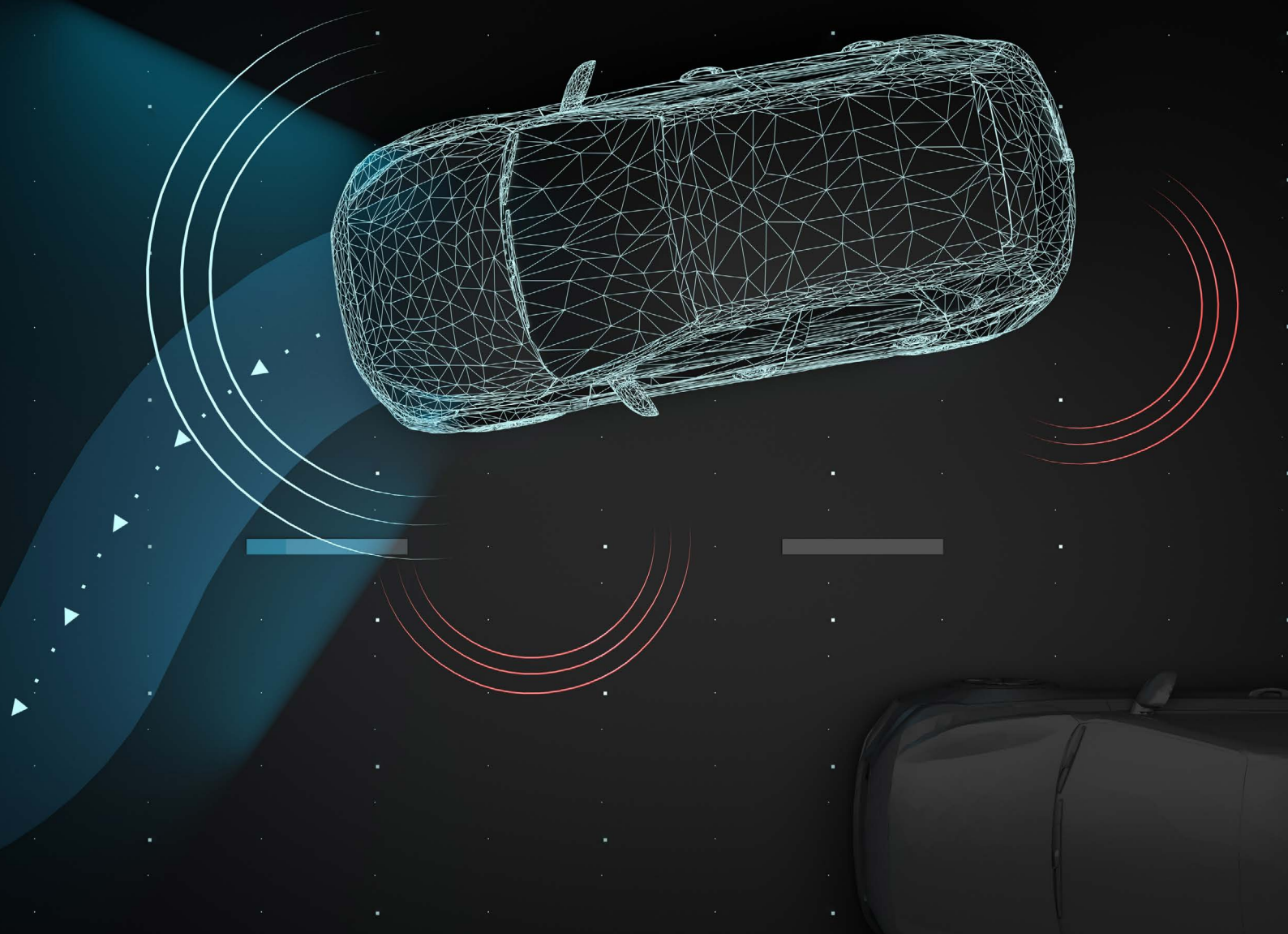


System aspects for remote operation of vehicles – Guide

September 2024 Version 2



BSI Flex 1886 v2.0:2024-09



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Foreword

This BSI Flex was sponsored by the Centre for Connected and Autonomous Vehicles (CCAV). Its development was facilitated by BSI Standards Limited and it was released under licence from The British Standards Institution. It came into effect on 30 September 2024.

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The content in this version is part of an iterative process. It is likely to change from time to time with subsequent iterations.

Supersession

This version of BSI Flex 1886 supersedes BSI Flex 1886 v1.0:2023-08, which is withdrawn.

Relationship with other publications

BSI Flex 1886 v2.0 is part of BSI's CAM Standards Programme, sponsored by the Centre for Connected and Autonomous Vehicles (CCAV). The CAM Standards Programme focuses on engaging with the UK CAM industry and developing standards for the safe development and deployment of self-driving vehicles.

Information about this document

This is Version 2 of BSI Flex 1886, which is the last planned version of the document. All comments received will be reviewed to inform the future direction of this document. Interested parties are encouraged to check the BSI website for updates regarding any future plans.

This is a full update of the document, and introduces the following principal changes.

- Additional regulations, standards and texts for reference have been added in notes throughout this version.
- The Scope has been amended in this version to clarify its focus on uncontrolled spaces.
- The definition of remote driving in 3.4 has been expanded.
- Table 1 from Version 1 has been replaced with a list of examples.
- Figure 1 and Figure 2 have been updated for clarity.
- Sub-clauses have been included in Clause 7.
- Information on occupant and load monitoring has been added in 8.7.
- Information regarding on-site access to vehicles has been added in 10.6.

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Use of this document

As a guide, this BSI Flex takes the form of guidance and advisory recommendations. It is not to be quoted as if it were a specification or a code of practice.

Presentational conventions

The guidance in this document is presented in roman (i.e. upright) type. Any recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Additional commentary, explanation and general informative material is presented in smaller italic type.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. “organization” rather than “organisation”).

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In particular, attention is drawn to the Automated Vehicles Act 2024 [1].

Introduction

Remote operators are already in use to monitor and assist highly automated vehicles when their automated driving system (ADS) is unable to continue the journey. Remotely operated vehicles of many types and sizes are already deployed to move goods and freight in numerous depots and warehouses, and to move container trailers.

This BSI Flex describes three classes of remote operation:

- remote monitoring of self-driving vehicles, where a human only supervises self-driving vehicles;
- remote driving, where a human operator takes full control of the dynamic driving task (DDT), accelerating, steering, braking and observing the vehicle environment with a view to immediate and safety-critical control of the vehicle; and
- remote assistance, where a human provides some short-term support to a self-driving vehicle in a non-safety-critical situation to achieve a safe situation, possibly so that the vehicle's autonomy can be re-engaged.

This BSI Flex is an overview of the key systems necessary for safe remote operation of vehicles, signposts important parameters related to the classes of remote operation, and recommends information to be provided to remote operators in the context of the class of remote operation and use case. There is a particular emphasis on systems related to the safety of remote operation of vehicles that are intended to be used on public roads or in other public spaces, especially where the vehicle is out of the operator's line of sight.

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1 Scope

This BSI Flex gives guidance for organizations and operators developing and managing remote operation systems for connected and automated vehicles (CAV) where a remote operator is not on board the vehicle. It focuses on remote systems operating in uncontrolled environments, such as public roads and public spaces, where an operator can assist or take over the dynamic driving task.

NOTE 1 *This BSI Flex primarily supports applications on public roads, however it can be used as guidance for controlled environments in the absence of relevant standards.*

NOTE 2 *This BSI Flex supports road vehicles, which means mechanically propelled vehicles intended or adapted for use on roads, in applications on roads and public spaces.*

This BSI Flex covers remote operation system aspects, including:

- a) class of remote operation;
- b) vehicle speed and operational design domain (ODD);
- c) information provided to the remote operator; and
- d) remote operation system parameters, including connectivity, security, software updates, and data and information needed to support remote monitoring, assistance and driving.

NOTE 3 *Annex A contains collated information from this BSI Flex on items to be included in safety cases for remote operation, however this is not an exhaustive list.*

This BSI Flex applies to remote operations used in developmental testing, advanced trials and deployment, including prototype vehicles and passenger and freight carrying services, as bound by and proportionate to the relevant ODD.

This BSI Flex reflects existing good practice, but it is not exhaustive. It does not cover:

- 1) the role or training of a remote operator;
- 2) assessing the competence of a remote operator; or
- 3) guidelines for remote operator workstations and environments.

NOTE 4 *Human factors of remote operation is covered in BSI Flex 1887 v1.0:2024-05, Human factors for remote operations of vehicles – Guide.*

This BSI Flex might be of use to any organization that utilizes or develops remote operation systems. It might also be of use to road authorities, local authorities, testbeds, vehicle agencies and insurers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions, or limits the application, of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BSI Flex 1890 v5.0:2023-04, *Connected and automated mobility – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in BSI Flex 1890 v5.0:2023-04 and the following apply.

3.1 operator

human person that has some responsibilities for a remotely operated vehicle

NOTE 1 For example, a remote operator can be:

- *monitoring the behaviour of one or more self-driving vehicles;*
- *assisting a self-driving vehicle to resolve an issue in its journey or supporting the vehicle's occupants; and/or*
- *driving the vehicle by performing lateral and longitudinal control: steering, braking and accelerating.*

For more information see Figure 1.

NOTE 2 An operator might take up different roles during a vehicle's journey, or a work period (shift).

NOTE 3 In contrast to common usage such as a "bus operator" or "train operator", the term "operator" is not used of an organization in this BSI Flex. The UK Law Commission proposes a new term for organizations conducting or responsible for remote operation of vehicles in the UK: "Entity for Remote Driving Operation" (ERDO) [2].

3.2 remote

not on board the vehicle or its trailer and relying on external aids (other than corrective spectacles) to see some or all safety-critical elements of the driving environment

NOTE 1 BSI Flex 1890 v5.0:2023-04 (3.1.14 and 3.1.74, Note 2) and the UK Law Commission report on remote driving [2] define this as "beyond line-of-sight".

NOTE 2 This definition differs slightly from the common definition of beyond visual line of sight (BVLOS) used in an aviation context for remote pilots of aircraft, such as drones, uncrewed aerial vehicles (UAVs) or uncrewed aircraft systems (UAS) [3].

NOTE 3 This definition also differs from the SAE definition [4], which can include a user who is within the vehicle, within line-of-sight of the vehicle, or beyond line-of-sight of the vehicle.

NOTE 4 This BSI Flex might also be applied to use cases where a remote operator might be able to see the vehicle (for example in a depot or yard), but nevertheless relies on technical aids (cameras, display screens etc.) to see the path and any traffic and obstacles ahead of the vehicle.

3.3 remote monitoring

class of remote operation involving continual oversight of one or more vehicles¹⁾ from beyond line-of-sight, their behaviour and performance, progress on a journey, safety and security of passengers, and/or any cargo/load

NOTE 1 Remote monitoring does not include any human intervention in the lateral or longitudinal control of the vehicle, and no ability to perform immediate safety-critical interventions in the DDT²⁾ of the vehicle.

NOTE 2 In this BSI Flex, the term monitoring differs from common usage in driving. It does not refer to monitoring a vehicle and the driving environment with a view to immediate and safety-critical intervention in the way the vehicle drives.

3.4 remote driving

class of remote operation involving real-time performance of the DDT²⁾ of a single vehicle, including all or any one of the following tasks:

- a) steering;
- b) braking;
- c) removing a brake;
- d) accelerating; or
- e) monitoring the driving environment, with a view to immediate and safety-critical intervention in the way the vehicle drives from beyond line-of-sight³⁾

NOTE 1 A remote driver is responsible for continuous object and event detection and response (OEDR)⁴⁾, and for providing immediate and safety-critical control of the vehicle.

NOTE 2 A remote driver relies on external technical aids (such as cameras and display screens to see the path, and any traffic and obstacles ahead of the vehicle) to perform the DDT, which might be sophisticated and outside the human's direct control. The UK Law Commission's proposed ERDO [2] is expected to be responsible for the technical aids and for employing the remote driver.

NOTE 3 Remote driving is not automated driving.

¹⁾ BSI Flex 1890 v5.0:2023-04, 3.1.72.

²⁾ BSI Flex 1890 v5.0:2023-04, 3.1.28.

³⁾ BSI Flex 1890 v5.0:2023-04, 3.1.70.

⁴⁾ BSI Flex 1890 v5.0:2023-04, 3.1.58.