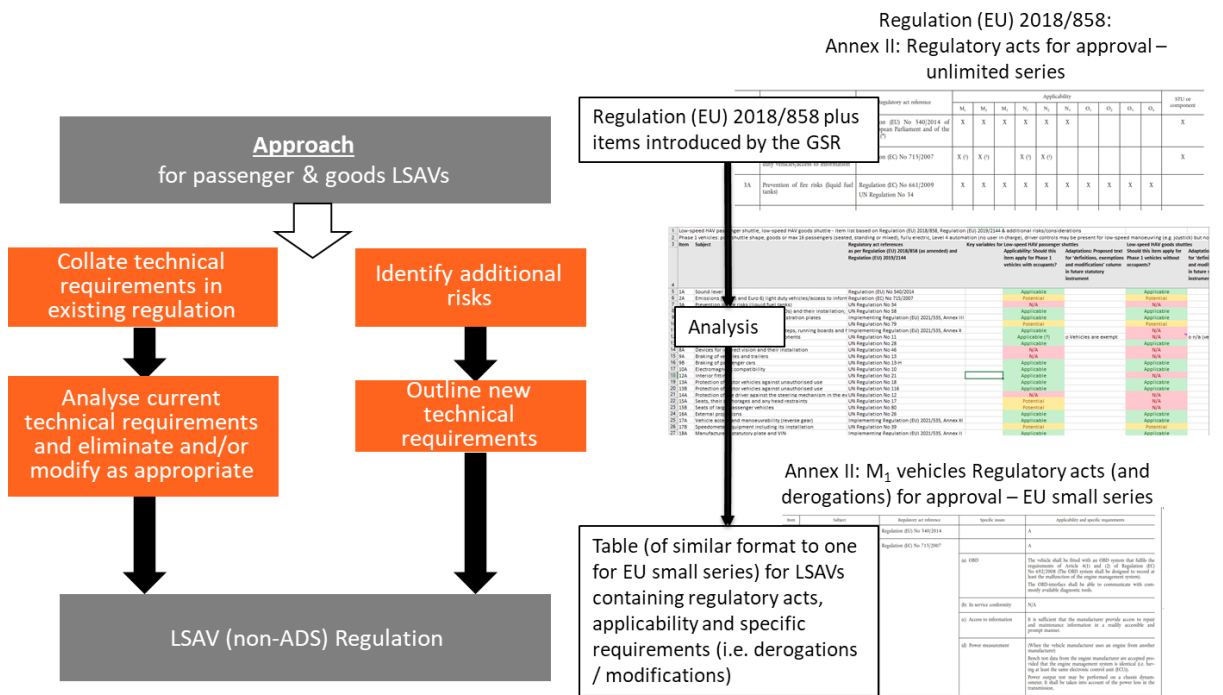


Figure 3-1: Overview of Task 2 and 3 approach

The approach taken to these tasks is illustrated in overview form in Figure 3-1. The individual steps taken were:

- To collate technical items in existing approval schemes to identify the most suitable basis for the new scheme. It was found that the requirements for unlimited series approvals of M/N-category vehicles under Regulation (EU) 2018/858 were the most desirable basis because they provided the most comprehensive list of items as a starting point. In addition, items introduced by Regulation (EU) 2019/2144 (GSR2) were added to the base list to arrive at a complete set of technical items for consideration. However, when writing this report, GSR2 has not been adopted into GB type approval. GSR2 also updates the referenced technical regulations for several items by pointing to Implementing Regulation (EU) 2021/535, which collates several previously separate regulations (e.g. registration plate space, vehicle access and manoeuvrability, etc.). Regulation (EU) 2021/535 was adopted after the UK left the EU and is therefore not currently applicable in GB; therefore, the older individual

delegated or implementing acts, which are retained in GB legislation, were used instead, as a baseline for technical requirements.

- To associate additional risks identified in Task 1 with existing technical items (to address in the associated legislation) or create new items as required. New items created based on additional risks were:
 - Software updates
 - Maximum vehicle speed limitation
 - Manual operation at very low speeds
 - Static vehicle stability
- To develop a coherent and well-balanced approach for requirements in key safety areas that spread across multiple regulations. These areas were:
 - Occupant restraint and crashworthiness
 - Vulnerable road user protection
 - Vehicle stability
 - Protection against unauthorised use and security

The guiding principle for the decisions taken was to provide ‘at least equivalent safety’. This means offering levels of protection comparable to those of current vehicles used in similar scenarios, while ensuring that requirements are proportionate to the low-speed use case and are not over-burdensome for smaller manufacturers.

- To eliminate superfluous regulatory items for the vehicles in scope.
- To analyse the technical requirements and test procedures of the remaining items (set out in UN and EU regulations referenced in the type approval framework) for aspects that can be waived or require modification.
- To develop outline regulations for specific aspects where no regulation existed, namely manual operation for vehicle recovery and static vehicle stability.
- To summarise all aspects that were flagged up during the analysis as potentially requiring further consideration but being out of scope of this work package.
- To perform an assessment of implications of potential scope changes, such as reducing the maximum mass of passenger vehicles to 3.5 tonnes or increasing it further.
- To provide considerations for future work related to potential later extensions of the approval scheme.

3.2 Summary of results

3.2.1 Decisions on key safety aspects

3.2.1.1 Occupant restraint and crashworthiness

The level of occupant protection and crashworthiness required by a passenger LSAV will change depending on its operating environment. A main factor is the risk of injury from collisions which could cause large accelerations and/or occupant compartment intrusion. The ADS is responsible for primary safety for collision avoidance, but the action of other road users may still result in collisions which require mitigation through secondary safety measures. Thus, given that the ADS regulation will assure that the vehicle drives well (e.g. in a manner which adheres to the Highway Code), the main types of collisions are anticipated to be 'not at fault' ones, i.e. other vehicles colliding into the LSAV.

The injury risk will be low in operating environments where the collision risk and/or consequence is reduced. Examples include separated lanes, where the collision risk will be reduced compared to open roads because less traffic is encountered, and 20 mph zones or business/university campuses where the collision consequences will be reduced because of the low traffic speed. Conversely, in environments such as roads with 30 mph speed limits on which mixed traffic is present, the injury risk will be much higher because the presence of many other vehicles increases the collision risk and because they are likely to be travelling faster at 30 mph or potentially above, this also increases the collision consequence. Different levels of protection will be required for these different operating environments.

When considering whether or not standing or unrestrained passengers should be permitted in passenger LSAVs, the presence of Vulnerable Road Users (VRUs) in the operating environment should be taken into account because automatic emergency braking manoeuvres to avoid VRUs could cause occupants to fall and/or be thrown forward. Standing/unrestrained passengers could be permitted only in environments with low/no prevalence of VRUs or a very low speed restriction could be imposed on vehicles with such passengers in areas with VRUs.

With this in mind, and based on the principle of achieving a safety level at least equivalent to current non-automated vehicles, it is proposed that there should be two Crashworthiness Approval Levels (CALs) for passenger LSAVs with outline requirements as follows:

1. **CAL Reduced:** based on class A bus requirements for operating environments with a low risk of collision and/or low consequences.
 - Occupant restraint:
 - Standees: permitted, requirements include handrails/handholds as per R107
 - Seated: side-facing seats permitted, requirements include guard or at least 2-point safety belt for exposed seats only
 - Crashworthiness: No requirements.

2. **CAL Standard:** based on car requirements for all operating environments, including those with a higher risk of collision and/or higher consequences.

○ Occupant restraint:

- Standees: not permitted

- Seated:

- Side-facing seats not permitted
- Front and rear impact: requirements include 3-point safety belts and head restraints for all seating positions (including rear-facing seats). Fit impact friendly interior for parts likely to be hit by passengers.

Relevant regulations: UN R14, UN R16, UN R17 and UN R21

- Side impact: Require side impact protection, e.g. meet anthropomorphic test device (ATD) Injury Assessment Reference Values (IARVs) in side impact test

Relevant regulations: UN R95

○ Crashworthiness:

- Front impact:

- Requirements: Structural integrity for electrical power train protection and to limit compartment intrusion to allow occupant restraint to function correctly.
- Considered regulations: Main: UN R94 and UN R95. Other: UN R29 for truck cab strength. In addition, UN R135 and UN R137 which will be introduced in EU by the General Safety Regulation.
- Analysis found that UN R94, UN R135 and UN R137 are not applicable because the severity of the impact they represent is higher than anticipated for the use case considered. Therefore, it is proposed to perform a UN R95 type test at 50 km/h to the front of the vehicle and impose requirements for electrical power train safety as per the regulation, and structural performance through an assessment of intrusion.

- Rear impact:

- Requirements: As for frontal impact, structural integrity for electrical power train protection and to limit compartment intrusion to allow occupant restraint to function correctly.
- Considered regulations: Main: UN R32, UN R95; Other: UN R153 which will be introduced into EU legislation by the General Safety Regulation.

- It is proposed to perform a UN R95 type test to the rear of the vehicle and impose requirements for electrical powertrain safety as per the regulation and structural performance through an assessment of intrusion. It is proposed that the test speed should be 50km/h. This speed was chosen because it is the speed used in R153 which should be more representative than the speed of 36.5 km/h used in R32, given that R153 was developed much more recently. Also, this speed is representative of a 30 mph car impact. However, it is proposed that the structural performance requirements should be based on those within UN R32.
- Side impact:
 - Requirements: Structural integrity for electrical power train protection together with associated padding / airbags for occupant protection.
 - Given that UN R95 test represents a car travelling at 50km/h impacting side of a stationary vehicle, propose to implement this test with electrical power train and occupant protection requirements as per the regulation.

It is envisaged that the manufacturer will be able to choose which CAL to approve the LSAV to, depending upon the intended use. An LSAV, approved to CAL Reduced, shall be limited to operating environments where the risk of collision and/or consequences within the domain are appropriately low (considering the risk of impacting/being impacted by other vehicles and the risk of emergency braking manoeuvres endangering standing/unrestrained occupants).

With regard to passenger LSAVs which are similar to M₂ Class A buses, it is proposed that CAL Reduced requirements should be acceptable without restricting the operating environment. This will allow better alignment of GB AV scheme with safety countermeasures for current vehicles (M₂ class A buses do not have to fit seat belts or meet crashworthiness requirements) and potentially other regulatory schemes. The reduced requirements could be applied to passenger LSAVs with a maximum mass > 3,500 kg and the R-point of lowest seat > [800] mm above ground level. The technical justification is that:

- Large mass should ensure lower collision acceleration levels and thus reduce the risk of injury.
- High R-point should ensure a lower risk of injury because the main impact point for cars is largely below occupant position. Notes:
 - On this basis, UN Regulation No 95 (03 series of amendments, 4th supplement) used to contain a derogation for vehicles with seating R-points > 700 mm above ground level.
 - Typical lowest seat R-point height above ground of city buses in the range of 802 mm to 850 mm.

In summary, the main reasons for this proposal are:

- It aligns with current regulatory requirements: CAL Reduced with city (Class A) buses, CAL Standard with cars
- It provides approval levels for potential operating environments with low and higher injury risk from collisions respectively. It also permits standing passengers to enable frequent and fast passenger changes, at least in certain environments which are deemed low risk.
- It enables a safe approach for the deployment of LSAVs. For example, for operating environments where it is uncertain how high the collision risk may be, initially authorisation may be given to operate vehicles with a standard CAL only, until data can be collected to justify operation of vehicles with a reduced CAL.
- The exception for passenger LSAVs which are similar to M2 Class A buses to allow their use in operating environments with higher injury risk collisions, but with CAL Reduced requirements only, provides alignment of requirements for LSAVs with current non-automated vehicles.

3.2.1.2 *Vulnerable Road User (VRU) protection*

LSAVs are expected to predominantly operate in areas with a high density of VRUs (pedestrians and cyclists) which makes VRU protection a high priority. Given that it is unlikely to be possible for Advanced Emergency Braking (AEB) systems to avoid all VRU impacts, and ADSs are expected to have corresponding limitations, passive safety countermeasures are required. The relevant technical areas to consider are: external projections (to reduce the risk of injury to a person hit by sharp edges and protrusions on the vehicle body work), pedestrian safety (to reduce risk of injury from impacts) and frontal protection systems (to prevent additional injury risk from these devices).

The following approach was proposed for VRU protection requirements of LSAVs in the short term:

- External projections: Apply requirements of UN R26 with newly added requirements for ADS sensors, which are not currently covered within the regulation. If vehicle features are present that are regulated only in UN R61, the Technical Service may consider the relevant prescriptions of UN R61 in their assessment. An exemption for certain features can be given by the Approval Authority where the special purpose of a vehicle makes it impossible to fully comply. In general, the Technical Service should pay specific attention to features likely to cause leg injuries because pedestrian leg impact testing will not be performed.
- Pedestrian protection/head impact testing: UN R127 cannot be applied because many LSAVs are likely to have a close to vertical front shape (as opposed to a long bonnet type shape of typical passenger cars) which makes current protocol,

including leg impact, very difficult to perform, and because maximum LSAV speed is lower than the pedestrian impact represented in the current protocol.

It is therefore proposed, for all vehicles with a maximum speed > [16 km/h], to submit documentation to demonstrate that frontal areas of the vehicle that are likely to be hit by a VRU's head have safety levels in line with the principles of UN R127. The documentation will be assessed by the technical services. Notes:

- Assessed areas should include windscreen / window areas if likely to be hit, i.e. wrap-around distance of 800 mm to 2500 mm or a height above ground of 2000 mm for vehicles with close to vertical front shapes. Test areas to be defined using UN R127 procedures or, if not appropriate, an equivalent type of method
- Safety levels may be demonstrated with headform tests or logical argumentation, e.g. toughened glass windscreen with sufficient distance to hard points assumed to comply on the basis that such glazing is known to shatter on headform impact
- Headform test parameters may be adjusted where appropriate, e.g. impact angle for different vehicle front shapes, or impact speed to account for a vehicle's maximum speed being < 40 km/h, the nominal pedestrian impact speed used as the basis for the development of UN R127
- For child and adult headform tests the HIC recorded shall meet the requirement to not exceed [1000] over all of the test area. Note: this is different to UN R127 requirements which are < 1000 over 2/3 of test area and < 1700 over remaining area
- Frontal Protection Systems (FPS): It shall not be permitted to fit frontal protection systems to LSAVs because it is not envisaged that FPS will be needed in the environments LSAVs are expected to operate. Frontal protection systems are defined as a separate structure or structures, such as a bull bar, or a supplementary bumper which, in addition to the original-equipment bumper, is intended to protect the external surface of the vehicle from damage in the event of a collision with an object, with the exception of structures having a mass of less than 0.5 kg, intended to protect only the vehicle's lights.

In the medium to longer term, it is proposed that an appropriate regulation for the assessment of VRU impact protection for LSAVs is developed based on lessons learnt from in-use safety monitoring. This regulation should be suitable for the assessment of vertical fronted vehicles and include requirements for both leg and head impact.

3.2.1.3 *Vehicle stability*

There are two main questions related to requirements for LSAV stability in cornering type manoeuvres in which the vehicle may roll:

- Should Electronic Stability Control (ESC) and/or Anti-Lock Braking System (ABS) fitment be a mandatory requirement or not?

- Are static stability requirements such as a tilt test or a Static Stability Factor (SSF) needed?

ESC is important to help vehicle control in swerving type manoeuvres. LSAVs will have a maximum speed of 20 mph. In general, for collision avoidance at these low speeds it is preferable to brake rather than swerve because braking distances are short at these low speeds and unlike for a swerving manoeuvre there is no risk of colliding with a vehicle which may be alongside. On this basis, it is proposed that fitment of ESC need not be a mandatory requirement, though it should be permitted if a manufacturer chooses to develop the capability and fit it.

ABS helps maintain tractive contact with the road surface and allows the ADS to maintain more control over the vehicle, both in terms of steering and maximising braking, on surfaces with varying and low friction. On this basis, it is proposed that fitment of ABS, or provision of equivalent functionality through other systems such as the ADS, should be a mandatory requirement. This should apply to vehicles with a maximum speed >25 km/h (the current scope limitation of UN Regulation No 13-H).

With regard to static stability, it is expected that the stability of LSAVs in general should be good because heavy items such as batteries are likely to be located at low positions in the vehicle resulting in a low centre of gravity. However, some vehicles may be designed with batteries at high positions, e.g. on roof, to allow low entry heights, or with a narrow track width, both of which may lead to poor stability. It is therefore proposed that a Static Stability factor (SSF) requirement of $SSF > [1.0]$ is imposed for the vehicle in its worst-case loading condition.

SSF to be determined based on the following equations:

$SSF = T/2H$, where T = Track width and H = centre of gravity height

or, when the centre of gravity is laterally offset, extended equation to capture the worst-case side:

$SSF = (0.5*T - L)/H$, where L = lateral offset of the centre of gravity

The proposed SSF performance limit of [1.0] was pragmatically decided on the following bases:

- This should practically allow cornering lateral g forces of the order of 0.75g which should be far above those likely to be experienced by LSAVs.
- NHTSA (2017) data⁴ show that current light vehicles generally exceed this value with the exception of some full-size passenger vans which have SSF values circa 0.9.

3.2.1.4 *Protection against unauthorised use and security*

Under the European Community Whole Vehicle Type Approval Framework EU 2018/858 there are three interlinked UN regulations related to vehicle security and protection against unauthorised use which are referenced as part of vehicle approval. The applicability of these

regulations is dependent on vehicle category, and approval can be obtained for either a vehicle or for specific components (Separate Technical Unit or STU).

These regulations are:

- UN R18 Protection of motor vehicles against unauthorised use - M₂/M₃/N₂/N₃ & STU
- UN R116 Protection of motor vehicles against unauthorised use – M₁/N₁ & STU
- UN R97 vehicle alarm systems – M₁/N₁ & ST

Recognising that the subject LSAVs do not currently sit within the defined categories referenced by the regulations, their public service vehicle-like use cases will be very diverse, and they will be fleet owned, which may involve safe overnight storage in many cases, a large degree of flexibility in the application of the regulations should be afforded. It is therefore proposed to apply the regulations on an if fitted basis, i.e. make fitment of the corresponding systems optional so as to allow the manufacturers to cater for the requirements of specific use cases, but ensure that systems that are voluntarily fitted fulfil established safety standards and reduce nuisance (in the case of vehicle alarm systems).

It should be noted that the following three new UN Regulations entered into force on the 30/09/2021:

1. UN R161 Protection against unauthorised use by mean of a locking device (M₁/N₁)
2. UN R162 Approval of immobilisers (M₁/N₁)
3. UN R163 Approval of vehicle alarm systems (M₁/N₁)

The content of these new regulations mirrors the respective sections of UN R18/97/116 however they now split the content by subject. Currently, these new regulations are not referenced by any European or UK whole vehicle approval framework but will be introduced via a delegated act amending EU 2019/2144. Approvals to the new UN regulations, UN R161, UN R162, UN R163, should be accepted as alternatives to the established regulations, UN R18, UN R116, UN R97.

Depending on the vehicle specification, the manufacturer should have the choice of compliance with the regulations as published, or where operating incompatibilities with the regulation arise, the scheme should allow a mechanism to agree an equivalent level of protection, which may include using emerging technologies, with the technical service.

3.2.2 Selection and modification of technical regulations

The full list of technical items collated for consideration, from Regulation (EU) 2018/858, Regulation (EU) 2019/2144 and additional risks identified in Task 1, is provided in Table 8-1 (Appendix A, Page 47). The table details the items' proposed applicability for Passenger and Goods LSAVs, respectively, and contains the technical regulations and series of amendments proposed for application.

Regulatory items that were found to be superfluous for LSAVs are marked as ‘not applicable’. This could have various reasons: some items were not applicable on technical grounds because the regulated systems are intended to support the driver (e.g. mirrors, windscreen wipers) or specific to combustion engine or hydrogen vehicles; some items were not required based on the approach developed for key safety areas; and some were related to the dynamic-driving task and therefore not within the non-ADS scope of this work package. A total of 132 items was considered, of which 66 are proposed to be applied for pre-deployment approval of Passenger LSAVs and 54 for Goods LSAVs.

For certain aspects identified as additional risks for LSAVs no suitable regulatory text was available in the existing body of regulations to draw from. For these items, new regulatory proposals were developed:

- Item 58: Pedestrian protection
- Item 116: Manual operation at very low speeds
- Item 117: Static vehicle stability

Where existing regulations were recommended for application, in many cases modifications were required to make them suitable for LSAVs. Some parts of regulations could be waived or alleviated due to the specific use cases (low-speed, goods vehicles without occupants); other parts needed to be modified because of novel vehicle shapes or the absence of a driver, driver’s seat and conventional vehicle controls. Based on this analysis, modifications to the existing requirements and test procedures were proposed in the format of regulatory text to detail the application of each regulation for LSAVs. Where elements were identified that required clarification or modification in multiple regulations (e.g. definition of ‘driver side’, how to treat bi-directional vehicles, etc.), these were summarised as Item 0 (Cross-cutting prescriptions). Note that the proposed new regulatory texts and proposed modifications for existing regulations are not reproduced in this overview report.

4 In-use regulations (Task 4)

4.1 Approach

The objective of Task 4 was to develop appropriate modifications for GB's in-use regulations relevant for non-ADS requirements:

- The Road Vehicles (Construction and Use) Regulations 1986 (SI 1986/1078), as last amended by SI 2020/1178. These are, in short, referred to as 'C&U' in the following text.
- The Road Vehicles Lighting Regulations 1989 (SI 1989/1796), as last amended by SI 2020/818. These are, in short, referred to as 'RVLR' in the following text.

The work builds directly on the outputs of Tasks 2 & 3 which recommend a set of pre-deployment, i.e. type-approval regulations. Task 4 performed analysis of the full regulatory texts and developed proposals for modifications to:

- ensure that vehicles type-approved to the set of requirements proposed will continue to be compliant with in-use regulations; and
- remove other potential barriers to compliance with in-use regulations, for instance related to the lack of a driver in LSAVs.

The modifications proposed are generally phrased in a way that refers specifically to LSAVs, i.e. to the narrow group of vehicles considered in this project, rather than all AVs. When drafting regulations, it should be considered whether some of the changes could be applied for a larger group of AVs so as to avoid having to repeat similar changes later when approval routes for other AVs become available.

Note that this work does not pre-empt whether or not wireless controls are permissible. Remote operation of an LSAV, in particular beyond line of sight, requires further work beyond the scope of this study to consider all pertinent technical and legal aspects.

4.2 Summary of results

Full lists of the C&U and RVLR items (regulations and schedules) are provided in Table 8-2 (Appendix B, Page 55) and Table 8-3 (Appendix B, Page 62), respectively. The tables detail the status of each item based on the results of the analysis performed:

Many items were found to be automatically not applicable for any LSAVs based on their shared characteristics, such as maximum permitted weight, maximum speed, vehicle class, or their ODD (76 items in C&U, 9 items in RVLR). No modifications or further consideration was required for these.

Some items were identified which would generally apply to some or all LSAVs, but which are not required because the vehicles are driverless or because the corresponding pre-

deployment approval requirements were waived (5 C&U, 0 RVLR). It is proposed to give an exemption from these items for LSAVs.

Some of the other items related to the use of vehicles (rather than their construction) and were therefore out of scope of WP4 (17 C&U, 6 RVLR). These regulations will require further consideration and may require adaptation/exemption in order to allow an AV to operate on-road legally.

The remaining items were analysed to identify aspects that require modification. The majority were found to be suitable for application to LSAVs without modifications (49 C&U, 38 RVLR). For those items which were not suitable as is (19 C&U, 7 RVLR), appropriate proposals for modifications were developed. These included addition or alteration of definitions, additional references to UN Regulations, appropriate application of braking and EMC requirements, options to require horn, seat belt anchorages and lamps also for very-low-speed LSAVs, additional information to be shown on plates, prohibition to tow trailers, lighting requirements for bi-directional vehicles and removal of driver's weight for lighting alignment. Note that the detailed modifications proposed are not reproduced in this overview report.

5 Administrative and procedural requirements (Task 5)

5.1 Approach

The objective of Task 5 was to develop a proposal for a set of procedural and administrative requirements for a GB Approval Scheme for automated vehicles, which covers the whole vehicle (with the exception of the system-level approval of the ADS).

To meet this objective, the following were delivered:

1. Description of proposal for approval process for GB scheme, with focus on non-ADS, which includes flowchart showing process stages and links between them
2. List of proposed modifications to the 'Information template' in Regulation (EU) 2020/683 to accommodate the non-ADS part of the GB scheme.

5.2 Approval process

The proposed process is illustrated in the flowchart shown in Appendix C. It was developed based on the UK National Small Series Type Approval (NSSTA) and UK Individual Vehicle Approval (IVA) schemes, as defined by The Road Vehicles (Approval) Regulations, Statutory Instrument 2020 No. 818, and with reference to the EU Whole Vehicle Type Approval Regulation, EU Regulation No. 2018/858. The process consists of the six following steps (which are illustrated as large vertical boxes in the flowchart):

1. Scheme selection
2. Requirements definition
3. Gathering and submission of evidence of compliance
4. Compliance decision
5. Additional checks
6. Granting of vehicle approval

It should be noted that the ADS approval, deployment approval and in-use monitoring processes are included at a high level in the flowchart to inform interactions with the vehicle approval flow, but should not be considered as the definitive version, which will be defined elsewhere.

5.3 Information document changes

EU Regulation 2020/683 includes the total list of all potentially applicable information for any motor vehicle type approval per EU Regulation 2018/858. To facilitate approval of LSAVs, document changes were defined in terms of sections to add and sections to modify as listed in Appendix D.

6 Stakeholder engagement (Task 6)

6.1 Approach

A two-stage stakeholder consultation was performed to solicit views and comments on TRL's proposals from relevant experts:

- Stage 1 was performed between 24 January and 8 February 2022 and consulted on the scheme outline, approach for vehicle categorisation (Task 1) and approach for the development of technical requirements proposed for key safety aspects, namely occupant restraint and crashworthiness, VRU impact protection, vehicle stability, and protection against unauthorised use and security (Task 2).
- Stage 2 was performed between 27 April and 19 May 2022 and sought comments on updates made to the scheme outline and the detailed technical proposals for pre-deployment approval (Tasks 2 & 3).

The consultation was held in written format. Stakeholders were provided with the relevant draft technical notes for review and comment as well as slide decks with specific questions.

Seven stakeholders were consulted: Two system / vehicle developers, three research organisations / test houses, one tier 1 supplier, and one motor industry trade association, which gathered views from its members. All stakeholders provided feedback on all or selected aspects of the consultation (see Table 6-1).

Table 6-1: Stakeholder participation in consultation

Stakeholder	Stage 1 feedback	Stage 2 feedback
System / vehicle developer 1	✓	✗
System / vehicle developer 2	✓	✓
Research / test house 1	✓	✓
Research / test house 2	✓	✗
Research / test house 3	✓	✓
Tier 1	✓	✓
Motor industry trade association	✓	✓

6.2 Summary of feedback

6.2.1 Scheme outline and approach for technical requirements

In general stakeholders were supportive of the scheme outline and the approach for technical requirements but the following comments were voiced:

- It is difficult to understand precisely what may constitute a potential low collision / consequence operating environment. Thus, the value of two Crashworthiness Approval Levels (CALs) may be questionable given that it increases the complexity of the regulation. Also, LSAV operation in a mixed traffic (higher potential collision / consequence type environment) may be so dominant that the number of LSAVs operating in potential low collision / consequence environments becomes so low that the associated reduced CAL becomes not worthwhile.
- Some suggestions for changes to the crashworthiness requirements for the standard CAL were made:
 - Increase the speed of the frontal impact test compared to the rear impact test on the basis that the closing speed between the LSAV and an impacting vehicle will be greater for a frontal impact than a rear one because the LSAV will, generally, be travelling forwards.

Note: It was decided to keep the speeds of the frontal and rear impact tests the same for the following reasons:

- Braking distances at low speeds are very short and hence it is expected that an LSAV will detect potential impacting vehicles approaching from the front and brake to a stop before being hit by them.
- Similar speeds for front and rear impact tests helps reduce the complexity of the regulation.
- To help understand fully the consequences of introducing new vehicle categories based on speed for LSAVs, please can additional information be provided on the categorisation approach for vehicles with maximum speeds above 20 mph and on the potential for scope extension to at least cover the use-cases already covered in the draft EU Regulation. For instance, does UK plan to align with the proposed categorization as per the amendments to EU Regulation (2018/858) for fully automated vehicles with speeds over 25km/h?

Note: A proposal for how a GB LSAV approval scheme (with new categories based on speed) could be integrated into the current draft EU AV scheme is described earlier in this report - see Section 2.3.2.5.

- The approach followed to develop the requirements for the LSAV approval scheme was that safety levels should be 'at least equivalent to those offered by current non-automated vehicles'. One stakeholder proposed that rather than follow this approach, the opportunity should be taken to improve safety further by adopting a more 'vision zero' type approach.

This stakeholder also suggested potential additional technical requirements for a more 'vision zero' type approach. These included:

Occupant restraint:

- Do not permit standing passengers

The literature highlights harsh acceleration and sudden braking as important contributory factors to falls of standing passengers, more so for elderly female passengers in public transport. Moreover, studies focusing on the injuries sustained by bus occupants report that 64.3% of serious injuries in Great Britain and 54.2% of injuries in Sweden, were due to non-collision incidents, a main cause of which is emergency braking, often to avoid VRU impact. To remove the risk of standing passengers falling and injuring themselves,

- Fit 3-point belts to all seating positions

For unrestrained seated passengers, collision with the seat in front is a frequent type of impact. Fitment of a 3-point seat belt, which controls the excursion of the upper body, is the potentially the best solution to avoid this type of impact.

Vulnerable Road User (VRU) protection:

- Use a whole-body model (physical dummy or simulation model) to assess kinematics of a VRU collision and build secondary and tertiary impact protection into the requirements for an LSAV.

For collisions with a VRU at speeds lower than 30 km/h, then impact testing alone may not capture the most important sources of injury risk. Ground contacts will take an increasing share of injury causing sources as vehicular speed decreases. Therefore, consideration should be given to both the energy absorbing potential of the vehicle structures and the resulting trajectory for the VRU. Designs that minimise ground contact injury risk and run-over risk should be encouraged.

- Extend the scope of the approval to consider the injurious or energy absorbing nature of external vehicle surfaces and structures all around the LSAV.

Given the application of automated LSAV braking, the remaining collisions will likely be biased towards those with high VRU speeds. This will increase the likelihood of VRU impacts to the front corners of the LSAV and also impacts with the sides or even the rear of the LSAV. Thus, it is recommended that the scope of approval is extended as described above.

6.2.2 Detailed technical proposals

A few specific in-depth comments were made by stakeholders on the proposed detailed technical proposals. Some examples of comments and resulting actions taken to respond to them are noted below:

- Item 20A (UN R48): Installation of lighting
Comment: Consider requiring coloured lamps rather than lenses for bi-directional vehicles to help ensure no red colour shown towards the front.

Discussion / action: Propose no action taken because Daytime Running Lamps (DRL) should ensure white light shown towards front.

- Item 45A (UN R43): Safety glazing

Comment: TRL proposal was to exempt Goods LSAVs from this requirement but industry has opposing view because requirements also aim to protect other road users not just occupants

Discussion / action: Re-introduce full safety glazing requirements for Goods LSAVs noting that industry also commented associated costs likely to be low.

- Item 52A (UN R107): M2 and M3 vehicles reg – external emergency stop button

Comment: agree would be open to misuse, suggest wait for consensus in on-going discussions on external Human Machine Interface (HMI) in GRVA/WP.29 before final decision taken on how to proceed.

Discussion / action: Do not include external emergency stop signal in current proposal. Review when advice available from GRVA/WP.29 discussions.

- Item 113 (UN R145): Child restraint anchorages

Comment: TRL proposal states that CRS anchorages should be fitted for forward-facing seats only, so unclear what should be done for bi-directional vehicles.

Discussion / action: UN R129 requires that all CRS are subjected to frontal impact testing and in addition that all rearward and lateral facing CRS are subjected to rear impact testing as well. The crash pulse for a frontal impact test (delta v 50 km/h, magnitude 20-28g, stopping distance 650 mm) is much more severe than for a rear impact test (delta v 30 km/h, magnitude 14-21g, stopping distance 275 mm). The reason for these requirements is that forward facing CRSs are inherently safe for rear impacts (child is propelled into seat back which is supportive), but in contrast rear facing CRSs may not be (child is propelled rearward and lifted out of seat), hence rear facing CRSs are tested for rear impact.

For LSAV with maximum speed < 20 mph (32 km/h), the severity of the rear impact test (delta v 30 km/h, magnitude 14-21g, stopping distance 275 mm) largely covers the crash pulses likely to be experienced in frontal and/or rear impacts, thus the direction an LSAV may be traveling in is largely immaterial. However, if the LSAV has a higher maximum speed this assumption would become invalid because crash severity could become greater than that for the CRS rear impact test (delta v 30 km/h) but would still be less than that for the CRS frontal test (delta v 50 km/h). Consequently it would need to be ensured that rear facing CRSs were positioned in forward facing seats. It may also be necessary to position forward facing CRSs in forward facing seats for the following two reasons. The first is to ensure that the CRS load the ISOFIX anchorages in the direction in which they are tested in for regulatory approval, i.e. the forward direction, although by the nature of their design they will likely withstand a substantial proportion of that load in the opposite direction. The second reason is to ensure that the rotation of the CRS is controlled because when CRS positioned in a rear facing seat this will be dependent on the seat back stiffness only, whereas in a front facing seat rotation is controlled by the CRS top tether or foot. One potential way to ensure positioning of CRS in forward facing seats only could be the fitment of a system to detect the presence of CRS which links to the ADS to ensure the LSAV does not move unless CRS positioned in forward facing seat.

Notes were added to Item 113 regarding potential solutions such as this for bi-directional vehicles.

- Item 116 (new Reg): Manual operation for vehicle recovery
Comment: low speed manual operation should be permitted for scenarios other than vehicle recovery, e.g. manoeuvring in yard
Discussion / action: Agree with comment. Title of new regulation changed to 'Manual operation at very low speeds' and provisions updated appropriately.

7 Conclusions and way forward

7.1 Conclusions

The project reported (WP4) has delivered the main components for a GB approval scheme for LSAVs that comprehensively mitigates non-ADS risks without overburdening manufacturers with superfluous requirements and which is extensible to future use cases.

The project consisted of six main tasks which delivered the following main components:

- Task 1: Major considerations / safety risks and scheme outline
 - A list of major considerations and safety risks, in particular those unique to and/or highlighted by LSAVs and not mitigated appropriately by requirements in current type approval legislation. Note that this list was used to define additional technical requirements needed in Tasks 2 and 3.
 - A scheme outline for LSAV approval based on the introduction of two new vehicle categories, namely LSAVs with and without occupants respectively. The new categories were found necessary to enable the application of requirements to LSAVs with a maximum speed below 25 km/h, and the application of appropriate VRU impact protection requirements for larger M2 category type LSAVs. An example of how the scheme could be integrated into the draft EU scheme is given to demonstrate its extensibility to future use cases.
- Tasks 2 & 3: Pre-deployment approval regulations
 - A list of 66 items proposed to be applied for the approval of Passenger LSAVs and 54 items for the approval of Goods LSAVs with references to appropriate technical regulations or proposed new regulatory text.
 - Proposed modifications and additions to the regulatory texts in order to make them suitable for application to LSAVs.
 - The study further found that a general permission to carry standing passengers in light vehicles could present unreasonable risks to occupants in braking manoeuvres or collisions, but that it could be safely possible in some operating environments. A concept was proposed which offers manufacturers a choice between two Crashworthiness Approval Levels (CALs). The less demanding CAL allows spaces for standing passengers but restricts the subsequent operating environments of the vehicles.
 - VRU impact protection was a high priority due to the expected operation in areas with a high density of pedestrians and cyclists. However, LSAV aspects such as their flat-fronted shape cause issues for the application of the current regulation, so modifications were proposed.
- Task 4: In-use regulations
 - A list of 68 applicable C&U items (regulations and schedules) and 45 RVLr items.

- Proposed modifications and additions to the regulatory texts in order to make them suitable for application to LSAVs.
- Task 5: Administrative and procedural requirements
 - A 6-step administrative process for the approval of an LSAV illustrated in a flowchart.
 - EU Regulation 2020/683 includes a list of all potentially applicable information for any motor vehicle type-approval per Regulation (EU) 2018/858, called the information document. Modifications were made to this document to make it appropriate for whole vehicle approval of an LSAV.
- Task 6: Stakeholder consultation
 - Review of the proposed scheme outline, approach for vehicle categorisation, and technical requirements and test procedures by seven expert stakeholders from industry, research and test houses.
 - Adaptations to the proposals were made based on the comments received.

7.2 Way forward

A number of items have been identified which require further work. These include:

- Elements which fall outside the scope of this WP but need consideration for the LSAV scheme as a whole. These items include things such as, speed measurement accuracy, precisely how the functional safety case should be formulated and approved, how the ADS should react to emergency stop requests by passengers, how it can be verified that all functions of the ADS work correctly under all EMC immunity test conditions, whether wireless control/remote operation should be permitted and what technical requirements would be appropriate.
- Further development of overall GB AV approval scheme and consideration of how it aligns with the EU scheme. This should include:
 - Potential scope increases, for example to include use cases within current EU scheme, i.e.:
 - Higher speed AVs which operate in a urban or sub-urban environment.
 - Hub to hub: fully automated or dual mode vehicles for carriage of passengers or goods on a predefined route with fixed start and end points which operate in a urban, sub-urban or motorway environment.
 - Automated valet parking: dual mode vehicles with a fully automated mode for parking applications within predefined parking facilities
 - Integration of the LSAV new vehicle categories and alignment of requirements with EU scheme. This should include a review of the maximum speeds permitted by LSAVs.

-
- Trial approval of a specified LSAV to check that processes and requirements are appropriate and complete.
 - To help drive a 'vision zero' strategy, consider further development of safety requirements in the medium term including, among other things, a bespoke VRU impact regulation and crash test regulation with ATDs, more detailed safety belt reminder specifications, whiplash tests, bus interior impact tests, as well as other topics that might emerge from in-use safety monitoring experience. This could also include further consideration whether standing passengers should be prohibited.
 - If deemed relevant, consider extension of the scheme in the medium term to include vehicles with criteria out of scope of the current WP, including pavement-based/micro-mobility vehicles, three-wheeled vehicles, vehicles with maximum speed of 10 mph or less, modular vehicles/road trains, or vehicles capable of towing trailers. This would require analysis of additional pertinent regulations and development of new approaches, for instance for modular vehicles.

8 Glossary

Term	Definition
ACV	Subgroup on Automated and Connected Vehicles, organised under the MVWG
ABS	Anti-lock Braking System
ADS	Automated Driving System
AEB	Advanced Emergency Braking
ATD	Anthropomorphic Test Device
AV	Automated Vehicle
CAL	Crashworthiness Approval Level
ESC	Electronic Stability Control
C&U	The Road Vehicles (Construction and Use) Regulations 1986 (SI 1986/1078), as last amended by SI 2020/1178
DfT	Department for Transport
ESC	Electronic Stability Control
FPS	Frontal Protection System
GB	Great Britain
GSR2	Regulation (EU) 2019/2144
GRVA	WP.29 Group Rapport Automated / Autonomous and Connected Vehicles
GVW	Gross Vehicle Weight
HMI	Human Machine Interface
IVA	Individual Vehicle Approval
ICE	Internal Combustion Engine
IVA	Individual Vehicle Approval
LSAV	Low-Speed Automated Vehicle
MSVA	Motorcycle Single Vehicle Approval
MVWG	Motor Vehicles Working Group
NSSTA	National Small Series Type Approval
ODD	Operational Design Domain, i.e. the operating conditions under which an ADS is specifically designed to function
RVLR	The Road Vehicles Lighting Regulations 1989 (SI 1989/1796), as last amended by SI 2020/818
SSF	Static Stability Factor
SSTA	Small Series Type Approval
UN R...	UN Regulation No ...
VRU	Vulnerable Road User
WP	Work Package
WP.29	UNECE World Forum for Harmonisation of Vehicles Regulations

Appendix A List of pre-deployment regulations and proposed application

Table 8-1: Proposed application of technical regulations for type-approval and individual vehicle approval of Passenger and Goods LSAVs

Item	Subject	Regulatory act recommended for application	Series of amendments recommended for application	Applicability Passenger LSAV	Goods LSAV
0	Cross-cutting prescriptions	New regulatory text	n/a	Applicable	Applicable
1A	Sound level	UN Regulation No 138	01	Applicable	Applicable
2A	Emissions (Euro 5 and Euro 6) light duty vehicles/access to information	Regulation (EC) No 715/2007 (light duty vehicle emissions)	Regulation (EC) No 715/2007: As last amended by Regulation (EU) 2018/858 of 30 may 2018; Regulation (EU) 2018/858: Original version of the Regulation	Applicable	Applicable
3A	Prevention of fire risks (liquid fuel tanks)	n/a	n/a	Not applicable	Not applicable
3B	Rear underrun protective devices (RUPDs) and their installation; rear underrun protection (RUP)	UN Regulation No 58	03	Applicable	Applicable
4A	Space for mounting and fixing rear registration plates	Commission Regulation (EU) 1003/2010	As last amended by Commission Regulation (EU) 2015/166	Applicable	Applicable
5A	Steering equipment	UN Regulation No 79	03	Applicable	Applicable
6A	Vehicle access and manoeuvrability (steps, running boards and handholds)	Commission Regulation (EU) 130/2012, Annex II	Original version of the Regulation	Applicable	Not applicable
6B	Door latches and door retention components	UN Regulation No 11	04	Applicable	Not applicable
7A	Audible warning devices and signals	UN Regulation No 28	Original version of the Regulation	Applicable	Applicable
8A	Devices for indirect vision and their installation	n/a	n/a	Not applicable	Not applicable

Item	Subject	Regulatory act recommended for application	Series of amendments recommended for application	Applicability	
				Passenger LSAV	Goods LSAV
9A	Braking of vehicles and trailers	n/a	n/a	Not applicable	Not applicable
9B	Braking of passenger cars	UN Regulation No 13-H	01	Applicable	Applicable
10A	Electromagnetic compatibility	UN Regulation No 10	06	Applicable	Applicable
12A	Interior fittings	UN Regulation No 21	01	Applicable	Not applicable
13A	Protection of motor vehicles against unauthorised use	UN Regulation No 18	03	Applicable	Applicable
13B	Protection of motor vehicles against unauthorised use	UN Regulation No 116	Original version of the Regulation	Applicable	Applicable
14A	Protection of the driver against the steering mechanism in the event of impact	n/a	n/a	Not applicable	Not applicable
15A	Seats, their anchorages and any head restraints	UN Regulation No 17	09	Applicable	Not applicable
15B	Seats of large passenger vehicles	n/a	n/a	Not applicable	Not applicable
16A	External projections	UN Regulation No 26	04	Applicable	Applicable
17A	Vehicle access and manoeuvrability (reverse gear)	Commission Regulation (EU) 130/2012, Annex III	Original version of the Regulation	Applicable	Applicable
17B	Speedometer equipment including its installation	n/a	n/a	Not applicable	Not applicable
18A	Manufacturer's statutory plate and VIN	Commission Regulation (EU) 19/2011	As last amended by Commission Regulation (EU) 249/2012	Applicable	Applicable
19A	Safety-belt anchorages	UN Regulation No 14	09	Applicable	Not applicable
20A	Installation of lighting and light-signalling devices on vehicles	UN Regulation No 48	07	Applicable	Applicable
21A	Retro-reflecting devices for power-driven vehicles and their trailers	UN Regulation No 3	03	Applicable	Applicable

Item	Subject	Regulatory act recommended for application	Series of amendments recommended for application	Applicability	
				Passenger LSAV	Goods LSAV
22A	Front and rear position lamps, stop- lamps and end-outline marker lamps for motor vehicles and their trailers	UN Regulation No 7	02	Applicable	Applicable
22B	Daytime running lamps for power- driven vehicles	UN Regulation No 87	01	Applicable	Applicable
22C	Side-marker lamps for motor vehicles and their trailers	UN Regulation No 91	01	Applicable	Applicable
23A	Direction indicators for power-driven vehicles and their trailers	UN Regulation No 6	02	Applicable	Applicable
24A	Illumination of rear-registration plates of power-driven vehicles and their trailers	UN Regulation No 4	01	Applicable	Applicable
25A	Power-driven vehicle's sealed-beam headlamps (SB) emitting an European asymmetrical passing beam or a driving beam or both	UN Regulation No 31	03	Applicable	Applicable
25B	Filament lamps for use in approved lamp units of power-driven vehicles and their trailers	UN Regulation No 37	03	Applicable	Applicable
25C	Motor vehicle headlamps equipped with gas-discharge light sources	UN Regulation No 98	02	Applicable	Applicable
25D	Gas-discharge light sources for use in approved gas-discharge lamp units of power-driven vehicles	UN Regulation No 99	Original version of the Regulation	Applicable	Applicable
25E	Motor vehicle headlamps emitting an asymmetrical passing beam or a driving beam or both and equipped with filament lamps and/or LED modules	UN Regulation No 112	01	Applicable	Applicable
25F	Adaptive front-lighting systems (AFS) for motor vehicles	UN Regulation No 123	02	Applicable	Applicable

Item	Subject	Regulatory act recommended for application	Series of amendments recommended for application	Applicability	
				Passenger LSAV	Goods LSAV
26A	Power-driven vehicle front fog lamps	UN Regulation No 19	04	Applicable	Applicable
27A	Towing device	Commission Regulation (EU) 1005/2010	Original version of the Regulation	Applicable	Applicable
28A	Rear fog lamps for power-driven vehicles and their trailers	UN Regulation No 38	01	Applicable	Applicable
29A	Reversing lights for power-driven vehicles and their trailers	UN Regulation No 23	01	Applicable	Applicable
30A	Parking lamps for power-driven vehicles	UN Regulation No 77	01	Applicable	Applicable
31A	Safety-belts, restraint systems, child restraint systems and ISOFIX child restraint systems	UN Regulation No 16	08	Applicable	Not applicable
32A	Forward field of vision	n/a	n/a	Not applicable	Not applicable
33A	Location and identification of hand controls, tell-tales and indicators	n/a	n/a	Not applicable	Not applicable
34A	Windscreen defrosting and demisting systems	n/a	n/a	Not applicable	Not applicable
35A	Windscreen wiper and washer systems	n/a	n/a	Not applicable	Not applicable
36A	Heating systems	UN Regulation No 122	Original version of the Regulation	Applicable	Applicable
37A	Wheel guards	Commission Regulation (EU) 1009/2010	Original version of the Regulation	Applicable	Applicable
38A	Head restraints (headrests), whether or not incorporated in vehicle seats	UN Regulation No 25	Original version of the Regulation	Applicable	Not applicable
41A	Emissions (Euro VI) heavy duty vehicles/access to information	n/a	n/a	Not applicable	Not applicable
42A	Lateral protection of goods vehicles	n/a	n/a	Not applicable	Not applicable
43A	Spray suppression systems	n/a	n/a	Not applicable	Not applicable

Item	Subject	Regulatory act recommended for application	Series of amendments recommended for application	Applicability	
				Passenger LSAV	Goods LSAV
44A	Masses and dimensions (M1)	Commission Regulation (EU) 1230/2012	As last amended by Commission Regulation (EU) 2019/1892	Applicable	Applicable
45A	Safety glazing materials and their installation on vehicles	UN Regulation No 43	01	Applicable	Applicable
46A	Installation of tyres	UN Regulation No 142	Original version of the Regulation	Applicable	Applicable
46B	Pneumatic tyres for motor vehicles and their trailers (Class C1)	UN Regulation No 30	02	Applicable	Applicable
46C	Pneumatic tyres for commercial vehicles and their trailers (Classes C2 and C3)	UN Regulation No 54	Original version of the Regulation	Applicable	Applicable
46D	Tyre rolling sound emissions, adhesion on wet surfaces and rolling resistance (Classes C1, C2 and C3)	UN Regulation No 117	02	Applicable	Applicable
46E	Temporary-use spare unit, run-flat tyres/system	UN Regulation No 64	03	Applicable	Applicable
47A	Speed limitation of vehicles	n/a	n/a	Not applicable	Not applicable
48A	Masses and dimensions (non-M1)	n/a	n/a	Not applicable	Not applicable
49A	Commercial vehicles with regard to their external projections	n/a	n/a	Not applicable	Not applicable
50A	Mechanical coupling components of combinations of vehicles	n/a	n/a	Not applicable	Not applicable
50B	Close-coupling device (CCD); fitting of an approved type of CCD	n/a	n/a	Not applicable	Not applicable
51A	Burning behaviour of materials used in the interior construction of certain categories of motor vehicles	n/a	n/a	Not applicable	Not applicable
52A	M2 and M3 vehicles Regulation (EC)	UN Regulation No 107	08	Applicable	Not applicable
52B	Strength of the superstructure of large passenger vehicles	n/a	n/a	Not applicable	Not applicable

Item	Subject	Regulatory act recommended for application	Series of amendments recommended for application	Applicability	
				Passenger LSAV	Goods LSAV
53A	Protection of occupants in the event of a frontal collision	n/a	n/a	Not applicable	Not applicable
54A	Protection of occupants in the event of lateral, frontal or rear collision	UN Regulation No 95	04	Applicable	Not applicable
56A	Vehicles for the carriage of dangerous goods	n/a	n/a	Not applicable	Not applicable
57A	Front underrun protective devices (FUPDs) and their installation; front underrun protection (FUP)	n/a	n/a	Not applicable	Not applicable
58	Pedestrian protection	New regulatory text	n/a	Applicable	Applicable
59	Recyclability	UN Regulation No 133	Original version of the Directive	Applicable	Applicable
61	Air-conditioning systems	Directive 2006/40/EC	Original version of the Directive	Applicable	Applicable
62	Hydrogen system	n/a	n/a	Not applicable	Not applicable
63	General Safety	n/a	n/a	Not applicable	Not applicable
64	Gear shift indicators	n/a	n/a	Not applicable	Not applicable
65	Advanced emergency braking system (heavy vehicles)	n/a	n/a	Not applicable	Not applicable
66	Lane departure warning system (heavy vehicles)	n/a	n/a	Not applicable	Not applicable
67	Specific components for liquefied petroleum gases (LPG) and their installation on motor vehicles	n/a	n/a	Not applicable	Not applicable
68	Vehicle alarm systems (VAS)	UN Regulation No 97	01	Applicable	Applicable
69	Electric safety	UN Regulation No 100	02	Applicable	Applicable
70	Specific components for CNG and their installation on motor vehicles	n/a	n/a	Not applicable	Not applicable
71	Cab strength	n/a	n/a	Not applicable	Not applicable
72	eCall system	n/a	n/a	Not applicable	Not applicable

Item	Subject	Regulatory act recommended for application	Series of amendments recommended for application	Applicability	
				Passenger LSAV	Goods LSAV
73	Partitioning systems	n/a	n/a	Not applicable	Not applicable
74	Enhanced child restraint systems	n/a	n/a	Not applicable	Not applicable
75	Hydrogen system material qualification	n/a	n/a	Not applicable	Not applicable
76	Frontal full-width impact	n/a	n/a	Not applicable	Not applicable
77	Replacement airbag	n/a	n/a	Not applicable	Not applicable
78	Pole side impact	n/a	n/a	Not applicable	Not applicable
79	Rear impact	n/a	n/a	Not applicable	Not applicable
80	Enlarged head impact zone	n/a	n/a	Not applicable	Not applicable
81	Advanced emergency braking for pedestrians and cyclists ahead (AEBS PC)	n/a	n/a	Not applicable	Not applicable
82	Pedestrian and cyclist collision warning (MOIS)	n/a	n/a	Not applicable	Not applicable
83	Blind spot information system (BSIS)	n/a	n/a	Not applicable	Not applicable
84	Reversing safety	n/a	n/a	Not applicable	Not applicable
85	Heavy duty vehicles direct vision	n/a	n/a	Not applicable	Not applicable
86	Emergency lane keeping	n/a	n/a	Not applicable	Not applicable
87	Advanced emergency braking on light duty vehicles (AEBS)	n/a	n/a	Not applicable	Not applicable
88	Retreaded tyres	n/a	n/a	Not applicable	Not applicable
89	Tyre pressure monitoring	n/a	n/a	Not applicable	Not applicable
90	Replacement wheels	n/a	n/a	Not applicable	Not applicable
91	Protection of vehicle against cyberattacks	UN Regulation No 155	Original version of the Regulation	Applicable	Applicable
92	Intelligent speed assistance	n/a	n/a	Not applicable	Not applicable
93	Emergency stop signal	n/a	n/a	Not applicable	Not applicable
94	Headlamp cleaners	UN Regulation No 45	01	Applicable	Applicable
95	Alcohol interlock installation facilitation	n/a	n/a	Not applicable	Not applicable
96	Driver drowsiness and attention warning	n/a	n/a	Not applicable	Not applicable

Item	Subject	Regulatory act recommended for application	Series of amendments recommended for application	Applicability	
				Passenger LSAV	Goods LSAV
97	Advanced driver distraction warning	n/a	n/a	Not applicable	Not applicable
98	Driver availability monitoring system	n/a	n/a	Not applicable	Not applicable
99	Event data recorder	n/a	n/a	Not applicable	Not applicable
100	Systems to replace driver's control	n/a	n/a	Not applicable	Not applicable
101	Systems to provide the vehicle with information on state of vehicle and surrounding area	n/a	n/a	Not applicable	Not applicable
102	Platooning	n/a	n/a	Not applicable	Not applicable
103	Systems to provide safety information to other road users	n/a	n/a	Not applicable	Not applicable
104	Safety-belt reminders	UN Regulation No 16	08	Applicable	Not applicable
105	Hydrogen safety	n/a	n/a	Not applicable	Not applicable
106	Frontal protection system	n/a	n/a	Not applicable	Not applicable
107	Replacement braking parts	n/a	n/a	Not applicable	Not applicable
108	Brake Assist	n/a	n/a	Not applicable	Not applicable
109	Stability control	n/a	n/a	Not applicable	Not applicable
110	Cornering lamps	UN Regulation No 119	02	Applicable	Applicable
111	Retro-reflective markings (heavy and long vehicles)	n/a	n/a	Not applicable	Not applicable
112	LED light sources	UN Regulation No 128	Original version of the Regulation	Applicable	Applicable
113	Child restraint anchorages	UN Regulation No 145	Original version of the Regulation	Applicable	Not applicable
114	Software update and software updates management system	UN Regulation No 156	Original version of the Regulation	Applicable	Applicable
115	Maximum vehicle speed limitation	Commission Delegated Regulation (EU) No 3/2014, Annex XVIII	As last amended by Commission Delegated Regulation (EU) 2016/1824	Applicable	Applicable
116	Manual operation at very low speeds	New regulatory text	n/a	Applicable	Applicable
117	Static vehicle stability	New regulatory text	n/a	Applicable	Applicable

Appendix B Lists of in-use regulations and applicability

Table 8-2: Overview of C&U regulations and schedules and their status based on Task 4 analysis ('Applicable' – items which can be applied to LSAVs without modifications / 'Applicable with modifications' – items which should be applied to LSAVs with modifications as proposed / 'Not applicable' – items which are automatically not applicable based on shared characteristics of all LSAVs / 'Exempt' – items for which an exemption is proposed to be implemented / 'Omitted' – items which are no longer contained in C&U based on historic amendments / 'For further consideration' – items which may require adaptation or modification but are out of scope for WP4)

Regulation/ Schedule	Subject	Status
R1	Commencement and citation	Applicable
R2	Revocation	Applicable
R3	Interpretation	Applicable with modifications
R3A	Modification of Regulations in relation to vehicles for which a Minister's approval certificate has been issued under the Motor Vehicles (Approval) Regulations 1996	Not applicable
R4	Application and Exemptions	Applicable with modifications
R5	Trade Descriptions Act 1968	Applicable
R6	Compliance with Community Directives and ECE Regulations	Applicable with modifications
R7	Length	Applicable
R8	Width	Applicable
R9	Height	Applicable
R10	Indication of overall travelling height	For further consideration
R10A	Warning devices where certain high level equipment is fitted to a vehicle	For further consideration
R10B	Vehicles to which Regulation 10A applies	For further consideration
R10C	Interpretation of Regulations 10A and 10B	For further consideration
R11	Overhang	Applicable
R12	Minimum ground clearance	Not applicable
R13	Turning circle–buses	Applicable
R13A	Turning circle–articulated vehicles other than those incorporating a car transporter	Not applicable
R13B	Turning circle–articulated vehicles incorporating a car transporter	Not applicable

Regulation/ Schedule	Subject	Status
R13C	Turning circle–heavy motor car	Applicable
R14	Connecting sections and direction-holding of articulated buses	Not applicable
R15	Braking systems of certain vehicles first used on or after April 1, 1983	Applicable with modifications
R16	Braking systems of vehicles to which Regulation 15 does not apply	Applicable
R17	Vacuum or pressure brake warning devices	Applicable with modifications
R17A	Couplings on trailer pneumatic braking systems	Not applicable
R18	Maintenance and efficiency of brakes	Applicable
R18A	Review of Regulation 18	Omitted
R19	Application of brakes of trailers	Not applicable
R20	General requirement as to wheels and tracks	Applicable
R21	Diameter of wheels	Omitted
R22	Springs and resilient material	Applicable
R23	Wheel loads	Applicable
R24	Tyres	Applicable with modifications
R25	Tyre Loads and Speed Ratings	Applicable with modifications
R25A	Tyre noise	Applicable
R26	Mixing of tyres	Applicable with modifications
R27	Condition and maintenance of tyres	Applicable with modifications
R28	Tracks	Not applicable
R29	Maintenance of steering gear	Applicable
R30	View to the front	Exempt
R31	Glass	Not applicable
R32	Glass	Applicable with modifications
R33	Mirrors and other Devices for Indirect Vision	Exempt
R34	Windscreen wipers and washers	Exempt
R35	Speedometers	Exempt
R36	Maintenance of speedometers	Exempt
R36A	Speed limiters for coaches	Not applicable

Regulation/ Schedule	Subject	Status
R36B	Speed limiters for goods vehicles	Not applicable
R36C	Speed limiters—authorised sealers	Not applicable
R37	Audible warning instruments	Applicable with modifications
R38	Motorcycle sidestands	Not applicable
R39	Petrol tanks	Not applicable
R39A	Unleaded Petrol	Not applicable
R39B	Unleaded Petrol	Not applicable
R40	Gas propulsion systems and gas-fired appliances	Applicable
R41	Minibuses—Construction	Applicable
R41A	Minibuses—Alternative means of compliance	Applicable with modifications
R42	Minibuses—Fire extinguishing apparatus	Applicable
R43	Minibuses—First aid equipment	Applicable
R44	Minibuses—Carriage or dangerous substances	Applicable
R45	Power to weight ratio	Omitted
R46	Seat belt anchorage points	Applicable with modifications
R47	Seat belts	Applicable with modifications
R48	Maintenance of seat belts and anchorage points	Applicable
R48A	Minibuses and coaches to be fitted with additional seat belts when used in certain circumstances	Applicable
R49	Rear under-run protection	Not applicable
R50	Maintenance of rear under-run protective device	Not applicable
R51	Sideguards	Not applicable
R52	Maintenance of sideguards	Not applicable
R53	Mascots	Applicable
R53A	Strength of superstructure	Not applicable
R53B	Additional exits from double-decked coaches	Not applicable
R53C	Alternative means of compliance for coaches	Not applicable
R54	Silencers—general	Not applicable
R55	Noise limits—certain vehicles with 3 or more wheels—general	Applicable

Regulation/ Schedule	Subject	Status
R55A	Noise limits—certain vehicles with 3 or more wheels—general	Applicable
R56	Noise limits—agricultural motor vehicles and industrial tractors	Not applicable
R57	Noise limits—construction requirements relating to motorcycles	Not applicable
R57A	Exhaust systems—motorcycles	Not applicable
R57B	Noise Limit—maintenance requirements relating to motorcycles	Not applicable
R58	Noise limits—vehicles not subject to Regulations 55 to 57, first used on or after April 1, 1970	Omitted
R59	Exceptions to certain regulations	Not applicable
R60	Radio interference suppression	Applicable with modifications
R61	Emission of smoke, vapour, gases, oily substances etc	Not applicable
R61A	Emission of smoke, vapour, gases, oily substances etc – further requirements for certain motor vehicles first used on or after January 1, 2001	Not applicable
R61B	Retrofitting and refilling of certain air conditioning systems	Applicable
R61C	End-of-series exemption	Not applicable
R61D	Review of Regulations 61 to 61B	Applicable
R62	Closets etc	Applicable
R63	Wings	Applicable
R64	Spray suppression devices	Not applicable
R65	Maintenance of spray suppression devices	Not applicable
R66	Plates for goods vehicles and buses	Applicable
R67	Vehicle identification numbers	Applicable
R68	Plates—agricultural trailed appliances	Not applicable
R69	Plates—motorcycles	Not applicable
R70	Ministry plates	Not applicable
R70A	Speed limiter plates for coaches	Not applicable
R70B	Plate relating to dimensions	Applicable
R71	Marking of weights on certain vehicles	Not applicable
R71A	Marking of date of manufacture of trailers	Not applicable
R72	Additional markings	Not applicable

Regulation/ Schedule	Subject	Status
R73	Test date discs	Not applicable
R74	Testing and Inspection	For further consideration
R75	Maximum permitted laden weight of a vehicle	Applicable
R76	Maximum permitted laden weight of a vehicle and trailer, other than an articulated vehicle	Not applicable
R77	Maximum permitted laden weight of an articulated vehicle	Not applicable
R78	Maximum permitted wheel and axle weights	Applicable
R79	Maximum permitted weights for certain closely-spaced axles etc.	Not applicable
R79A	Saving for the Road Vehicles (Authorised Weight) Regulations 1998	Applicable
R80	Over-riding weight restrictions	Applicable
R81	Restrictions on use of vehicles carrying wide or long loads or having fixed appliances or apparatus	Applicable
R82	Restrictions on use of vehicles carrying wide or long loads or having fixed appliances or apparatus	Applicable
R83	Number of trailers	Applicable with modifications
R84	Trailers drawn by motorcycles	Not applicable
R85	Trailers drawn by agricultural motor vehicles	Not applicable
R86	Distance between motor vehicles and trailers	Not applicable
R86A	Use of secondary coupling on trailers	Not applicable
R86B	Use of mechanical coupling devices	Not applicable
R87	Unbraked trailers	Not applicable
R88	Use of bridging plates between motor vehicle and trailer	Not applicable
R89	Leaving trailers at rest	Not applicable
R90	Passengers in trailers	Not applicable
R91	Passengers in trailers	Not applicable
R92	Attachment of sidecars	Not applicable
R93	Use of sidecars	Not applicable
R93A	Additional braking requirements for motor vehicles carrying or hauling dangerous goods	Not applicable
R94	Use of gas propulsion systems	Not applicable
R95	Use of gas-fired appliances—general	Applicable
R96	Use of gas-fired appliances when a vehicle is in motion	Applicable

Regulation/ Schedule	Subject	Status
R97	Avoidance of excessive noise	For further consideration
R98	Stopping of engine when stationary	For further consideration
R99	Use of audible warning instruments	For further consideration
R100	Maintenance and use of vehicle so as not to be a danger, etc	Applicable
R100A	Speed of low platform trailers and restricted speed vehicles	Not applicable
R101	Parking in darkness	For further consideration
R102	Passengers on motorcycles	Not applicable
R103	Obstruction	For further consideration
R104	Driver's control	For further consideration
R105	Opening of doors	For further consideration
R106	Reversing	For further consideration
R107	Leaving motor vehicles unattended	For further consideration
R108	Securing of suspended implements	For further consideration
R109	Television sets	For further consideration
R110	Mobile telephones	For further consideration
R111	Review	Applicable
S1	Regulations revoked by Regulation 2	Applicable
S2	Community Directives and ECE regulations	Applicable with modifications
S2A	Vehicles for which a Minister's Approval Certificate has been issued under the Motor Vehicles (Approval) Regulations 1996	Not applicable
S3	Braking requirements	Applicable with modifications
S3A	Exclusion of certain vehicles from the application of Regulation 39A	Not applicable
S3B	Authorised sealers	Not applicable
S4	Gas containers	Not applicable
S5	Gas systems	Applicable
S6	Construction of minibuses	Applicable
S7	Fire extinguishing apparatus and first aid equipment for minibuses	Applicable
S7XA	End of series exemptions	Not applicable

Regulation/ Schedule	Subject	Status
S7A	Motorcycle noise and motorcycle silencers	Not applicable
S7B	Emissions from certain motor vehicles	Not applicable
S8	Plates for certain vehicles	Applicable with modifications
S9	Plates for motorcycles	Not applicable
S10	Ministry plate	Not applicable
S10A	Ministry plate	Not applicable
S10B	Ministry plate	Not applicable
S10C	Ministry plate	Not applicable
S11	Maximum permitted weights, etc.	Applicable
S11A	Exemptions relating to intermodal transport operations	Not applicable
S12	Conditions to be complied with in relation to the use of vehicles carrying wide or long loads or vehicles carrying loads or having fixed appliances or apparatus which project	Applicable
S13	Plate for restricted speed vehicle	Not applicable

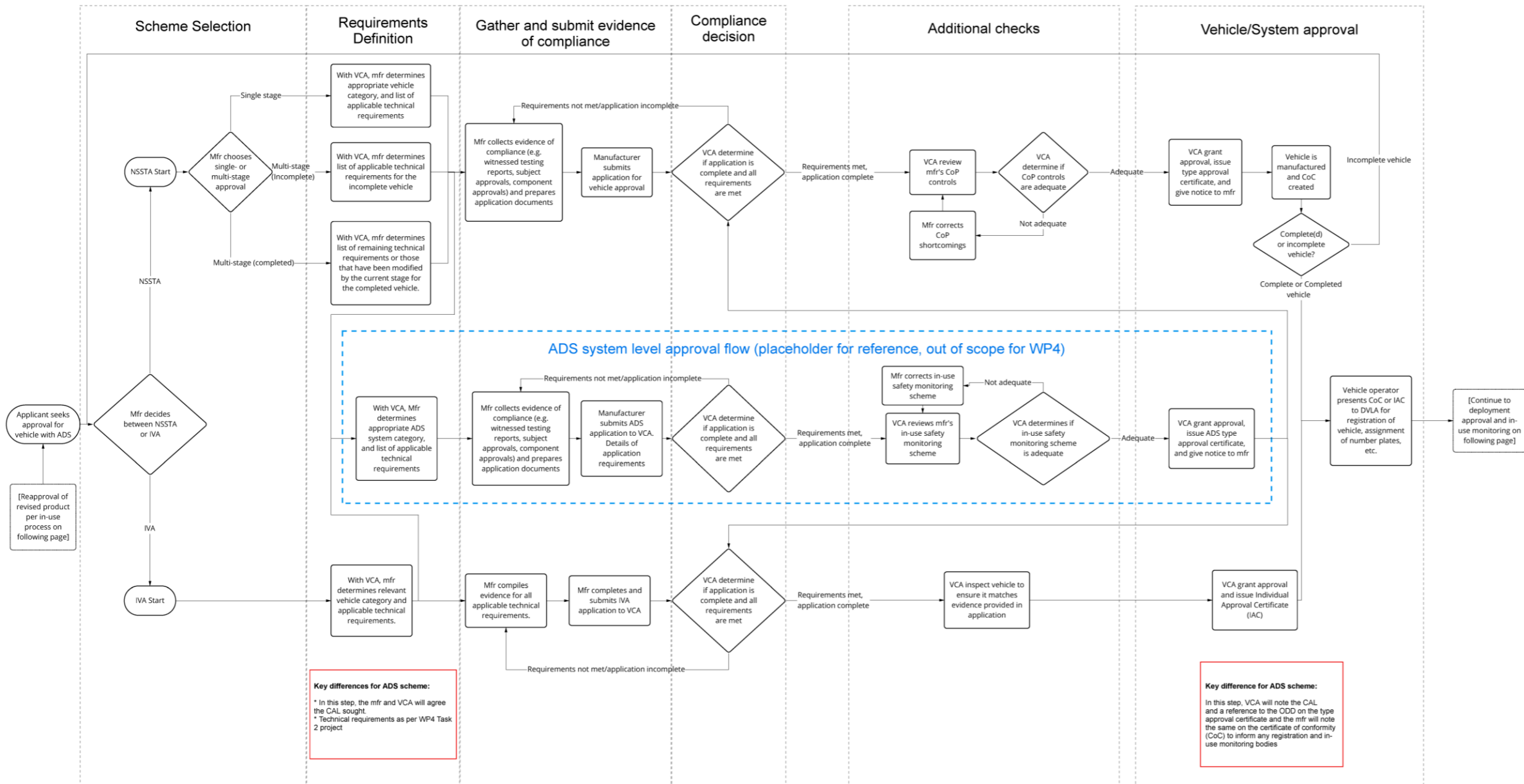
Table 8-3: Overview of RVLRL regulations and schedules and their status based on Task 4 analysis ('Applicable' – items which can be applied to LSAVs without modifications / 'Applicable with modifications' – items which should be applied to LSAVs with modifications as proposed / 'Not applicable' – items which are automatically not applicable based on shared characteristics of all LSAVs / 'For further consideration' – items which may require adaptation or modification but are out of scope for WP4)

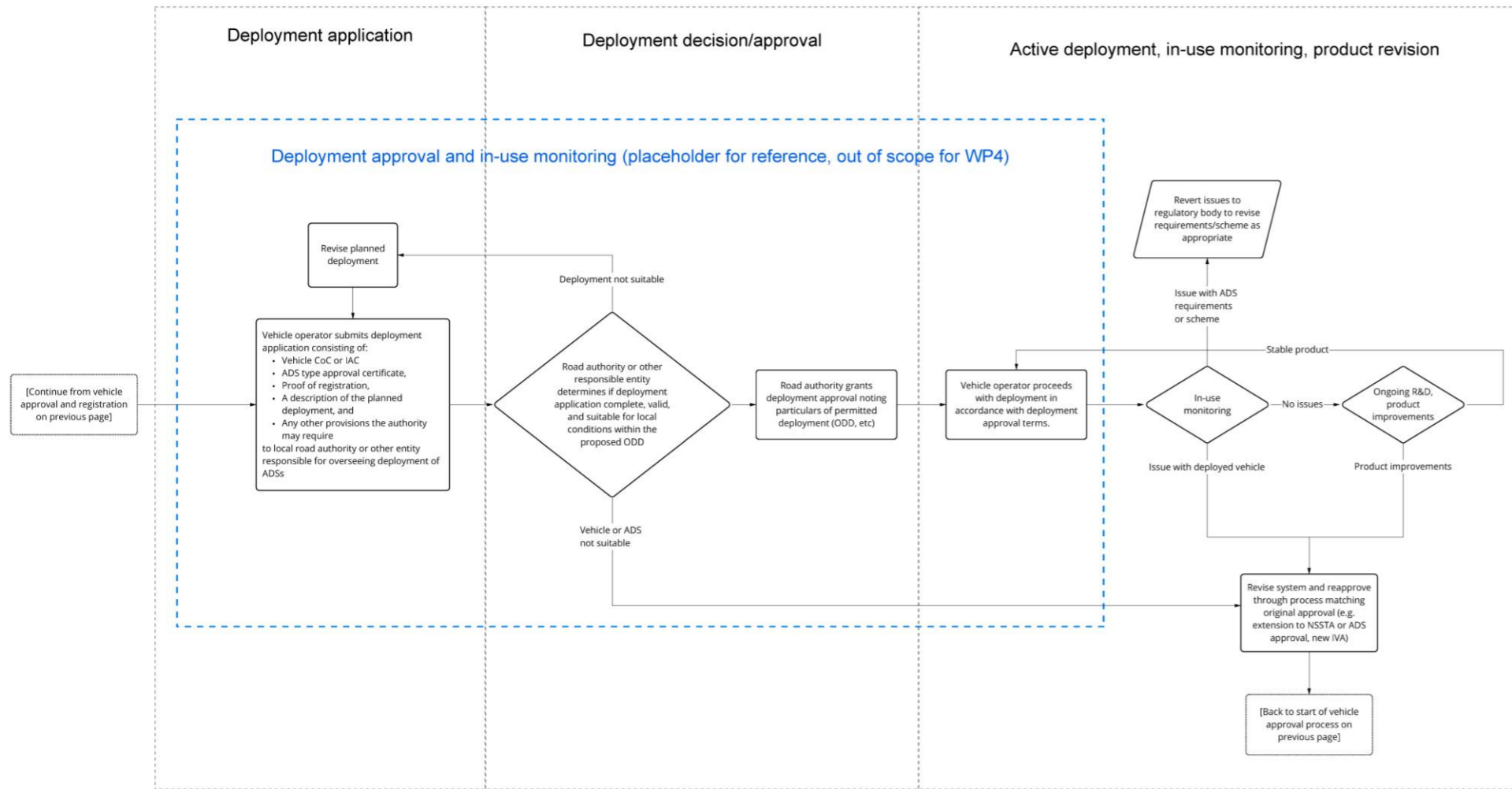
Regulation/ Schedule	Subject	Status
R1	Commencement, citation and revocation	Applicable
R2	Statement under Section 43(3) of the Road Traffic Act 1988	Applicable
R3	Interpretation	Applicable with modifications
R3A	Equivalent standards	Applicable
R4	Exemptions – General	Applicable
R4A	Exemptions – Vehicle examiners	Applicable
R5	Exemptions – Temporarily imported vehicles and vehicles proceeding to a port for export	Applicable
R6	Exemptions – Vehicles towing or being towed	Applicable
R7	Exemptions – Military vehicles	Not applicable
R8	Exemptions – Invalid carriages	Not applicable
R9	Exemptions – Vehicles drawn or propelled by hand	Not applicable
R9A	Exemptions – Tramcars	Not applicable
R9B	Modifications in relation to vehicles approved under the Motor Vehicles (Approval) Regulations 1996	Not applicable
R10	Provision as respects the Trade Descriptions Act 1968	Applicable
R11	Colour of light shown by lamps and reflectors (including reflectors on rear markings and signs on buses carrying children)	Applicable with modifications
R12	Movement of lamps and reflectors	Applicable
R13	Lamps to show a steady light	Applicable
R14	Filament lamps	Applicable
R15	General requirements for electrical connections	Applicable
R16	Restrictions on fitting blue warning beacons, special warning lamps and similar devices	Applicable
R17	Obligatory warning beacons	Not applicable
R17A	Signs on buses carrying children	Applicable
R18	Obligatory lamps, reflectors, rear markings and devices	Applicable

Regulation/ Schedule	Subject	Status
R19	Restrictions on the obscuration of certain lamps and reflectors	Applicable
R20	Optional lamps, reflectors, rear markings and devices	Applicable
R20A	Application of the ECE conspicuity requirements	Applicable
R21	Projecting trailers and vehicles carrying overhanging or projecting loads or equipment	Applicable
R22	Additional side marker lamps	Not applicable
R23	Maintenance of lamps, reflectors, rear markings and devices	For further consideration
R23A	Review	Applicable
R24	Requirements about the use of front and rear position lamps, rear registration plate lamps, side marker lamps and end-outline marker lamps	For further consideration
R25	Requirements about the use of headlamps and front fog lamps	For further consideration
R26	Requirements about the use of warning beacons	Not applicable
R27	Restrictions on the use of lamps other than those to which regulation 24 refers	For further consideration
R28	Testing and inspection of lighting equipment and reflectors	For further consideration
S1	Obligatory lamps, reflectors, rear markings and devices	Applicable with modifications
S2	Front position lamps	Applicable
S3	Dim-dip devices and running lamps	Applicable
S4	Dipped-beam headlamps	Applicable with modifications
S5	Main-beam headlamps	Applicable with modifications
S6	Front fog lamps	Applicable with modifications
S7	Direction indicators	Applicable
S8	Hazard warning signal devices	Applicable
S9	Side marker lamps	Applicable
S10	Rear position lamps	Applicable
S11	Rear fog lamps	Applicable
S12	Stop lamps	Applicable
S13	End-outline marker lamps	Applicable
S14	Reversing lamps	Applicable
S15	Rear registration plate lamps	Applicable

Regulation/ Schedule	Subject	Status
S16	Warning beacons	Applicable
S17	Side retro reflectors	Applicable
S18	Rear retro reflectors	Applicable
S19	Rear markings	Applicable
S20	Pedal retro reflectors	Not applicable
S21	Front retro reflectors	Applicable
S21A	Prescribed sign	Applicable
S22	Diagram showing where unlit parking is not permitted near a junction	For further consideration
S23	Example of marking showing the vertical downwards inclination of the dipped-beam headlamps	Applicable with modifications
S24	Requirements relating to daytime running lamps	Applicable

Appendix C Flow chart illustrating approval process proposed for LSAVs - non-ADS part. Note second half of chart on next page.





Appendix D Information document modifications

Table 8-4: Description of information document modifications required for LSAVs

Ref	Description	Reason
<u>Sections to add</u>		
2.4.2.10.	Position of centre of gravity of the vehicle at its mass in running order in the vertical direction	To facilitate the approval of the static vehicle stability according to new regulatory item 117
9.11.6.	Exterior components required to satisfy the special purpose of a vehicle equipped with ADS which are not able to meet the requirements of UNECE Regulation No. 26 and require an exemption per [add reference to new language to be added to UNECE R46 permitting exemption]	To facilitate the approval of the external projections according to UNECE Regulations 26 and 61 as revised.
9.11.6.1.	Description or drawings of all components for which such exemption is sought:	To facilitate the approval of the external projections according to UNECE Regulations 26 and 61 as revised.
17.	SPECIAL PROVISIONS FOR VEHICLES FITTED WITH AN AUTOMATED DRIVING SYSTEM (ADS)	To facilitate approval of ADS according to new regulatory item(s) to be defined by WP1.
17.1.	Vehicle is fitted with an ADS (yes/no):	To facilitate approval of ADS according to new regulatory item(s) to be defined by WP1.
17.2.	Bi-directional vehicle (yes/no):	To facilitate approval of ADS according to new regulatory item(s) to be defined by WP1.
17.3.	Manual control of vehicle fitted with ADS	To facilitate approval of manual operation for vehicle recovery according to new regulatory item 116.
17.3.1.	Description of manual controls including the vehicle parameters that may be controlled, and the limits of vehicle operation (maximum speed, turning rate, etc.) in this mode (if fitted):	To facilitate approval of manual operation for vehicle recovery according to new regulatory item 116.
17.3.2.	Method of communication between manual control system and vehicle (if	To facilitate approval of manual operation for vehicle recovery

Ref	Description	Reason
	fitted):	according to new regulatory item 116.
17.4.	Vehicles intended for transporting passengers	To facilitate approval of ADS according to new regulatory item(s) to be defined by WP1.
17.4.1.	Crashworthiness approval level (reduced/standard):	To facilitate approval of vehicles with different crashworthiness approval levels according to UNECE Regulations 14, 16, 17, 21, 95, 100, 107, and 145 as revised.
17.4.2.	Technical description of the passenger emergency communication system:	To facilitate approval of M2 and M3 vehicles according to UNECE Regulation 107 as revised.
17.4.3.	Drawing or description of emergency stop control and relevant markings:	To facilitate approval of M2 and M3 vehicles according to UNECE Regulation 107 as revised.
17.4.4.	<i>[Reserved for additional information supporting approval of the ADS]</i>	
17.5.	Vehicles intended for transporting goods	To facilitate approval of ADS according to new regulatory item(s) to be defined by WP1.
17.5.1.	<i>[Reserved for additional information supporting approval of the ADS]</i>	
Sections to modify		
9.14.	Space for mounting rear registration plates (<u>provide information for all registration plates where applicable, give range where appropriate</u>), drawings may be used where applicable)	To facilitate approval of ADS according to new regulatory item(s) to be defined by WP1. To facilitate approval of registration plate space according to Commission Regulation (EU) 1003/2010 as revised

GB LSAV Approval Scheme: Work Package 4 - Non-ADS requirements



The UK government are committed to bringing forward legislation to allow the safe and secure deployment of self-driving vehicles. As part of the CAVPASS programme, TRL was commissioned to propose approaches to vehicle classification, and suitable technical requirements for aspects not related to the Automated Driving System (ADS). These included crashworthiness, occupant protection, protection of Vulnerable Road Users (VRUs), and the lighting, braking and steering systems.

The focus of this study was on Low-Speed Automated Vehicles (LSAVs). It involved selection and adaptation of existing pre- and post-deployment regulation to enable it to be applied to LSAVs. A main part was the adaptation of the technical regulations for M- and N-category vehicles, laid down in Great Britain's Road Vehicles (Approval) Regulations 2020 (SI 2020 No. 818), which implements retained Regulation (EU) 2018/858.

The study proposed the introduction of two new vehicle categories (for LSAVs with and without occupants, respectively) to allow approval of designs not compatible with the M- and N-category definitions, such as passenger shuttles with six seats and space for standing passengers, or goods vehicles without any seats. Technical clarifications for regulations were developed relating to references to the driver or driver's seat, controls, warnings and tell-tales and relating to bi-directional vehicles in general. The study further found that a general permission to carry standing passengers in light vehicles could present unreasonable risks to occupants in braking manoeuvres or collisions, but that it could be safe in some Operational Design Domains (ODDs). A concept was proposed which offers manufacturers a choice between two Crashworthiness Approval Levels (CALs). The less demanding CAL allows standing passengers but restricts the subsequent ODD of the vehicles.

In summary, the study proposed a novel approach to link approval regulations to the vehicle's ODD and a set of technical requirements for non-ADS-related aspects of passenger- and goods-carrying LSAVs, which could help enable the approval of new vehicle concepts.

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