Design and implementation of publicly accessible charging sites for battery electric HGVs – Code of practice

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Department for Transport

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Foreword

This BSI Flex was sponsored by Connected Places Catapult (CPC). Its development was facilitated by BSI Standards Limited and it was released under licence from The British Standards Institution. It came into effect on 31 January 2025.

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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This version of BSI Flex 2071 supersedes BSI Flex 2071 v1.0:2024-06, which is withdrawn.

Relationship with other publications

This BSI Flex is part of the zero emission HGV and infrastructure demonstrator programme, alongside:

- BSI Flex 2072, *Battery electric and hydrogen-fuelled heavy-duty vehicles – Workshops and protocols for maintenance and inspection – Specification*
- BSI Flex 2073, *Design and implementation of mobile and static hydrogen refuelling sites – Code of practice*

Information about this document

This is Version 2.0 of BSI Flex 2071, 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 partial update of the document, and introduces the following principle changes:

- the Introduction and Scope have been expanded to include reference to the RIBA Plan of Work [1];
- greater emphasis on the development of an operational plan is given in Clause 5;
- risk assessment considerations and guidance have been included in Clause 6;
- further detail has been added to address electrical safety considerations; and
- additional information has been given around charging site safety and security.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at knowledge.bsigroup.com, or by contacting the Customer Services team.

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Users may substitute any of the recommendations in this BSI Flex with practices of equivalent or better outcome. Any user claiming compliance with this BSI Flex is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions of this BSI Flex are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

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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0 Introduction

0.1 Background

The switch to electric light-duty vehicles in the UK is progressing well, with sales of new petrol or diesel cars set to end by 2035 and interim sales targets set via the Zero Emission Vehicle mandates. In contrast, the shift to zero emission trucks has only just commenced. The previous government announced that sales of new, non-zero emission trucks less than or equal to 26 tonnes are also set to end by 2035, while all new non-zero emission truck sales are due to end by 2040. As a result, by 2050, the vast majority of the UK HGV fleet is anticipated to be zero emission at the tailpipe and the UK is likely to be in a very strong position to achieve its net zero climate goal for the road freight sector.

The early years of this decade have seen the development and commercialization of an ever-expanding range of battery electric trucks, across all vehicle segments and in all the major developed markets, including the UK. Established truck makers are focused on bringing many more battery-powered trucks to the mass market over the next few years.

New entrants and specialist manufacturers are expected to bring innovative new concepts to the urban/short-haul, municipal and long-haul vehicle markets. Radically improved business operating models, battery chemistries and charging systems are also evolving at pace, including a transition for high power truck charging from combined charging system (CCS) to megawatt charging system (MCS) technology. While some pioneering logistics organizations are already exploiting the commercial opportunities that battery electric trucks can provide, many others are not yet able to make the switch. As well as concerns around vehicle purchase costs, driving range and payload loss, which can be significant in some use cases, there are also concerns about getting sufficient power to logistics hubs and depots, and the (lack of) availability of high power publicly accessible charging infrastructure for HGVs.

In October 2023, the UK government announced the winning projects to be funded by Innovate UK as part of the £200m Zero Emission HGVs and Infrastructure Demonstrators programme (ZEHID, previously known as the Zero Emission Road Freight Demonstrators, ZERFD). The projects funded under this programme are expected to run real-world demonstrations of battery electric and hydrogen fuel cell technologies for the largest categories of HGVs and at scale over a five-year period. This aims to provide the sector with the essential evidence needed to make strategic, long-term national infrastructure decisions to decarbonize the nation’s road freight sector. The three ZEHID projects involving battery electric vehicles are expected to install and operate networks of high-power charging sites, accessible both to the vehicles directly involved in those projects but also more generally to other fleets.

The shift to zero emission HGVs is a crucial component in the transition to net zero. International harmonization and interoperability, achieved through standards and regulations, are key steps towards the viability of a wider roll-out. The drivers of eHGVs and their employers can expect the charging sites they use to be designed, built and maintained in ways that are safe, convenient and fit for purpose. Original equipment manufacturers (OEMs) are continuing to develop further generations of electric HGV models, with cross-industry stakeholder activities being led by the Charging Interface Initiative e.V. (CharIN) to standardize the future technical approach to higher power charging under the Megawatt Charging System[1].

[1] More information is available at https://www.charin.global/technology/mcs/.

BSI and Connected Places Catapult (CPC) are supporting the ZEHID programme led by the Department for Transport (DfT) and Innovate UK. The BSI/CPC contribution is articulated in two phases. Phase 1 of the project ran from April 2021 to March 2022 and produced a suite of outputs to help inform partners and build robust foundations for the demonstrations. Focus areas have included a demonstrator data strategy, export potential, safety and regulations, standards and market operations.

Building on this foundation work, BSI/CPC are now seeking to build an industry consensus around topics such as safety and security to support the ZEHID programme and the wider scale-up of zero emission HGV infrastructure.

0.2 Operational safety at charging sites

In September 2023, BSI published the *ZERFD (Zero Emission Road Freight Demonstrator) Standards Programme Prioritization Report* [2]. The report is structured around the following three activities:

- stakeholder engagement, aimed at understanding the existing barriers and constraints to the adoption of zero emission road freight vehicles;
- research and assessment of existing relevant standards at UK, European and international level; and
- prioritization of focus areas, building consensus across industry stakeholders and establishing principles to guide standards development.

This analysis and engagement work concluded that operational safety at charging sites is a priority focus area.

Numerous topics were raised in relation to the design of charging sites during the engagement activity, which are specifically linked to battery electric technology and the dwell times currently required by charging operations. Some of these were mentioned as potential areas for standardization, as follows.

- Classification of types of charging site

  There might be a range of charging needs and set ups, ranging from multi-hour (e.g. overnight) charging to charging during extended breaks, and rapid top-up charging during short breaks. Charging sites can be publicly accessible (such as along motorways) or within private premises (such as distribution centres or industrial sites).

- Bay design and parking method

  Stakeholders believe that the layout of sites can induce and support safe behaviour, including avoiding reverse manoeuvring where possible, which increases the risks of collisions. Herringbone parking or drive-through solutions could be explored based on space availability, charging unit design and vehicle layout.

- Separation of vehicles by category

  Charging sites are likely to have to cater for a variety of vehicles. Separate charging units for electric cars and HGVs might also be necessary. HGV charging site planners might also wish to cater for vans, minibuses and small lorries and other large vehicles such as coaches and buses.

- Safety measures for pedestrians

  Extended dwell times entail a likelihood that drivers and passengers might exit the vehicle while waiting, thus increasing pedestrian movements around charging units. Guidance is therefore required in relation to the design of safe walking routes and management of cables.

- Signage and wayfinding at access/egress points

  Stakeholders mentioned the need for design guidance to ensure that the separation of vehicles by category/size is clear and respected by all users. Areas for HGVs, where higher voltage is in use, could potentially be gated and access provided only to those vehicles with a charging slot booked. This would reduce the number of vehicles and pedestrians in the area but would also reduce accessibility and might be challenging to implement.

- Layout harmonization

  Interviewees highlighted that in the current electric car market, charging infrastructure providers have custom designs and layouts for charge points and hubs. While cars and other small vehicles can easily manoeuvre around such variable infrastructures, this is likely to be an issue with HGVs due to their size and lower manoeuvrability. Therefore, harmonization is needed to ensure consistency in design.

0.3 Objectives

This BSI Flex is intended to build upon the foundations laid by the above prioritization work and support the roll-out and expansion of a UK-wide network of high-power charging sites for eHGVs, specifically those accessible to any suitable vehicle rather than those with access restricted only to vehicles belonging to specific organizations.

The main objectives of this BSI Flex are to:

- identify and support safety and security good practice in collaboration with the demonstrations, through standards and specifications; and
- accelerate the roll-out of zero emission vehicles for road freight, towards wider commercialization, through consensus-based flexible standards.

This BSI Flex is intended to aid engineering and architectural stakeholders in the detailed design, layout and use of charging sites.

***NOTE** More information is available in the RIBA plan of work 2020 overview [1], specifically Stage 4: Technical design, and Stage 7: Use.*

1 Scope

This BSI Flex provides recommendations on the design of publicly accessible charging sites for battery electric heavy goods vehicles (HGVs).

***NOTE** Whilst this BSI Flex is for publicly accessible sites, designers of private sites are encouraged to consider the recommendations and implement where possible.*

This BSI Flex covers:

- harmonized vocabulary and units of measurement;
- charging site layouts, including:
  - public access;
  - approach to segregation between vehicle types (HGVs, coaches, cars, vans); and
  - interaction between vehicles and pedestrians;
- safety and design implications of charging sites; and
- considerations on the coexistence of various fuel types in the same site.

This BSI Flex is applicable to publicly accessible single and multi-fuel sites in the UK.

This BSI Flex is of use to the designers and operators of charging sites.

This BSI Flex might be of interest to logistics providers, electrical grid suppliers, consumer groups and any other parties concerned with charging sites or battery electric HGVs.

This BSI Flex does not cover:

- charging technologies;
- types of charging plugs/sockets;
- driver/user training in charge point usage;
- construction safety or handover issues (RIBA Plan of Work 2020 Stages 5-6) [1];
- prior stages such as selection of suitable locations, land acquisition, grid connections or securing of planning consents (RIBA Plan of Work 2020 Stages 0-3) [1]; or
- dangerous goods vehicles.

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[2)]. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7430, *Code of practice for protective earthing of electrical installations*

BS 7671, *Requirements for electrical installations – IET Wiring Regulations*

BS EN 50522, *Earthing of power installation exceeding 1 kV a.c.*

BS EN 60076 (all parts), *Power transformers*

BS EN 60079-14, *Explosive atmospheres – Part 14: Electrical installations, design, selection and erection*

BS EN 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

BS EN 62271 (all parts), *High-voltage switchgear and controlgear*

BS EN IEC 61851-1, *Electric vehicle conductive charging system – Part 1: General requirements*

BS EN IEC 61936-1, *Power installations exceeding 1 kV AC and 1,5 kV DC – Part 1: AC*

BS EN ISO 19650-5, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling – Part 5: Security-minded approach to information management*

IEC 61851-23, *Electric vehicle conductive charging system – Part 23: DC electric vehicle supply equipment*

[2)] Documents that are referred to solely in an informative manner are listed in the Bibliography.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 ad-hoc charge point

charge point available for use at any time by a vehicle that needs to charge up but that has not had its charging session reserved/booked in advance

NOTE *This is also known as ad-hoc charging.*

3.2 charge point

individual (tethered) cable and connector to physically plug into the vehicle

3.3 charger

physical asset/enclosure of power conversion equipment used to charge the vehicle

NOTE *Chargers may have more than one charge point to allow multiple vehicles to share an individual charger. The charge point(s) may be located remote of the charger(s). Where the charger (power conversion equipment) is remotely located, the cable is located at a dispenser.*

3.4 charging bay

ground area that a vehicle is expected to park within while charging

3.5 charging site

geographical area that encloses one or more charging bays, chargers and charge points

3.6 fuel

liquid or gaseous energy source or energy vector

3.7 heavy goods vehicle (HGV)

goods vehicle with a maximum permitted weight of more than 3.5 tonnes (or 4.25 tonnes in the case of zero emission goods vehicles)

NOTE *The terms truck and lorry are considered interchangeable with HGV.*

3.8 maximum rated power

upper limit for power deliverable by a charge point in normal operations

3.9 multi-fuel site

site featuring one or more fuel dispensers in addition to a charge point or points

3.10 pre-bookable charge point

charge point that can be reserved by a user in advance of a charging session and for a specific period of time

4 Harmonization and use of vocabulary and units of measurement

4.1 Power

4.1.1 Electrical power should be referred to in integer units of kilowatts (kW) rounded to the nearest multiple of 10 or in units of megawatts (MW) rounded to no more than two decimal places.

4.1.2 The maximum rated power that a charge point can deliver (to a connected vehicle capable of receiving at least that power level) should be available to the driver, and whether this value is constrained, such as due to sharing of power with other vehicles.

NOTE 1 *This is because the full charge speed might not be available if multiple vehicles are using the charge point; 350 kW is currently the most common maximum rated power for CCS car-charging sites.*

NOTE 2 *Example wording for driver information "This charge point can deliver up to 350 kW. Actual charging speeds may vary depending on factors such as, but not limited to, grid constraints, environmental conditions, the vehicle and/or available power".*

4.1.3 If superlative prefixes for the maximum rated power that a charge point can deliver are used, they should be accompanied by displays compliant with **4.1.1** and **4.1.2**.

NOTE *Examples of these terms are "super-fast", "mega-fast" and "ultra-fast"; however, there is a risk that such terminology could be inconsistently applied across different charging sites and lead to confusion amongst users.*

4.2 Energy

4.2.1 Electrical energy delivered to a connected vehicle should be referred to in units of kilowatt-hours (kWh) or megawatt-hours (MWh).

4.2.2 Where fixed energy pricing is used, the price should be available to the driver in units of:

a) pence per kWh (p/kWh);

b) pounds per kWh (£/kWh);

c) pounds per MWh (£/MWh); or

d) any combination of a), b) or c).

4.2.3 The choice of pricing nomenclature and units of energy delivered should be consistent with each other.

4.2.4 Where variable energy pricing is used, the current price of energy from a charge point should be available to the driver, including any changes in price anticipated during the charging session.

NOTE *This is typically achieved by displaying at the charge point, or, in situations where that is not feasible, information can be provided to inform drivers how/where to find the currently applicable pricing data.*

4.3 Vehicles

4.3.1 A HGV powered by electric motors and one or more externally rechargeable batteries, and which constitutes a key target market for charging sites within the scope of this BSI Flex, should be referred to as one, or any combination of, the following:

a) battery electric HGV;

b) battery electric truck (BET);

c) eHGV; and/or

d) e-truck.

4.3.2 The terms listed in **4.3.1** should not be used for goods or commercial vehicles with a gross weight of less than 4.25 t.

4.3.3 The abbreviation HDV should only be used if charge points are accessible to other large non-HGV vehicle types, such as coaches.

4.4 Vehicle batteries

4.4.1 The state of charge (SOC) should be quoted in units of percent.

4.4.2 If the SOC is communicated to the charger by the vehicle, this information should be made available to the driver to indicate charging progress.

***NOTE** Methods of communication might be screens on or near the charge point or in the welfare facilities, or via an app.*

4.4.3 In designing charging site layouts, assessing likely dwell times and developing robust fire safety protocols, designers and operators of charging sites should familiarize themselves with the various battery chemistries in use by battery electric HGVs and their differing charging speed and safety characteristics.

5 Planning, design and operation of charging sites

5.1 Operational plan

An operational plan setting out the number of charge points and their capacity should provide the basis for:

a) a traffic management plan;

b) a fire risk assessment;

c) the protection of physical assets from vehicle impact damage including consideration for low speed manoeuvring, off-tracking and vehicle/trailer overhang pathways;

d) the provision of safe, timely and accessible maintenance to achieve high levels of charge point availability;

e) reducing the likelihood of criminal damage to site facilities and the threat of crime to site users; and

f) welfare provision.

NOTE *Additional topics for an operational plan (not otherwise covered in this BSI Flex) might include:*

- *connection to a local distribution network and network stability in the event of a sudden disconnection of site power;*
- *flood management, surface water drainage and protection of charging equipment from water ingress; and*
- *temporary hazardous areas caused by fuel spills or other damage arising from vehicles carrying combustible liquid and/or gaseous fuels.*

5.2 Public access

5.2.1 Charging sites should be accessible to any battery electric HGV at any time, subject to the site's terms and conditions of use. Site access should not be restricted to vehicles made by particular manufacturers, or those with charge connectors at specific locations of the vehicle or those owned/operated by particular companies, unless there are over-riding issues of safety or security.

5.2.2 Charging sites should provide:

a) access to safe and secure parking areas (where space is available);

b) access to welfare facilities;

c) up-to-date charge point availability and energy pricing information;

d) cables capable of reaching the vehicle while in its charging station; and

e) a safe, straightforward and effective charging experience.

NOTE 1 *Pre-bookable charge points are expected to be the norm but some ad-hoc provision is also likely to be needed to cater for unforeseen circumstances. Compliance can be confirmed, for example, by positive responses to a driver survey.*

NOTE 2 *PAS 1899 covers accessible charging for cars and vans.*

5.2.3 Traffic management planning should minimize risks of the charging site and its surrounding areas being adversely affected by its associated vehicular activity and include:

a) provisions for lay-up of waiting vehicles;

b) provisions for one or more charge point failure(s); and

c) provision for vehicle abandonment, breakdown and vehicle collisions (with other vehicles, infrastructure or pedestrians) while using the charging site.

NOTE 1 Vehicle abandonment might, for example, arise if a driver/user is taken ill and taken offsite for emergency treatment while their vehicle remains connected to a charge point.

NOTE 2 For example, traffic queue management might include virtual prompts by in-cab devices, a layby system, or providing parking bays to promote faster throughput. Drivers might be charged for overstaying their time slot.

5.3 Access by specific vehicle types

5.3.1 A charging site should be designed using appropriate tools, such as swept-path modelling software, to be readily accessible to the full range of vehicle heights, lengths and weights currently permitted in the UK and in general circulation, including rigid and articulated HGVs, solo tractor units and rigid HGVs pulling a drawbar trailer.

NOTE At the time of publication, highway authorities are encouraged to sign all bridges over highways with less than 5.03 m headroom at any point over the carriageway [3]. The main vehicle maximum permitted lengths applicable to UK charging site designers are:

- *12 m – rigid HGV;*
- *13.5 m – bus/coach with 2 axles;*
- *15 m – bus/coach with more than 2 axles;*
- *16.5 m – articulated HGV (with standard trailer);*
- *18.55 m – articulated HGV (with longer semi-trailer); and*
- *18.75 m – rigid HGV with drawbar trailer.*

5.3.2 A charging site should also be accessible to other heavy-duty vehicle (HDV) types, such as coaches, with appropriate restrictions if necessary.

NOTE 1 Appropriate restrictions might, for example, include access for driver-only vehicles (i.e. no passengers permitted in the charge point area and/or to be disembarked safely before charging commences).

NOTE 2 Site designers and planners might also wish to consider potential future changes to vehicle weights and dimension limits, use of the site by foreign-registered vehicles, refrigerated vehicles and trailers, vehicles carrying dangerous and/or high value goods and provisions for the exceptionally long and/or heavy vehicles already permitted, e.g. for the movement of abnormal loads. In considering potential future changes to vehicle weights and dimensions, it is suggested that vehicle types up to 25.25 m in length and up to 60 t in gross weight are included. Attention is drawn to the ADR Regs [4]. The TAPA Parking Security Requirements (PSR) [5] provide guidance on secure parking for HGVs.

NOTE 3 Site operators are reminded that vehicles using the charging site might not be electrically propelled (they might wish to charge an electrically powered trailer, for example).

5.3.3 To minimize the need for reversing, where feasible, charge points with a rated power of 300 kW or greater should be accessible using a drive-through design.

NOTE 1 *Issues such as site-specific space constraints or traffic flow might render the preferred drive-through design unfeasible.*

NOTE 2 *Annex A provides a suggested preference hierarchy for access to and egress from various charging bay layouts.*

5.3.4 Where access to other electrically propelled vehicle types is permitted, additional risk assessments should be carried out and any safety protocols implemented, over and above those for HGVs.

NOTE *Other electrically propelled vehicle types might include, but are not limited to, coaches, vans and/or cars, including cars towing caravans.*

5.3.5 If non-HGV access is permitted, the needs of the non-HGV drivers and passengers should be provided for, including those with mobility issues.

5.4 Safety of drivers and pedestrians

5.4.1 The safety risks to be assessed and addressed should, as a minimum, include:

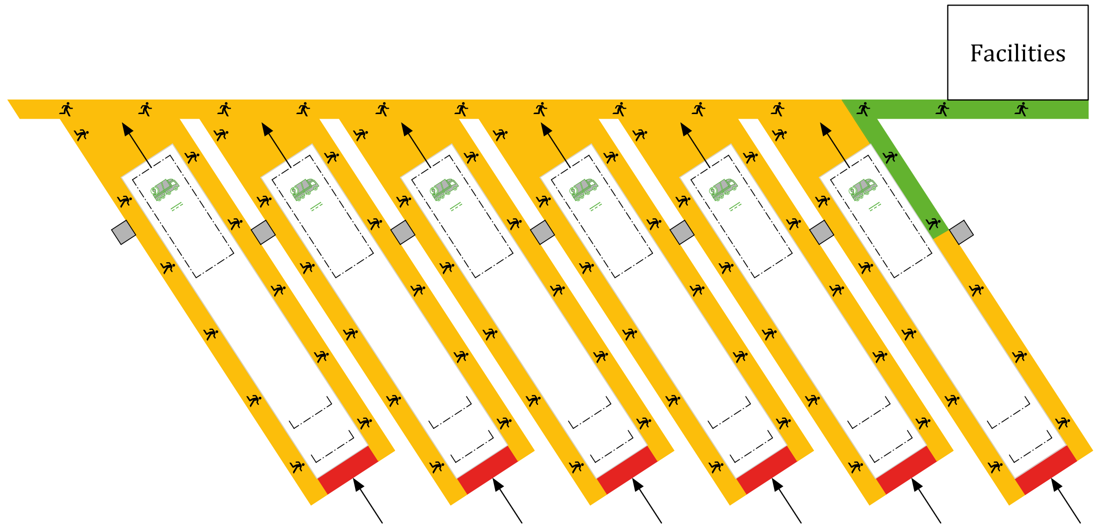
a) electrical safety and risks of electric shock;

b) fire safety; and

c) driver, other road user and pedestrian safety and risks of collision.

NOTE *Site planners and designers might find the concept of a zoning method to be a useful aid to making these safety risk assessments. For example, green zones for pedestrian walkways that do not conflict with vehicle movements or other hazards, red zones for walkways or escape routes that cross live traffic lanes or are located behind vehicles that might be reversing, and amber zones for areas where pedestrian movement is unlikely but might still be subject to trip or other hazards. Figure 1 provides an illustrative example of such a zoning method approach for a drive through design.*

Figure 1 – Illustrative example of a zoning method approach for a drive through design



NOTE Figure 1 is not to scale.

5.4.2 Where vehicle-pedestrian conflicts are possible, barriers, fencing and/or surface markings should be installed to minimize risks of inadvertent straying of pedestrians into traffic flow zones.

NOTE Barriers or fencing are the preferred method but, in circumstances where these might prevent non-standard vehicles (i.e. long or wide) from manoeuvring around the site, floor markings may be used as an alternative.

5.4.3 In general, a minimum 1.2 m width of walkway should be provided (this allows for a visually impaired person being guided), with a minimum unobstructed width of 1 m.

5.4.4 Any additional risks arising from previous usage of the site, e.g. soil contamination, should also be assessed and controlled.

5.4.5 Where assessments for different hazards indicate different standards are required, then the most stringent control measures of the two should be applied.

5.4.6 In consultation with the local fire and rescue authority, sites should be designed so as to allow easy and appropriate access for emergency service vehicles and personnel and to otherwise have an appropriate layout of the site facilities for emergency situations and the location of the site isolation facility/facilities. Notices showing safe evacuation areas and escape routes should be provided on or near the charger(s) or charge point(s).

5.4.7 If used, loudspeakers and CCTV systems, including their wiring and connections, should be installed in an area that is not impacted by the intended vehicles using the charging site. A loudspeaker system intended to warn of an emergency should be located and wired independently of any electric vehicle supply equipment and should not be controlled by its emergency switching device system.

5.4.8 All risk assessments and control measures should be kept under review and changes made if appropriate.

NOTE This might be because of an incident or a change in standards, legal requirements or accepted good practice.

5.5 Electrical safety

5.5.1 The charge point should be designed and constructed such that a suitably equipped battery electric vehicle can be connected and that in normal conditions of use, the energy transfer operates safely, and its performance is reliable and minimizes the risk of danger to the user or surroundings, even in the event of carelessness that can occur in normal use.

***NOTE** When considering appropriate and proportionate physical security protecting measures site designers and operators might adopt raised kerbs, protective barriers and physical location of assets (e.g., transformers) so as to reduce the collision risks associated with the movement of HGVs in a relatively congested space.*

5.5.2 The electrical safety of the charger should conform to the electrical safety requirements of BS EN IEC 61851-1 and IEC 61851-23.

***NOTE** BS EN IEC 61851-23-3 is in preparation but might also be of interest to installers of DC EVSE for MCS.*

5.5.3 Charging bays should be signed and marked prominently to allow vehicles to park close to the charge point and to prevent the straining of charging cables.

5.5.4 The length of charging cables should be sufficient to allow their use with the intended equipment without risk of damage.

***NOTE** At the time of publication, eHGVs are expected to most commonly have charge connecting points on the right-hand (driver's) side but left-hand connecting points are likely to become more prevalent as the industry transitions to MCS.*

5.5.5 An emergency electrical disconnection device should be installed on site to isolate all active conductive parts of the charger(s) and charge point(s). Such a switch should only be accessible to emergency service personnel and authorized site staff.

***NOTE** This disconnection device might, for example, be remote from the charger(s) and take the form of an emergency switching arrangement provided in the low voltage feeder pillar/distribution system.*

5.5.6 Protection of the disconnection device should be provided in order to prevent accidental disconnection.

5.5.7 The supply cable and connector should be permanently attached to the charge point.

5.5.8 A full earthing study should be performed before installing the charging equipment, taking into account all existing infrastructure earthing schemes and other utility supplies as well as the local ground conditions, to determine the most appropriate scheme to deploy.

5.5.9 Low voltage electrical installations should conform to BS 7671 and, where relevant, BS EN 60079-14. High voltage electrical installations should conform to BS EN IEC 61936-1.

Switchgear/equipment should conform to their respective standards: high voltage BS EN 62271 series, low voltage BS EN 61439 series, transformers BS EN 60076 series.

***NOTE** Attention is drawn to the IET* Code of practice for electric vehicle charging equipment installation, 5th Edition *[6]. Guidance for electrical energy storage, where provided, is available in the IET* Code of practice for electrical energy storage systems, 3rd Edition *[7].*

5.5.10 Earthing for electrical installations and equipment should conform to BS 7430 and BS EN 50522 as relevant.

***NOTE** Attention is drawn to the Electricity Safety, Quality and Continuity Regulations [8] with respect to earthing.*

5.6 Fire safety

5.6.1 Practical passive, active and managerial control measures should be included as part of the fire risk assessment for the premises when selecting and designing areas for use as electric charge points, including factoring in whether overhead canopies/structures are used and, if so, their potential for fire suppression systems to be fitted.

NOTE *More detailed fire safety guidance is available in the Fire Protection Association's (FPA) RC59: Recommendations for fire safety when charging electric vehicles [9], Fire safety: Approved Document B [10], and standards such as BS 9999.*

5.6.2 Further measures should be taken to address the specific risks associated with electrically propelled vehicle batteries and containment in the event of an outbreak of a battery fire, including those risks arising from the containment and disposal of fire water and/or other firefighting substances.

NOTE *Information on such measures and other fire safety guidance for lithium-ion batteries is available in the FPA's Need to know guide RE2: Lithium-ion battery use and storage [11].*

5.6.3 Additional and appropriate fire safety and containment measures should be taken for any on-site electrical energy storage batteries, if present.

NOTE *Fire safety guidance relevant to batteries other than lithium-ion is available in the FPA's RC61: Recommendations for the storage, handling and use of batteries) [12]. Guidance on risk assessments for electrical energy storage systems, including lithium battery chemistries, is also available in the IET's* Code of practice for electrical energy storage systems, 3rd Edition *[7].*

5.6.4 Control measures should be put in place for the protection of people in case of fire, including:

a) systems to detect a fire and warn people quickly via both audible and visual alarms;

b) the provision, where appropriate, of fire-fighting equipment;

c) keeping fire exits and escape routes clearly marked and unobstructed at all times; and

d) delivering training to on-site personnel on procedures to be followed, including fire drills.

5.6.5 The selection of materials used for the cladding of buildings and canopies, and signage, should be based on the needs of the specific designs and intended applications.

5.6.6 In relation to performance in a fire, the selection should take account of the most appropriate combination of material properties (i.e. ignitability, toxicity, fire load, smoke generation etc.).

5.7 Driver, other road user and pedestrian safety

5.7.1 The design of the site access and layout should take into account the safe speeds, turning circles and routes around the site of the various vehicle types expected to use it.

5.7.2 The risk of collisions between vehicles and other road users or pedestrians should be minimized by the careful management of the main vehicle flows on and off the site and through the charge point area(s).

5.7.3 Separation and/or other protection from vehicle collisions for all electrical equipment, including charge points, chargers and associated switchgear, energy storage capacity and substation sites, should be provided.

5.7.4 The carriageway and surrounding area, charge point area(s) and all pedestrian walkways should always be adequately lit.

NOTE *Lighting supports safe vehicle access and egress for drivers and safe movement of people around the charge site. Further guidance on lighting at truck stops, including a ranking scheme not currently applicable in the UK, is available in Annex I of the European Commission's draft delegated regulation [13]. The Institution of Lighting Professionals has also published Guidance note 01/21: The reduction of obtrusive light [14], as have the Institution of Engineering and Technology [15] and Chartered Institute of Building Services Engineers [16].*

5.7.5 Charging facilities should be set out in such a way to enable quick and safe access to faulty chargers by maintenance staff, including space to work and power isolation to allow other chargers to continue in use.

5.7.6 Potential route conflicts should be mitigated by the provision of extended sight lines, speed restrictions and signs and markings.

NOTE *It is good practice to avoid route conflicts as far as possible.*

5.8 Welfare facilities

5.8.1 Welfare facilities for drivers and passengers should be provided on site or be otherwise accessible from the charge point(s). Longer stay chargers should be made visible and drivers intending to take longer breaks encouraged to use these and not the high-power chargers intended for shorter, top-up and go stops.

5.8.2 Welfare facilities should be accessible whenever the charging site is open and have available as a minimum:

a) separate toilets and washrooms for male and female users;

b) light snacks and refreshments;

c) waste bins; and

d) drinking water.

5.8.3 The design should take account of any additional risks presented by charging sites and the vehicles using them regarding fire resistance, means of escape and access for disabled people.

5.8.4 Wherever feasible within space constraints, safe access and parking for drivers who wish to only use the welfare facilities, and for cleaning, maintenance and deliveries, should be provided.

5.9 Canopies

COMMENTARY ON ***5.9***

Canopies can help to define the location of the charge point(s), protect users from inclement weather and provide illumination.

5.9.1 Canopies should be constructed of materials that do not readily contribute to any fire occurring within the underside of the canopy area.

NOTE *BS EN 13501-1 and BS EN 13501-2 provide information on the fire classification of construction products and building elements.*

5.9.2 Canopies with headroom < 5.03 m should be signed to identify the maximum height of a vehicle which can pass beneath, in both metric and imperial units.

NOTE *This is to avoid impact damage from high-sided vehicles, such as articulated vehicles with double-deck trailers.*

5.10 HGVs with ancillary power needs

5.10.1 Site designers and planners should provide, wherever feasible, electrical power supplies for HGVs with ancillary electrical power needs, such as fridge units.

NOTE HGV fridge units can usually be powered externally via either a 415 V, 32 A three-phase supply or 240 V, 16 A single phase.

5.10.2 Where it is possible to have more than one electrical supply cable connected to a vehicle at the same time, such as when charging and (separately) powering a fridge unit, mitigating measures should be used to remind drivers to disconnect all cables before pulling away.

5.11 Site security

5.11.1 Site designers and planners should seek crime prevention and security advice to reduce crime, or the threat of crime that could affect:

a) the charging site;

b) the vehicles using the charging site; and

c) drivers and passengers in vehicles using the charging site.

NOTE The Secured by Design initiative includes guidance regarding good design practice that reduces crime and the threat of crime.[3] A structured approach to addressing security considerations across the design and construction lifecycle is contained in the security overlay to the RIBA Plan of Work [17], produced in collaboration with the National Protective Security Authority (NPSA) and the Police Crime Prevention Initiative (CPI). BS 16000 gives guidance on strategic and operational safety management. The Pass Mark Freight scheme[4] gives security measures for lorry parks and truck stops that might also be helpful to consider in the context of charging sites.

5.11.2 Site designers and planners should, wherever practicable, take steps to protect physical assets located at the charging site.

NOTE 1 These assets include charging equipment and any welfare or other facilities provided at the site. Users of this BSI Flex are advised to consider the desirability of using components that have been demonstrated by third-party assessment to be suitable.

NOTE 2 It may also be prudent to consider measures to reduce the risk of theft of site power cables, i.e., install power cables underground and avoid the use of ducts that might make it easier to extract and steal such cabling. Where fire safety and security systems are installed, adoption of appropriate measures can reduce the risk of vandalism. For example, where ANPR cameras are used, installing them in a location and at a height where they are unlikely to be hit by a vehicle or reachable by a pedestrian.

5.11.3 Information regarding the design and operation of the charging site should be managed in accordance with the security minded principles set out in BS EN ISO 19650-5.

5.11.4 Where a site is not continuously staffed, site designers should incorporate appropriate lighting and CCTV systems to deter criminal and/or malicious behaviour.

NOTE Further guidance on security at truck stops, including a ranking scheme (not currently applicable to UK but covering perimeter security, parking areas, entry/exit points and staff procedures), is available in Annex I of the European Commission's draft delegated regulation [13]. More information on an earlier European scheme is available in the Handbook for labelling [18].

[3] Available at https://securedbydesign.com

[4] Available at https://www.britishparking.co.uk/park-mark-freight

6 Additional considerations for multi-fuel sites

6.1 Regulatory and safety requirements

The charging site owner/provider should engage with the operator of any nearby fuel filling station and the local Petroleum Enforcement Authority for advice as to whether the charging site design, layout, equipment and usage are affected by any additional regulatory or other safety requirements applying to the fuel filling station.

NOTE 1 *The Association for Petroleum and Explosives Administration (APEA) and the Energy Institute jointly publish detailed guidance on fuel forecourt operational safety considerations, including where such facilities are co-located with EV charging equipment. The latest published version of this document is known as the Blue Book [19].*

NOTE 2 *The Institution of Engineering and Technology (IET) and the Association for Petroleum and Explosives Administration (APEA) jointly published Electric vehicle charging installations at filling stations [20].*

6.2 Risk management

Appropriate methods should be used to identify the control and mitigation measures that need to be put in place to provide an adequate level of risk management for the proposed multi-fuel site installation, including risks associated with:

a) leaks of gaseous and/or liquid fuels;

b) control of ignition sources;

c) hazardous area definitions;

d) fuel deliveries and tanker movements;

e) cable routeing; and

f) firefighting equipment and emergency evacuation procedures.

NOTE *There are a number of techniques that can be used to support this depending on the facility's specific circumstances, including:*

- *HAZID (hazard identification) – a systematic critical examination of a facility to identify the potential hazards;*
- *HAZOP (hazard and operability study) – a detailed systematic method used to identify possible hazards and operability issues;*
- *Qualitative risk assessments – a method to categorize the likelihood and consequence of each hazard;*
- *Layer of protection analysis (LOPA) – a semi-quantitative method for analysing and assessing higher consequence hazards; and,*
- *Quantitative risk assessments – a detailed systematic method using measurable, objective data to determine a numerical value for the likelihood and consequence of each hazard.*

Annex A (informative) Layout, access to and egress from charging bays

This annex provides a suggested preference hierarchy covering some of the various options for eHGVs to enter and leave a charge point. The hierarchy prioritizes layouts that do not require eHGVs to reverse and that provide for good visibility for drivers. It also minimizes safety risks to pedestrians and road-side infrastructure, and uses a seven-point scale with 1 being most preferred, and 7 being least.

Individual layouts within Figure A.1 may be mirrored depending on direction of traffic flow.

Figure A.1 – Suggested preference hierarchy for access to and from eHGV charging bays

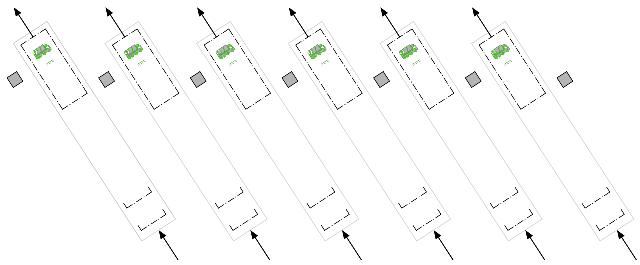
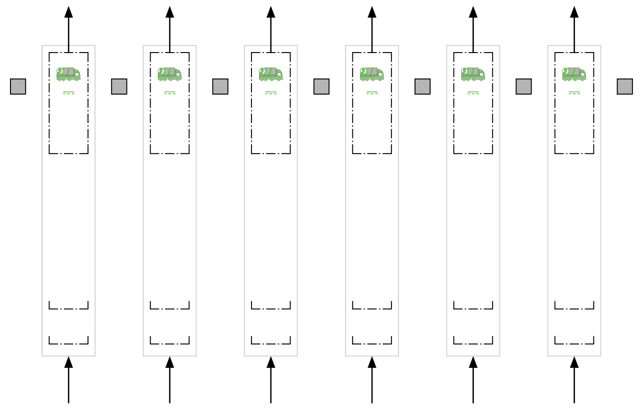
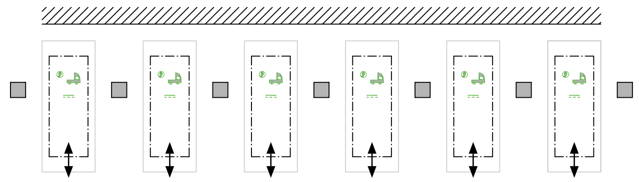
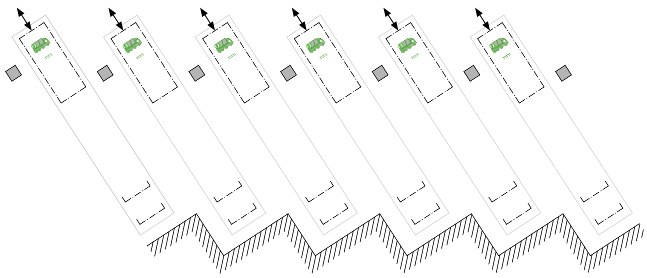
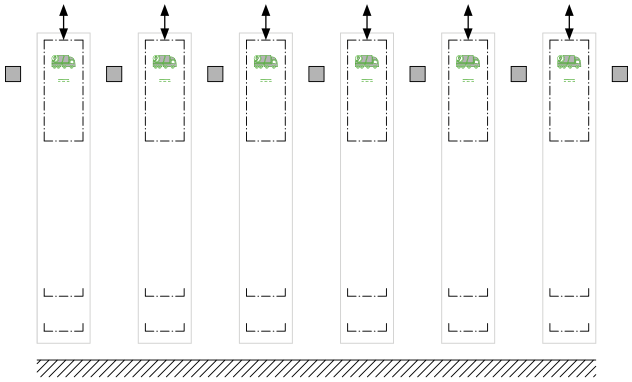
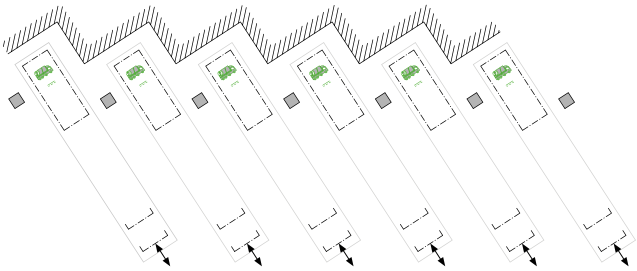
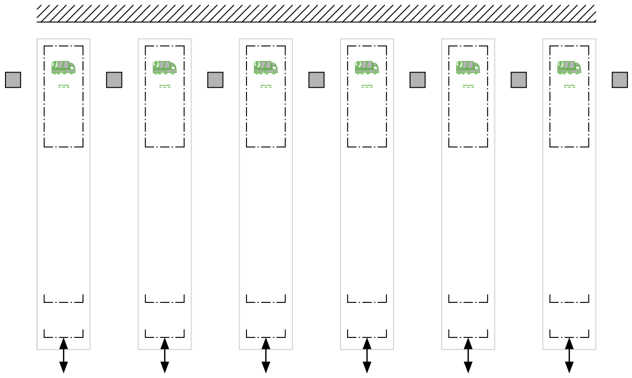
Arrangement	Layout	Preference
Laden vehicle, with travel being in a single direction. Bays arranged staggered, such that there is clear vision from one cab window to either the left or right.		1
Laden vehicle, with travel being in a single direction. Bays arranged in a line.		2
Tractor only, with vehicle travel being bi-directional from a single access (drive in, reverse out or vice-versa). Bays arranged in a line with a dead stop.		3

Figure A.1 – Suggested preference hierarchy for access to and from eHGV charging bays *(continued)*

Arrangement	Layout	Preference
Laden vehicle, with travel being bi-directional from a single access (reverse in, drive out). Bays arranged staggered, such that there is clear vision from one cab window to either the left or right, with a dead stop.		4
Laden vehicle, with travel being bi-directional from a single access (reverse in, drive out). Bays arranged in a line with a dead stop.		5
Laden vehicle, with travel being bi-directional from a single access (drive in, reverse out). Bays arranged staggered, such that there is clear vision from one cab window to either the left or right, with a dead stop.		6
Laden vehicle, with travel being bi-directional from a single access (drive in, reverse out). Bays arranged in a line with a dead stop.		7

NOTE This figure is not to scale and assumes that the chargers are dual-socket (apart from the far-left and far-right which are single socket) and cater for trucks regardless of whether the socket is on the right or left.

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