

COMPETITION: Electric vehicle charging for public spaces: real-world demonstrators

PROJECT TITLE

Scaling On-Street Charging Infrastructure (SOSCI) Project No: 34290
Periodic Report

Period: Q8

**Electric Vehicle Chargepoint Standards Development Project
Application for Drivers with Limited Mobility**

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1. EXECUTIVE SUMMARY

- These photos clearly demonstrate the challenges of a wheelchair driver trying to use an EVCP.



- This report to be completed

2. FOREWORD

This project for development of guidance standards for EV charging facilities is supported by funding from OZEV via Innovate UK, and forms part of the Scaling On-Street Charging Infrastructure (SOSCI) project led by Cybermoor Services Ltd.

This report has been prepared by Access Consultancy Support.

2.1. Project Update

- **Project Stage 1 Report Update**

The Stage 1 Report demonstrated the space standards applied to the draft guidance and diagrams for accessible EVCP bays based on the BS 8300:2018 and referenced to Department for Transport research. Consideration was also given to the space required to avoid projection of connected cable plug(s) and trailing cable at the side of adjacent vehicles and the potential obstruction and trip hazard from such cable location.

The BS 8300 principal measurements applied to accessible EVCP spatial layouts are based on:

- 1200mm clear width between adjacent vehicles accommodates passage through by wheelchair users and ambulant persons using crutches, as well as attendant propelled wheelchairs and buggies.
- 1600mm clear width between adjacent vehicles accommodates turning and manoeuvring through 90-degrees and 180-degrees for independent access by the majority of manual and electric wheelchair users; such as when connecting cable at vehicle and charging equipment, and interacting with the charging device.

Development drawings were produced for different scenarios of charging facility layout, for perpendicular bays and parallel bays with the charging devices located at bay level and kerb level; with each scenario demonstrating the spatial layout of bays for access to the charging device for drivers with impaired mobility, including ambulant persons who use walking aids, and manual or powered wheelchair users, who can travel independently.

The principal parameters applied for each scenario, based on the BS8300:2018 volumes 1 and 2 were:

- 1600mm wide access aisles to each side of the vehicle bays to provide clear access for turning and manoeuvring to connect cable to vehicle, and for clear passage past trailing cable(s).
- Level access in front of the vehicle bays of at least 1600mm width to enable connection on vehicles with front power inlet, as well as access to the charging equipment; with
- 1200mm minimum width past any obstruction across the head of the bays, such as from charging equipment, protection barriers, signposts, or bollards.
- 1200mm access aisle to the rear of all bays for movement around vehicle and boot access clear of vehicle route.

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- Dropped kerb access where the chargepoints are located at a raised level within an existing footpath.

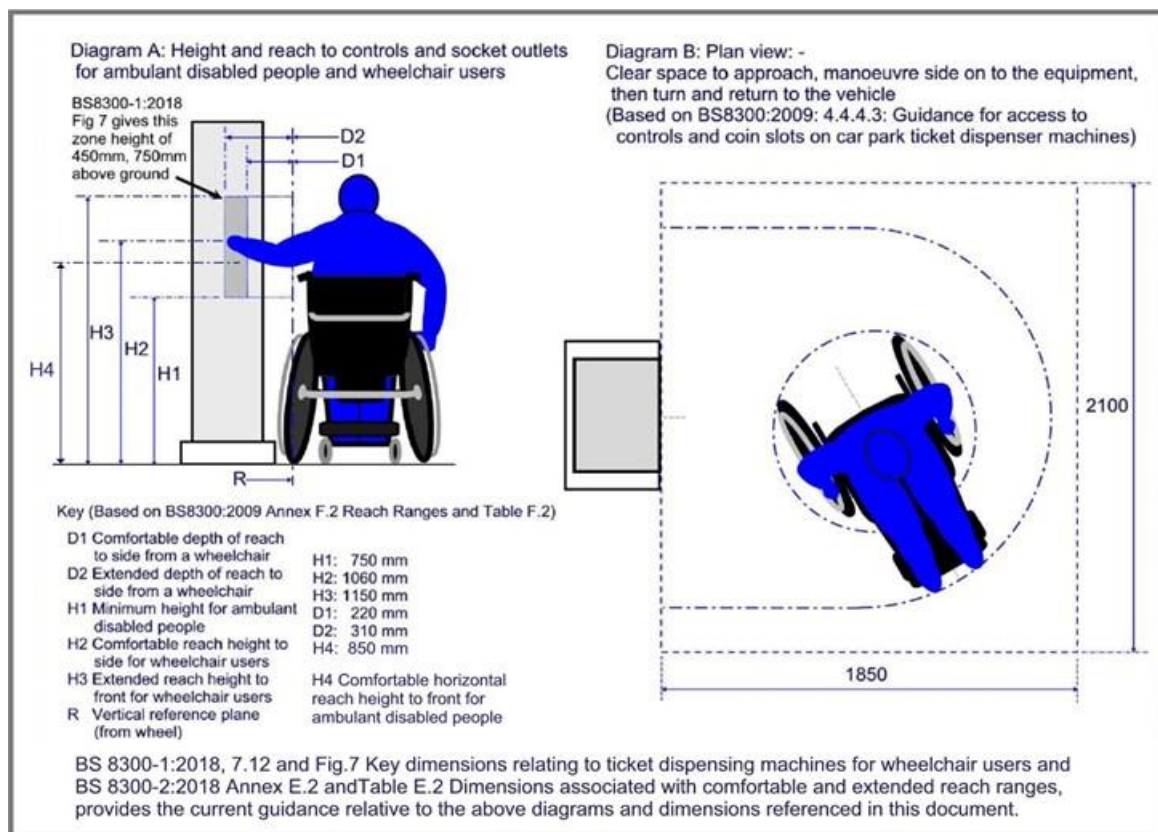
Stage 1 of this project deliberated on constraints that have been known in practice to restrict access to current EV charging equipment, for vehicle bays located perpendicular and parallel to the kerb, wall or barrier locations. The Stage 1 development drawings considered the issue of how to address access to approach charging devices located at vehicle bay level and behind a kerb, such as in the case of pedestrian routes for off-street location, which in some instances might also be applied to on-street provisions.

Stages 2 and 3 consider the requirements for best practice for inclusive access to the EV charging device for future installations, and the guidance required to support such inclusive installations. The output from Stage 2 is in the form of guidance notes and checklists for installers and will also be of relevance to equipment designers and manufacturers. Stage 3 considers the issues that may require further consideration by designers and manufacturers and current user concerns for standardisation and consistency across all future charging devices to aid ease of recognition and user experience.

3. EV CHARGING DEVICE ACCESSIBILITY

Stage 1 of this project developed from the earlier standard developed for Gateshead Standard for accessible charging bay design, based on the BS8300 guidance for accessibility requirements for use of a car park ticket machine: as referenced in Figure 1 below.

Figure 1 - Machine access parameters for persons with impaired mobility



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The Stage 1 Report demonstrated further consideration of current British Standard referenced data for physical access, which resulted in the decision that 1600mm wide access aisles could potentially facilitate independent access by the majority of wheelchair users as well as ambulant persons with impaired mobility and parent/ carers with a child's buggy when:

- transferring at side of vehicle to / from mobility aid, wheelchair or buggy;
- passing between two vehicles being charged;
- manoeuvring around the vehicle; and
- approach to the charging device.

As referenced in Figure 1 above, the current British Standard 8300 guidance indicates a '450mm high zone for control buttons, coin slot and ticket release' at the height range between 750mm and 1200mm above the ground level, as being accessible for both wheelchair users and ambulant impaired users including persons of short stature; in relation to the use of a machine taking coin or card payments and dispensing a paper or card ticket or receipt. Elsewhere, the BS8300 guidance also indicates the ranges for accessible heights for wheelchair users as:¹

- 400mm is lower limit for telephone and TV sockets;
- 400mm to 1000mm for socket outlets;
- 750mm to 1200mm for permanently wired switches;
- 750mm to 1000mm for controls requiring precise hand movement;
- 750mm to 1200mm for light switches;
- 1200mm to 1400mm for meter indicators;
- 1400mm is upper limit for all controls / outlets.

The BS also advises that electrical socket outlets should not be located more than 1000mm above floor level. The current IET Guidance ² therefore appears to be misleading in regard to the statement that the zone for socket-outlets and controls between 750mm and 1200mm is based on the recommended heights in BS8300-1 and BS8300-2. ³

However, the current application of the guidance for socket outlets in the BS 8300 was likely intended to be applicable to lightweight domestic type 3-pin plug, telephone and data sockets, when also used in public buildings, as well as in

¹ BS 8300:2018 Design of an accessible and inclusive built environment: Part 2 Buildings – Code of practice, 15.7.2 and Figure 18 – Heights to the centre of outlets, switches and controls

² The Institution of Engineering and Technology Code of Practice Electric Vehicle Charging Equipment Installation, 4th Edition, 2020.

³ BS 8300:2018 Design of an accessible and inclusive built environment: - Part 1 External environment – Code of practice, Part 2 Buildings – Code of practice

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commercial and industrial premises, but is unlikely to be appropriate for application to heavier duty items similar to EV charging cables and electric vehicle connectors.

There are some similarities to the use of EV charging devices when compared to ticketing machine access, in relation to the potential use of card payments and the height of indicators and displays. However, the actions to complete a charging cable connection between the electric vehicle and charging device needs to be recognised as a more strenuous activity; in regard to the weight of the charging cable and the vehicle connector (cable plug). When considering the cable connection task for persons with impaired mobility, reach, and/or dexterity, who are able to independently drive and safely operate such vehicles with or without the aid of approved vehicle adaptations, it is very important to recognise they can have limited ability to circulate and manoeuvre with a coiled or trailing cable around their vehicle and the charging device.

For the reasons discussed above, the development of guidance for installers and equipment suppliers necessitates further consideration of the ease of access for persons with impairments to complete the connection to a charging device.

3.1. Ease of Access

This section discusses ease of access for ambulant disabled persons and wheelchair users.

Current available research data in BS 8300 identifies the limits of comfortable and extended reach capabilities for the majority of wheelchair users and ambulant disabled persons based on angles above and below a horizontal reference plane height of 750mm and 850mm respectively. For each case, it is unsurprisingly confirmed that an individual's reach capability is decreased below and above the height at which their out-stretched arm is actually held horizontal.

This data has had obvious importance when considering the design of such things as ATMs, ticketing machines for car parks and public transport services, telephone booths, retail display or storage shelving, library facilities, etc., although not always successfully utilised. Also, the use of such data has led to the recognised need for ATMs and other devices involving monetary transactions and dispensing to be provided at two different heights. Lowered ATMs for wheelchair users and persons of short stature, enables their reach and potential readability of the display screen, which is important for their ease of recognition of on-screen text aligned to physical selector button, such as to select a cash amount or to print a receipt or account balance.

However, as the accessible charging bays are needed to satisfy the range of needs for wheelchair users, ambulant impaired users, and persons of short stature who may need to independently use a publicly sited EV charging device, our aim at this stage is to try to identify an appropriate height and reach range to accommodate the majority of all such users.

The following diagrams consider reach implications for cable connection and issues regarding user interaction with the charging device.

Figure 2 - Illustrating wheelchair user access

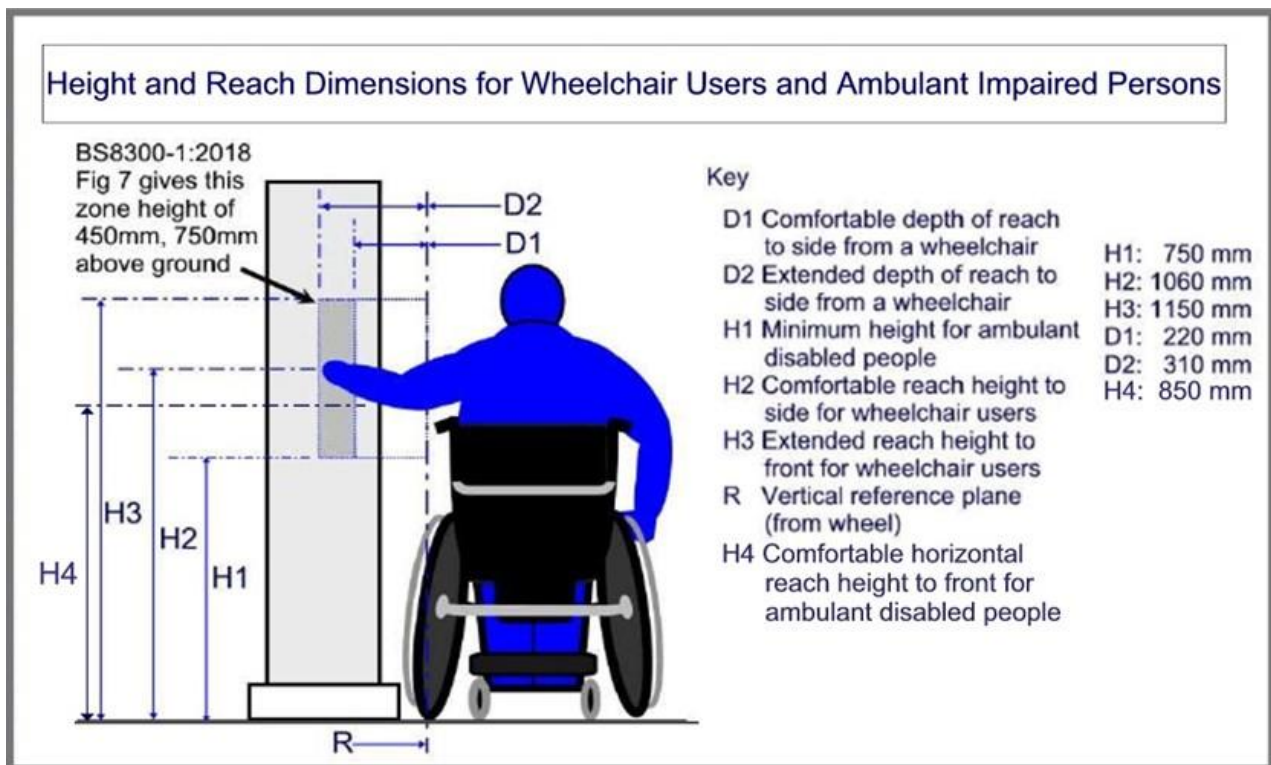


Figure 2 above illustrates a wheelchair user reaching to the side, with the current BS8300 reach height zone indicated along with the comfortable and extended reach depths to their side, and the respective reach heights for wheelchair users and ambulant impaired users.

However, it is important to recognise that the best available comfortable reach to the side for the majority of wheelchair users will not be directly out to their side at 90° with an outstretched arm, but instead nearer to a 30°-45° horizontal angle to their body, especially when they are required to achieve a task such as inserting a plug into a socket. Their comfortable angle of reach may need to be even narrower, according to the weight of plug and cable and the force required to insert or remove the connection, and with their elbow closer to their body; which in effect keeps the forearm wrist and hand in a lowered position closer to being horizontal. Consequently, the depth of reach by a wheelchair user at a narrowed angle from their body will approach the value for their depth of reach forward to their front, which from the reference data table suggests a comfortable reach reducing to a value between approx. 220mm (to side) and 180mm (to front) at a horizontal height of 750mm⁴.

BS 8300 advises an appropriate reach height range between 750mm and 1500mm for frequent use to the side by a standing person who has difficulty reaching and bending.⁵

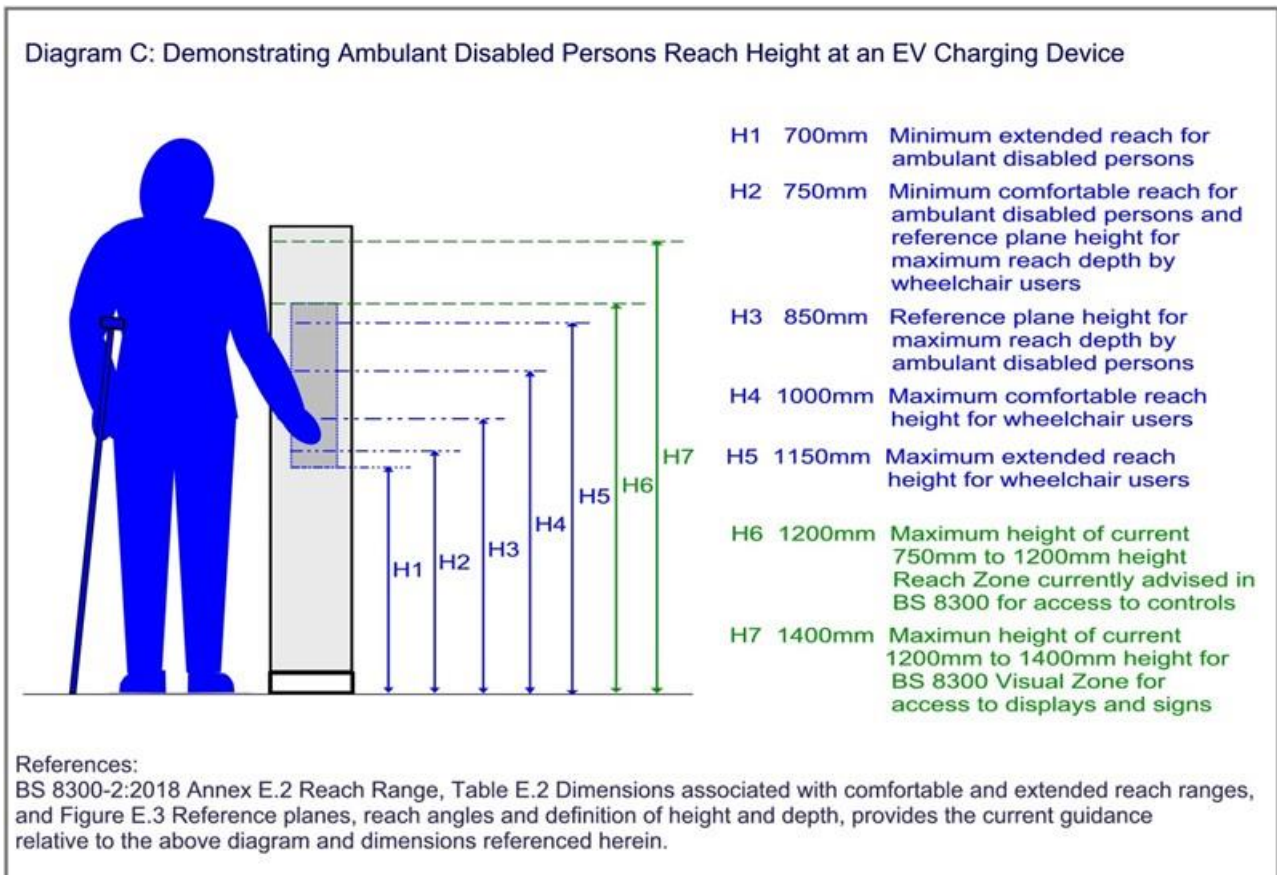
⁴ BS 8300:2018 Design of an accessible and inclusive built environment: Part 2 Buildings – Code of practice, Annex E and Table E.2 - Dimensions associated with comfortable and extended reach ranges.

⁵ BS 8300:2018 Design of an accessible and inclusive built environment: Part 2 Buildings – Code of practice, Part 2, 15.2.2 and Figure 14.

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The reach data for ambulant disabled persons relative to that for wheelchair users is further demonstrated in the Figure 3 for access to an EV charging device.

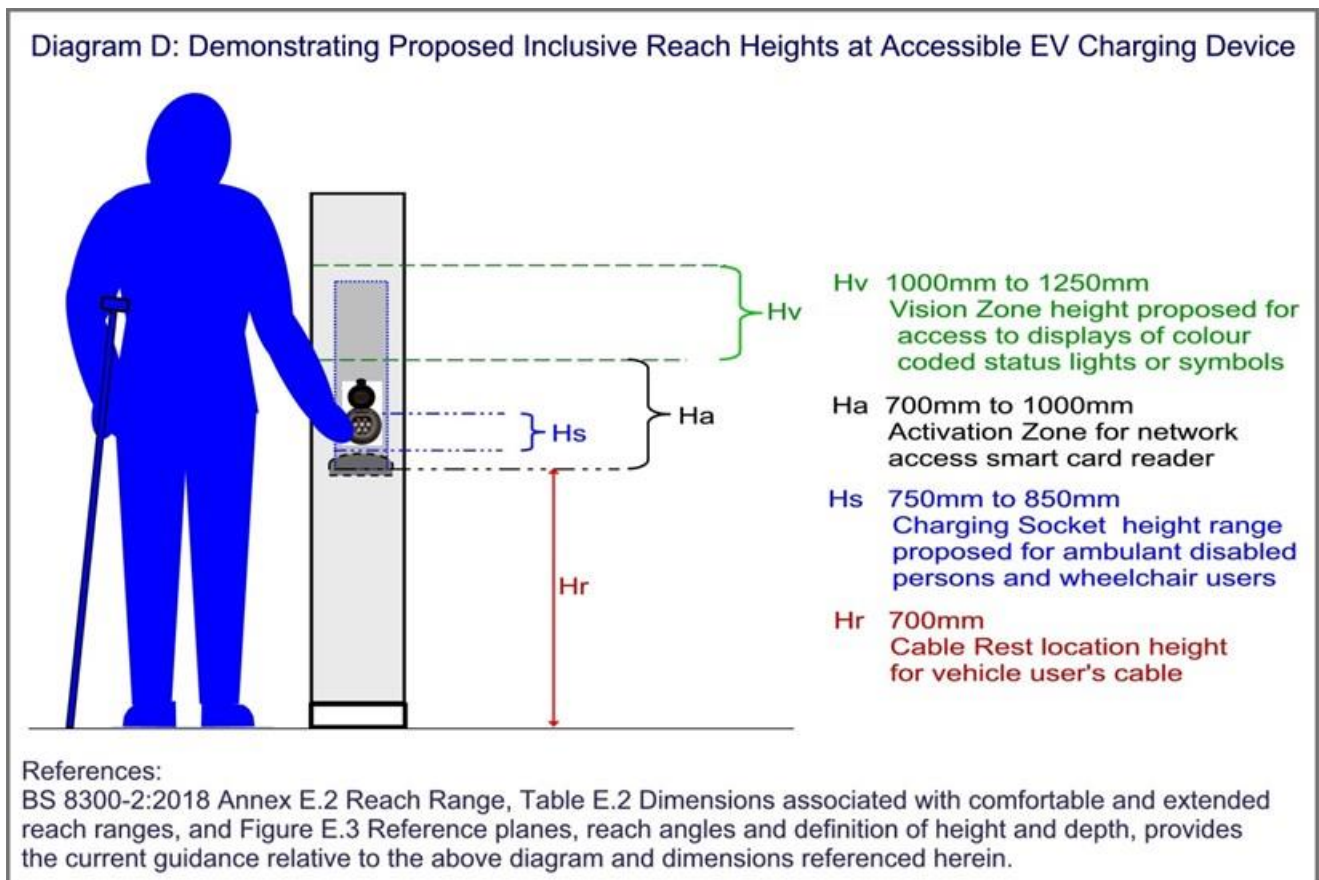
Figure 3 - Illustrating ambulant disabled user access to charging device



Giving consideration again to the effort required for manoeuvring with a coiled or trailing cable and the effort required to insert and remove the cable connection at the charging device, we consider it is important for all ambulant disabled persons, persons of short stature and wheelchair users, that we aim for solutions that as far as possible accommodate their comfortable reach capabilities; so as to avoid any future need for installations at two heights as in the case of ATMs.

From the BS8300 data we can identify that reach heights from 750mm to 1000mm can be accessible for ambulant disabled persons and wheelchair users. However, many wheelchair users experience difficulty raising their arms at their side towards shoulder level, which can also be a problem for some persons of short stature, and such limitations are likely to increase with ageing. Given these issues consideration, it appears appropriate to further consider the comfortable reach heights identified in the BS8300 data. The data tabulation in the BS300 identifies the greatest comfortable reach forward or to the side for wheelchair users and forward for ambulant disabled persons, is at the horizontal reference plane heights of 750mm and 850mm respectively.

Figure 4 - Illustrating proposed inclusive reach heights and zones



The proposed outcome of such consideration and analysis of the currently available data discussed in the forgoing text and diagrams is demonstrated in Figure 4, with indicative height ranges for interaction with a generic charging device; as well as the suggested addition of a cable-rest to aid persons with impairments who need to complete the interactive tasks at the charging device with the use of one hand, which for many is likely to include the insertion and removal of the cable connector.

3.2. EVCP and Bollard Protection

This section outlines the proposed relationship between Charging Device and Bollard Protection.

From the use of a simplified in-house mock-up and verified by on-site measurements from recent site visits, we have been able to identify an arrangement of a front-facing charging device with associated bollard protection that we believe may provide the best potential for close approach and use by wheelchair users and ambulant impaired persons, similar to the images in Figure 5 below.

These images demonstrate the likely procedure for charging (image 1) and manoeuvring with a charging cable to achieve a comfortable approach angle (image 2) that a wheelchair user is likely to need for their ease of reach to connect to the charging device.

Figure 5 – Charging Device & Bollards



Image 1: Wheelchair user preparing to connect cable between the vehicle and the charging device.



Image 2: Wheelchair user accessing a front-facing charging device mounted at vehicle bay level with bollard protection in front of kerb.

The following two diagrams in Figure 6 demonstrate the outcomes of our considerations of the need for close approach and ease of reach to a front-facing charging device with bollard protection. The proposed cable-rest is not shown as this will require a device specific adaptation or accessory, but its proposed height (between 700mm and 750mm) is indicated.

The proposed location of the bollards at a height between 600mm and 650mm to each side of the charging device(s) is also identified, as well as the proposed 40mm-60mm distance between the face of the socket inlet / charging device faceplate and rear side of the bollards. This intended relationship of bollards location to charging device aims to provide suitable protection to the chargepoint installation while also enabling close approach and ease of reach for persons with impaired mobility.

3.3. Physical Installation Requirements

This section describes the considerations and recommendations with reference to the diagrams.

A reach height range of 750mm to 850mm was considered and initially proposed for the location of the charging socket, as previously indicated in Figure 4. However, given the physical size of the Type 2 Standard Charging Socket housing and enclosure, of approx. 100mm outer diameter/height, it seemed more appropriate to locate the socket centre-line height at 850mm, so as to avoid any overlap with any adjacent interactive features or displays while maintaining the reach range within acceptable heights for ease of use by the majority of ambulant persons and wheelchair users; based on the BS8300 published data.

Recognising that smartcard sensors operate over a relatively small contact area, and anticipated user desire for consistency of location, we have revised the proposed sensor location to between heights of 900mm to 1000mm and preferably located directly above the power outlet socket(s).

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Lowering the standard Alfen Eve Proline Double-socket charging device to provide a socket height of 850mm above vehicle bay level, also coincidentally results in the interactive feature and display panel location being within the proposed accessible zones as demonstrated in Figure 6.

Figure 6 - Relative heights of interactive features of the ALFEN EVE Proline

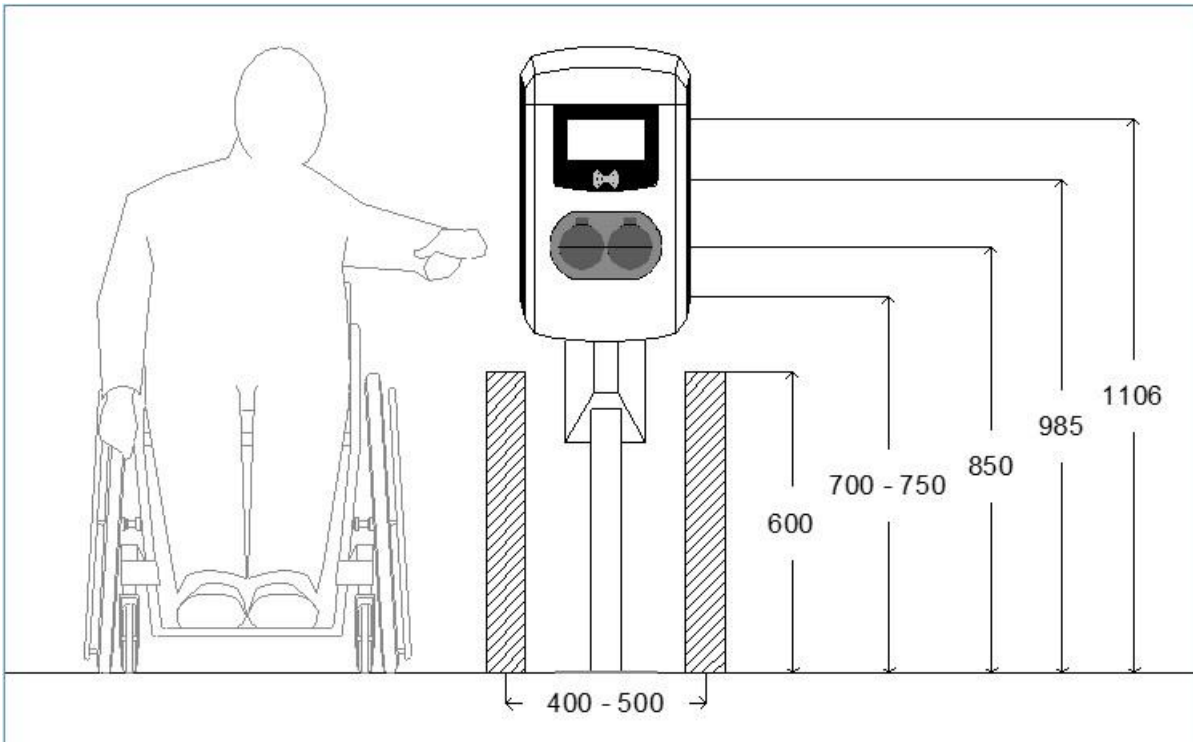
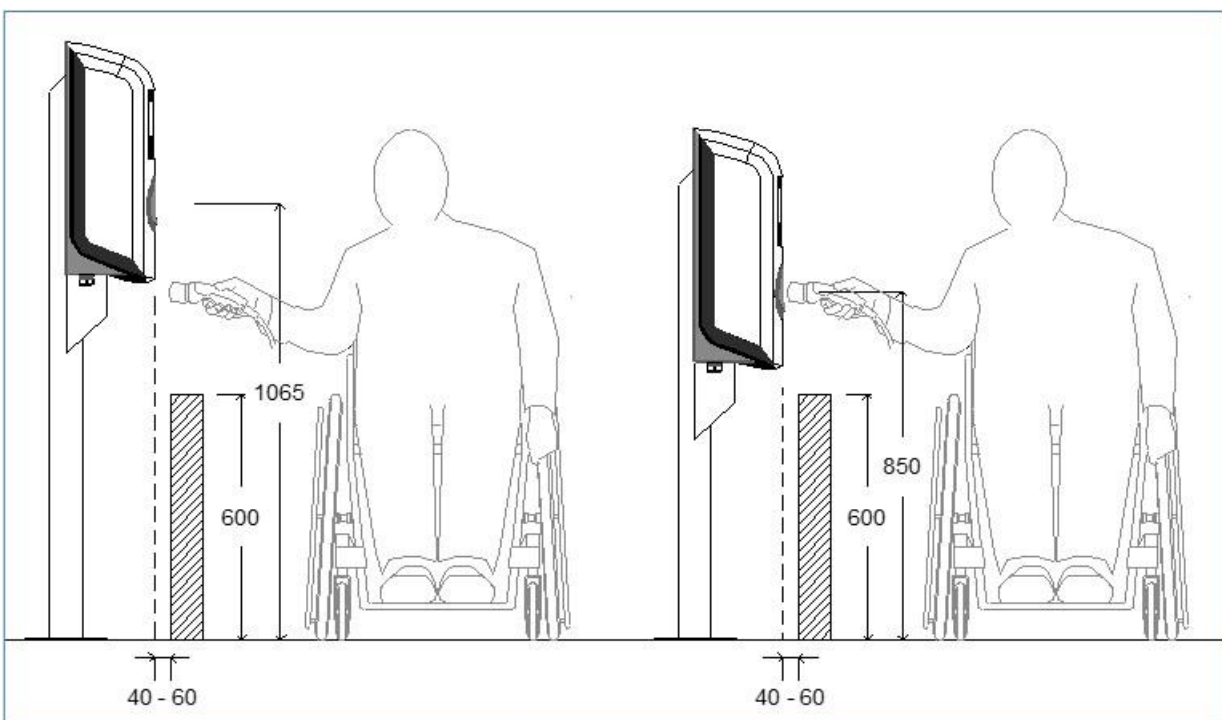


Figure 7 - Illustrates standard height vs proposed lowered height unit



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Following the Sniperley User Trial Event, we have updated our current proposals for the socket height and protection bollards arrangement relative to a front-facing charging device: the data results and observations indicated that preferred socket height by wheelchair users was 850mm, and 940mm for ambulant disabled participants. A compromise height of 900mm is therefore proposed as a potential inclusive height for all users as demonstrated above in diagram 2b in comparison to the current standard installation height of the Alfen double socket device.

Whereas the bollard arrangement was observed to support the close approach to the chargepoint by some participants in wheelchairs, positioning themselves at an angle across the front of the bollards, most manual wheelchair users' preference was observed to have adequate space between the bollards to access the chargepoint, positioning themselves at approx. 90-degrees to the chargepoint and reaching forward to interact with the charging device.

An ambulant participant using crutches also commented he could not approach close enough to insert the cable plug due to the position of the bollards.

3.4. User Trial on 6th October 2021

- **Overview**

The user trial was arranged to provide an opportunity to test out the current proposals on device reach height and interactive zone proposals for inclusive accessibility, and in response to consultation following the Stage 1 Report. The mock-up consisted of a non-operational Alfen Eve Single Pro-line charging device with a single socket, similar to two currently installed operational units at the event site and elsewhere in the Durham area.

Three charging devices and a plug-in vehicle were used in the trial activities, including the use of two operational charging devices including: an Alfen Proline Double-Socket unit, an Alfen Eve Proline Single Socket Unit and the non-operational Mock-up Unit. Each of the two existing operational chargepoints were installed at different heights, and with differing bollard arrangements, to the temporary fixing of the mock-up chargepoint: these variations in the installations were recognised as potentially augmenting the trial environment, which was also evidenced by the resulting data and observations during the day.

During the event 13 complete sets of data were collected for the four tasks during which the participants were observed and asked a series of questions related to the tasks, so that their experience of connecting an electric vehicle to a chargepoint and interacting with the three chargepoints could be compared and assessed. Of the 13 sets of data, one was for a person identifying as non-disabled, 6 sets include four manual wheelchair users and 2 powered wheelchair users, and 6 sets were for ambulant impaired persons including two using elbow crutches and one person with impaired sight who carries a white cane and has a guide dog, but expected to assist in connecting a vehicle driven by his wife to a chargepoint, if they had an electric vehicle.

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- **Bay and Cable Use**

Individuals were asked to obtain the charging cable from the boot of a vehicle and then connect the cable between the vehicle and charging device. Participants were observed during the task and the space they each required to perform this task in the aisle adjacent to the vehicle. As expected, side aisle width of 1200mm was adequate for the majority of users, other than the two powered wheelchair users who required wider turning space when manoeuvring to connect and disconnect the cable at side of vehicle. None of the participants required more than 1500mm aisle width during this task at side of the vehicle. However, based on the existing published Department of Transport research data in BS8300-2:20186, we continue to advise a preferred 1600mm-wide side aisle width, and a minimum width of 1500mm where existing space constraints impact on increased provision.

- **Charging Cables**

It was evident from the data that use of a cable and interaction with a vehicle and charging device is heavily reliant on an individual's ability and capacity. The results may also be influenced to some degree by the disposition of an individual and how they manage their impairment, particularly when faced with new or unfamiliar tasks, as in this trial event. Many participants had some problem with the cable, either to remove the dust cover from the plug end, moving with the cable, or when trying to re-coil the cable after use. Crutch users in particular had problems moving around with the cable. Where it is possible to do so, the weight of a cable should be as light as is absolutely necessary to satisfy its required electrical duty and safety regulations.

- **Chargepoint Use**

From the results of the user trial participants scoring for the tasks of lifting the charging socket cover flap, inserting the cable and removing the cable, when all 13 sets of results are included for all participants (including one ambulant non-disabled participant), there is a clear indication of an overall preference for the 940mm centreline height of socket for 'cover-flap and socket use'.

Results based on Impairment groups for cable plug extraction:

Socket Height above ground (mm)	Wheelchair Users Ave. Score	Percentage Score	Ambulant Disabled Ave. Score	Percentage Score
850	4.50	90.0%	3.17	63.3%
940	4.17	83.3%	4.33	86.7%

⁶ BS 8300-2:2018 Design of an accessible and inclusive built environment: Part 2 Buildings – Code of practice, Annex G Space allowances for wheelchair manoeuvring and Tables G.2 and G8 - Dimensions associated with occupied space when stationary and turning 90-degrees.

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1065	3.33	66.7%	3.17	63.3%
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However, when results for the non-disabled participant are discounted, and only the cumulative results considered for the two impairment groups of six wheelchair users and six ambulant participants with impairments, the difference in preference for ease of use for the three associated tasks of lifting the flap, plug insertion, and plug extraction, appears to confirm a definitive split between the two groups based on the socket heights of 850mm being preferred by the wheelchair users and the 940mm being the preference of the ambulant impaired users.

The results also indicate that chargepoint socket height above 940mm are less likely to provide an appropriate solution for persons with impairments affecting their mobility, strength, or dexterity; some of which are recognised impairments experienced by many people with ageing.

It has therefore been concluded that if an optimum chargepoint socket height exists, for all potential chargepoint users including those who are ambulant or in wheelchairs with impairments; it is likely that the height would be between 850mm and 940mm above the ground or floor level from where the chargepoint was accessed.

On this basis along with the previously documented review and consideration of published reach height data and advised standards in BS8300:2018, standard socket height of 900mm above the charging bay level is proposed to provide inclusive access.

- **Protective Bollards**

The two operational charging devices used in the trial had different bollard arrangements while the non-operational mock-up unit provided a third arrangement for testing. Observations during the trial confirmed that some wheelchair users positioned themselves at an angle to the bollards and chargepoint: this was the expected method of approach and reach to use the chargepoint to be preferred by the majority of wheelchair users prior to the trial, and had been a dominant factor for the bollard arrangement for this mock-up. Whereas most wheelchair users were observed to prefer a less angled and more straight-on approach and reach forward, in some cases leaning forward to lift the flap, to make the cable connection, and when removing the cable.

Figure 8 - Participant in powered wheelchair

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The image shows the participant accessing 850mm height socket on mock-up charging device with wheelchair at an angle to bollards. The width between the bollards in combination with the socket height appears to have been one of the positive contributory factors in regards to the 940mm height socket device. Note that the 1065mm-height socket was second preference, however, by comparison with the 940mm-height socket device, the negative contributory factors for this arrangement was the socket height, bollard location and the location of printed information on the side panels of the charging device – the latter of which was problematic to access for wheelchair users due to the bollard arrangement.

Results based on Impairment groups for protection bollard arrangement:

Socket Height above ground (mm)	Wheelchair Users Ave. Score	Percentage Score	Ambulant Disabled Ave. Score	Percentage Score
850	4.17	83.3%	4.17	83.3%
940	4.50	90.0%	5.00	100%
1065	4.33	86.7%	4.67	93.3%

In view of the above results, participant comments, and observations of participants during the trial, the location of bollards has been given further consideration. These considerations have informed the recognition of the requirements for unobstructed close approach to chargepoints by individuals with impaired mobility, and the apparent need to locate protection bollards to enable a wide angle of access to chargepoint by the following provisions: -

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- Adequate unobstructed space directly in front for approach and reach by all mobility impaired users; and
- Adequate space directly to facilitate manoeuvring with large powered wheelchairs at both oblique and acute angles in front of chargepoint;
- Location of bollards to avoid obstruction to approach and manoeuvring in front of chargepoint and at side of vehicle; and
- Bollard location to avoid obstruction and approach to power-inlet socket on side or front of vehicle.

Alternative options for bollard location within the centre-aisle aisle have been subjected to desktop trial and review with the use of CAD scaled layout plans and elevations, and scaled images representing ambulant persons and wheelchair users. This has included persons using large powered-wheelchairs, based on the range of data for physical size and manoeuvring space identified in the existing Department of Transport published data, as referenced in the British Standards Institute guidance⁷.

These desktop studies have led to amended proposals for the arrangement of chargepoint protection bollards, where provision is deemed to be required for protection against vehicle impact with the charging device.

- **Display Screens**

Across the range of the results for all individuals who took part in the trial, almost all those with impairments experienced problems with legibility; irrespective of their eye level.

If we consider all six wheelchair users responses and all six ambulant disabled users' responses for the screens, we obtain the results in the table below.

Screen Information Cumulative Scores by Impairment Group:

Socket Height	Screen Top Height	Wheelchair Users Score out of 30	Ambulant Disabled Score out of 30
850	1030	28.5	13
940	1120	22	11
1065	1315	14	12

⁷ BS 8300-2:2018 Design of an accessible and inclusive built environment: Part 2 Buildings Code of practice, Annex G Space allowances for wheelchair manoeuvring and Tables G.2 and G8: Dimensions associated with occupied space when stationary and turning 90-degrees.

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Perhaps not surprisingly the wheelchair users preferred the lowest screen height, although this was not operational and could therefore not be judged on ease of reading the display. However, if only the results for the two operational units are considered, it is clear that the lower height display was preferred by the wheelchair users; even though it had a smaller size display. Also by comparison, although there is little variation (by only one or two points) between the overall scores for the three unit heights by the ambulant impaired participants, their scores were considerably lower overall than those for wheelchair users: this appears to indicate that the height of each of the devices with operational displays were too low for their ease of viewing as well as being difficult to read.

On this basis and it not being possible to identify a suitable height display for persons standing and seated from the results, we advise minimising the requirement for information to be visually displayed on screen to that of a simple meter to identify cost and charging status or estimated duration to charge, and the application of guidance in BS8300:20188: that meters should be mounted between 1200 mm and 1400mm from the floor (or ground) so that the readings can be viewed by a person standing or sitting.

The issues of screen display legibility, and content are reviewed and discussed further in the Stage 3 Report.

- **Printed Information on Charging Devices**

Most participants had some difficulty reading the printed information on the two operational charging devices, with overall scoring of 67.7% for the 940mm socket-height device and 69.2% for the 1065mm socket-height device with larger print size, but its location on the side caused issues for viewing and recognition, as some participants had to be told to look on the side.

Figure 9 - Printed information on Socket



⁸ BS 8300-2:2018 Design of an accessible and inclusive built environment: Part 2 Buildings – Code of practice, 15.7.2

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Front of single socket device and larger print on side of larger double socket device.

- **Smart Card Readers**

The results of the trial indicate that none of the participants had any issues reaching to use the smart card reader function, once they were told the location was the symbol on the black panel under the display screen. The results therefore appear to support the proposed zone for the location of such smart sensing provision between the heights of 750mm and 1200mm, which is the UK standard accessibility guidance for reach height to light switches and other permanently wired switches in buildings.

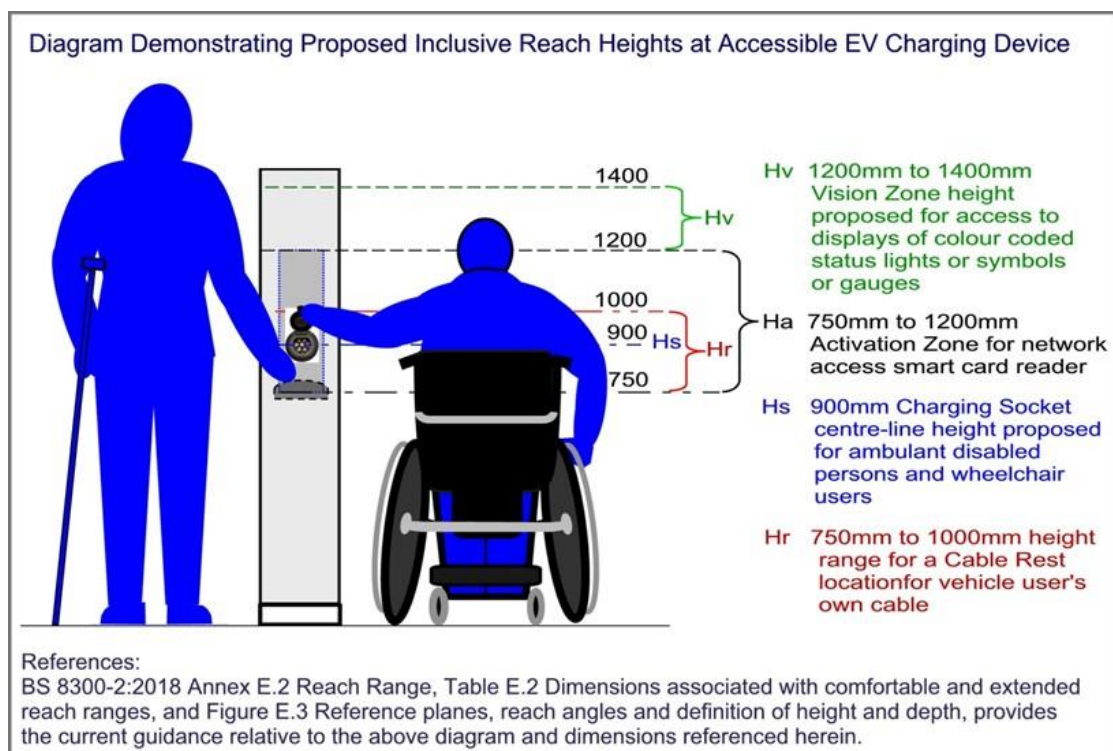
3.5. Summary of Outcomes from User Trial Review

The outcomes that are expected to impact on future installation of EV charging equipment installations of the fast charge type considered in this project are summarised below, and discussed further in the Stage 3 Report on Guidance for EV Chargepoint Designers and Manufacturers.

- **Chargepoint Reach and Viewing Heights**

Following the review of the results from the user trial event data, including the event observation, the following diagram demonstrates the proposed revisions to accessible and inclusive reach heights.

Figure 10: Illustrating revised inclusive reach heights and zones



- **Chargepoint and Vehicle Bay Overrun Protection**

As a general rule bollard should be located out of the access route. However, when this cannot be adequately achieved, they should be installed at a height of at least 1000 mm above ground level and should contrast visually with the background against which they are seen, preferably with base and top highlighted with high contrast strips; to be visible to people with sight-loss.

On this basis our advice is that all bollard heights above ground level, associated with either the vehicle bay identification or chargepoint protection, or otherwise located within an access route, should be at least 1000 mm height and should contrast visually with the background against which they are seen, with: a 150mm deep contrasting strip at the top; a surface finish that is not highly reflective and is contrasted to the ground;

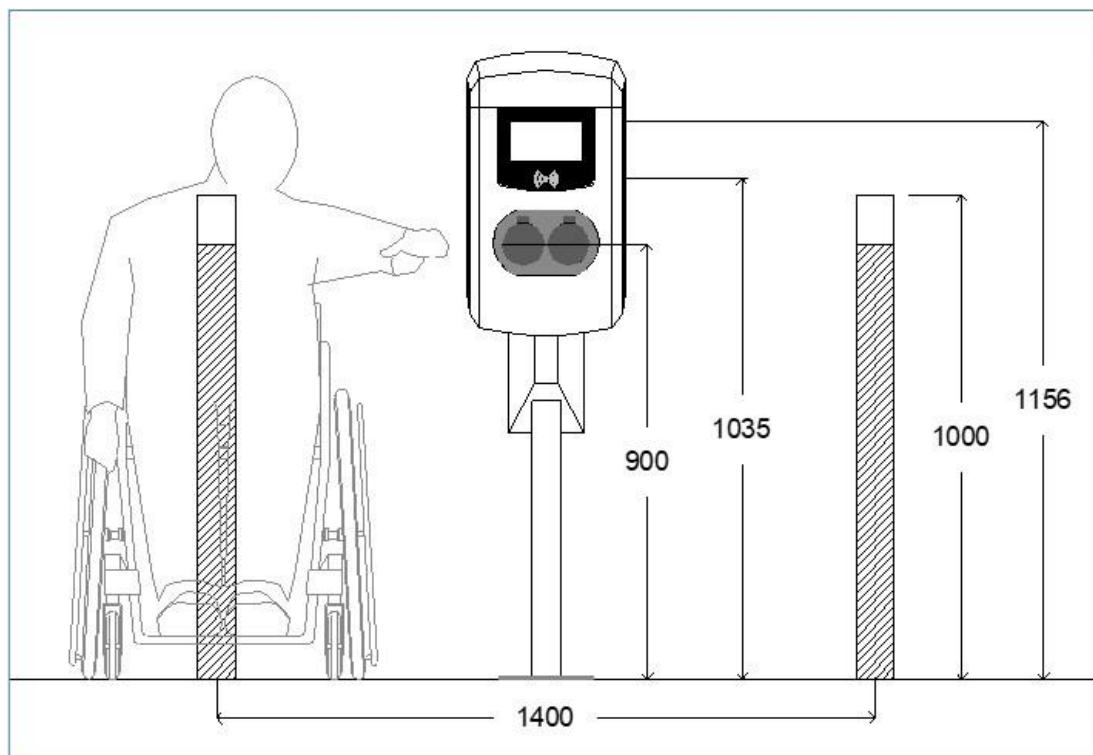
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to be visible to people with sight-loss, who may be passing by or as passengers assisting their driver with impaired mobility to connect to a chargepoint.

- **Protection of Chargepoints Location**

All three chargepoint used in this one-day trial were front-facing charging devices, i.e. intended to have sockets facing the vehicle bays or centre aisle between the bays. It was not possible to test the earlier Stage 2 Report proposals for side-facing sockets arrangements during the user trial. However, based on the considerations of charging bay layout options in the Stage 2 Report and the outcomes and observations from the user trial, we have determined the following proposed bollard arrangements for a double-socket chargepoint located relative to the centre aisle between two adjacent vehicle charging bays, as demonstrated in the diagram below to provide clear approach for all potential users.

Figure 11: Demonstrates Protection Bollards Arrangement at Chargepoint



This arrangement of bollards has been determined with the assistance of computer aided design diagram layouts to consider the manoeuvring requirements of wheelchair users as well as ambulant impaired persons.

3.6. Next Work Stages for the Project

Having considered the physical relationship between the vehicle user, their parked vehicle and the chargepoint location in Stage 1, and the accessibility to reach and use the chargepoint at Stage 2 of this project. The outcomes from these investigations, and past experience from use and auditing EV chargepoint facilities, will be further used to inform the following project stages.

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The Stage 3 Report will consider the issues that may require further consideration by designers and manufacturers, and its preparation will be informed by the outcomes of consultation and the proposed mock-up with the user-group trial following this report; involving disabled people, including existing and prospective drivers of electric vehicles.

Building on the outcomes of this Stage 2 report on physical installation requirements for user accessibility, Stage 3 will also include consideration of current user concerns for standardisation and consistency across future charging devices; to aid ease of recognition of chargepoint status for user experience.

Stage 4 will consider issues that require consideration with regard to proposals for the location of EV charging facilities, in relation to assessment of the potential suitability of local community and neighbourhood sites, where homes do not have availability for any private off-street parking for electric vehicle charging installation, and where on-street charging provision may also be difficult to achieve.

3.7. Stage 2

- **Stage 2.A**

Output: Guidance for EV Chargepoint Installers

The following guidance has been updated following consideration of the results and observations from the single user trial event held 06 October 2021 in Durham City. The details of which are discussed further in the Stage 3 Report for this project.

2A.1 Location of Accessible EV Charging Bays Relative to Buildings

Just as the current national guidance and building regulations applies to accessible parking bays, for parking provisions associated with building(s), accessible charging bays should also be located close to the main entrance, or the designated accessible entrance to a building where the main entrance does not adequately provide for access by wheelchair users or other persons with impaired mobility.

2A.2 Summary of Main Physical Installation Requirements (PIRs)

Summarising the data from our Stage 1 Report and Stage 2 proposals for ease of access to front-facing charging devices - subject to the outcomes of proposed user trials with disabled individuals - we currently advocate the following guidance for the spatial requirements for charging bay design, based on perpendicular charging bays sharing a two-socket chargepoint installation, and the physical relationship between charging bay, charging device, and bollard protection. However, consideration has also been given to the use of single socket and side-socket devices.

2A.2a Accessible Vehicle Bay and Aisle Dimensions:

The following dimensions assumes the access aisles are at same level as the vehicle bay surface, located on firm and level ground, with gradient along the length of the bays and access aisles not exceeding 1:60 with cross-gradients not exceeding 1:50.

- A. Vehicle Bay at least 2.4m width x 4.8m length
- B. Outer Access Aisles 1.6m width

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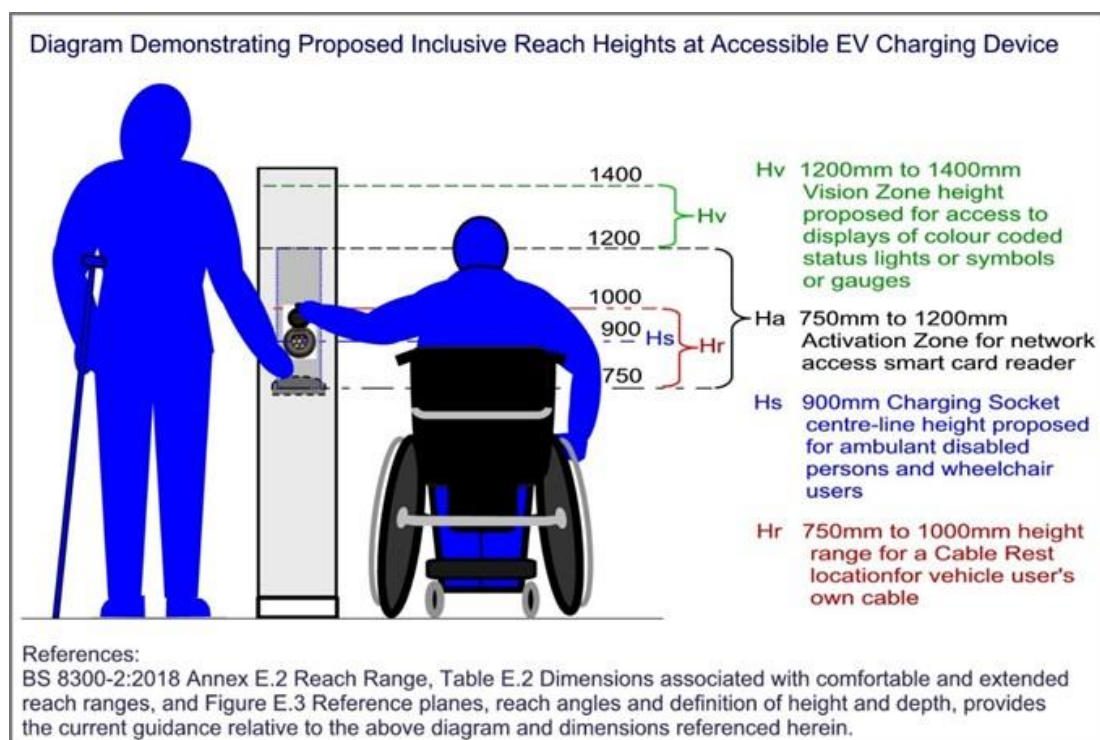
- C. Centre Access Aisle 1.6m width preferred between adjacent bays (1.5m minimum)
- D. Rear Access Aisle 1.2m width (for safe access and separation from adjacent vehicle route)
- E. Cross Aisle at head of vehicle bays 1.6m minimum depth (wherever possible to facilitate access to vehicles with front power inlet socket)

2A.2b Accessible Chargepoint Location Relative to Vehicle Bays:

The following assumes use of two single-socket charging devices or one double-socket charging device.

1. Charging Unit mounted at same level as vehicle bays' surface and located on longitudinal centreline of Centre Access Aisle, as close as possible to the head of the aisle.
2. Charging device sockets centreline height to be located at preferred height of 900mm above the Centre Aisle surface.
3. Display of visual information for chargepoint status should be located between 1200mm and 1400mm above the Centre Aisle surface.
4. Smart card activation sensor and / or QR Code where provided, should be located between 750mm and 1200mm above the Centre Aisle surface.
5. A cable rest / holder is an advised provision on the chargepoint at a height between 750mm and 1000mm above the Centre Aisle surface.

Figure 12: Demonstrates the proposed inclusive reach heights at EVCP



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6. A minimum clear passage width of 1200mm should be maintained across the head of the vehicle bays, behind and past the chargepoint and any other obstruction within the Cross Aisle or any pedestrian route provided or retained.
7. Obstructions may arise from elements such as street furniture including bollards, signposts, and lighting columns. Any reduction in width of passage should not continue for more than 2m along the length of the aisle or pedestrian route.

2A.2c Bollard Protection at Head of Vehicle Bays

The following measures are provided in order to prevent or minimise the potential of vehicle encroachment onto an access aisle or pedestrian route at the head of the vehicle bays:

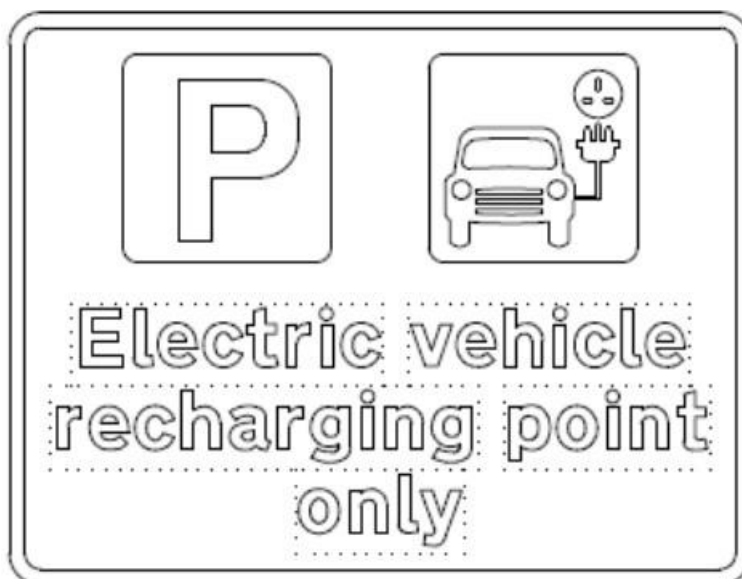
8. All bollard heights above ground level should be at least 1000 mm and should contrast visually with the background against which they are seen, with: a 150mm deep contrasting strip at the top; a surface finish that is not highly reflective; and is contrasted to the ground;⁹ to be visible to people with sight-loss, who may be passengers and assisting their driver with impaired mobility to connect to a chargepoint.
9. Bollards and signposts should be located as close as practicable to alignment with the head of the vehicle charging bays and positioned to maximise close approach to the charging device by all users, including wheelchair users.
10. Bollard depth and width (or diameter) should preferably not exceed 100mm.
11. A bollard-signpost should be provided centrally at head of vehicle bay to identify bay is for use as an 'Electric vehicle recharging point only', with the lower edge of the sign at least 1000mm above the vehicle bays surface; to identify the space when road markings are obscured such as by snow or fallen leaves.¹⁰ Where the charging bays' location is within a local authority owned or controlled site, the sign should comply with the highways regulations, as referenced in Department of Transport (DfT) Drawing No. P 60.9 'Electric Vehicle Recharging Point', 11 November 2011.¹¹

⁹ Based on BS 8300:2018 Design of an accessible and inclusive built environment: Part 1 External Environments – Code of practice, Clause 8.2.1.2 Low-level walls and free-standing posts and columns

¹⁰ Based on BS 8300:2018 Design of an accessible and inclusive built environment: Part 1 External Environments – Code of practice, Clause 7.6 and Figure 5 – Markings for multiple designated off-street parking bays

¹¹ Department of Transport traffic-sign-drawing-schedule-04-part-05-item-07-p660x9

Figure 13 Diagram 2f: Example of a DfT Highway Regulation EV Charging Bay Sign



12. It is also advised to utilise the same electric vehicle symbol as used on the DfT sign, for application to the vehicle bay surface marking, to visually distinguish the charging bay from other bays that are similarly located; and also when signposting the location of EV charging bays from the site entry and on approach to aid wayfinding to vehicle charging bays within the site.
13. Where bollards are located within a pedestrian route passing charging bays' locations, their height should be at least 1m above the route surface, and located clear of the route such that the route width is not reduced below 1200mm.¹²
14. Any street furniture, including bollards, free-standing posts, and columns, should not have a highly reflective finish and should contrast visually with the background against which they are seen.¹³

2A.2d Chargepoint Protection Bollards Location

The following measures are provided in order to prevent or minimise the potential of vehicle impact damage to the charging unit. Their location as advised is also important to minimise any obstruction to interaction with the socket connections and charging device activation by wheelchair users, persons of short stature, and other persons with impaired mobility:

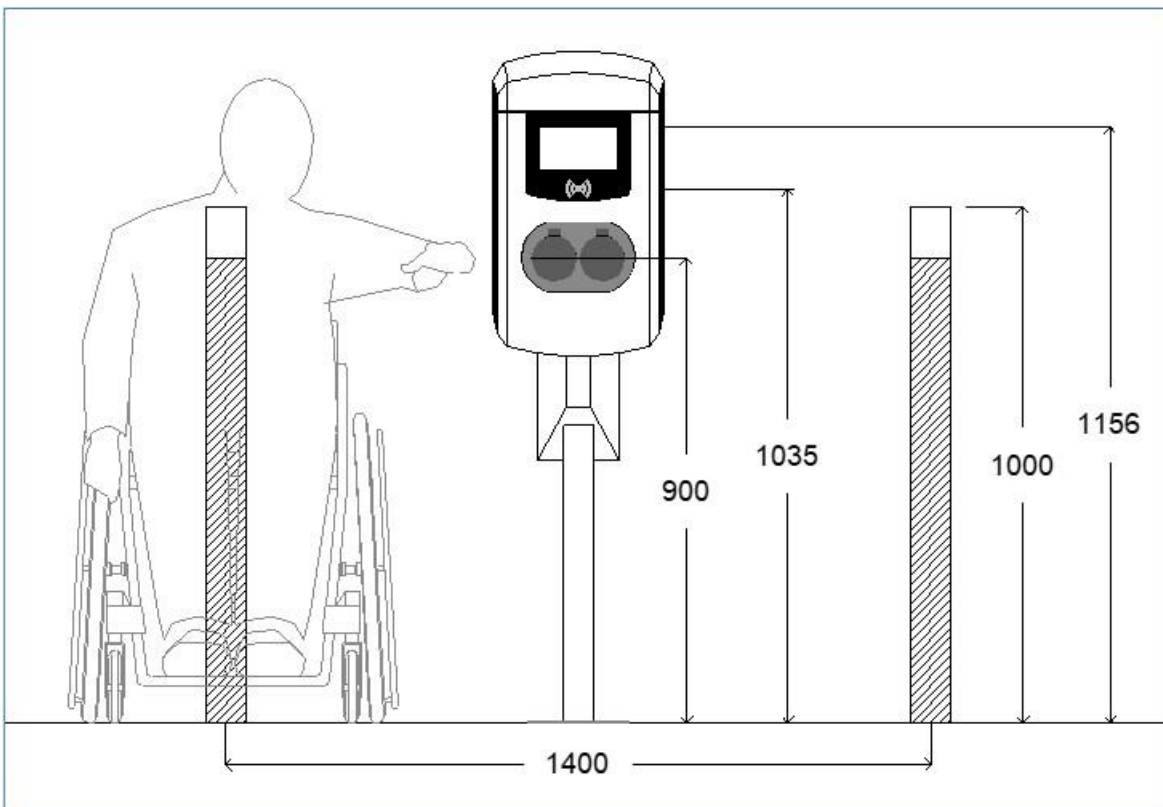
¹² Based on BS 8300:2018 Design of an accessible and inclusive built environment: Part 1 External Environments – Code of practice, Clause 8.2.1.2 Low-level walls and free-standing posts and columns.

¹³ Based on BS 8300:2018 Design of an accessible and inclusive built environment: Part 1 External Environments – Code of practice, Clause 8.2.1.1 Location of street furniture.

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- 15. Two bollards located at 1400mm between centres and equidistant to the centreline of the Centre Access Aisle (i.e. located with centre of bollards 700mm each side of the centre aisle centreline); and
- 16. For chargepoints located on or behind a kerb or kerb-line, the rear face of the bollards should be positioned at least 50mm forward of the power outlet sockets (or chargepoint if side sockets) and preferably not more than 100mm forward of the kerb when measured along the centre aisle.
- 17. For chargepoints located in front of the kerb, or at head of centre aisle with a level access cross aisle, the rear face of the bollards should be positioned at least 50mm and preferably not more than 100mm forward of the power outlet sockets (or chargepoint if side sockets) when measured along the centre aisle.

Figure 14: Demonstrates Protection Bollards Arrangement at Chargepoint



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- **Stage 2.B**

Output: Checklists for EV Chargepoint Installers

2B.1 Chargepoints and Charging Bay Layout Options

A number of charging bay diagrams have been produced to demonstrate some potential variation in charging bay and charging device layouts. This is in recognition that there is currently a wide range of public chargepoint devices and network operators across the UK, and the potential need to consider installations in locations where level access cannot be achieved around all sides of a vehicle bay, or where single socket or side-socket devices, as well as double-socket devices are in use.

These layout diagrams provide installers with templates for application to proposed charging device locations in the form of companion reference diagrams to be used alongside the PIR Checklists. These templates were initially developed to accommodate use of the Alfen Eve Double Proline (as currently being installed in the Durham area by SOSCI project partners) serving two adjacent vehicle bays. However, consideration has also been given to the use of single socket devices and side-socket devices, including the EO Genius single socket device (currently being installed by SOSCI project partners in the North West counties). The details incorporated in the diagrams for the chargepoint location have also been considered as far as possible to potentially be appropriate for installation of any Fast Charge EV Device for public locations; and as such the diagrams and checklists for installers have been progressed principally on the basis of their potential application universally as templates to suit any such slow or fast chargepoint installations for off-street locations, or on-street where space permits.

We anticipate the likely need for adjustments and possible simplifications to checklists and their use with the companion 'reference drawing' templates, based on the relevant charging device being installed and as appropriate to the site location; especially where the device and mounting installation have been purposely designed to satisfy the advised accessibility requirements for disabled persons. We also recognise the importance of further user-group testing to provide additional data to further corroborate and / or update the appropriate requirements for accessibility and inclusive design.

The following diagrams and checklists have been updated following the outcomes of the single user trial event 06 October 2021 in Durham City that provided data and observations on the accessibility needs of wheelchair users and ambulant persons with impairments.

2B.2 Physical Installation Requirement (PIR) Accessibility Checklists and Diagrams:

Checklists have been prepared with companion diagrams for use as on-site templates for installation planning and execution. These diagrams provide examples of alternative charging bay and device layouts as mentioned above. The following diagrams and checklists are appended in this report.

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Physical Installation Requirement (PIR) Accessibility Checklists and Diagrams:

PIR Checklist Number	Description	Companion Drawing Ref
2B1a:	Level Cross Aisle with Two Front Sockets	2B1a
2B1b:	Level Cross Aisle with Two Side Sockets	2B1b
2B2a:	Footpath with Two Front Sockets on Kerb	2B2a
2B2b:	Footpath with Two Front Sockets in Aisle	2B2b
2B3a:	Border with Two Front Sockets in Aisle	2B3a
2B3b:	Border with Two Front Sockets Behind Kerb	2B3b
2B4a:	Dropped Footpath with Two Front Sockets	2B4a
2B4b:	Dropped Footpath with Two Side Sockets	2B4b

As discussed in the report, the checklists and companion reference drawing templates have been progressed on the basis of providing examples that can be applied to suit different sites, as well as providing options for chargepoint location: these include options for side-located sockets and well as sockets facing the vehicle bays. The diagrams aim to support the SOSCI Project installation of the Alfen double-socket devices currently being installed in the Durham area, and also for the EO Genius single-socket devices being installed in the North West; subject to modification of the mounting post arrangement in each case to satisfy the proposed accessibility parameters.

Table 1 - PIR Accessibility Checklist 2B1a

Checklist Physical Installation Requirements: Level Cross Aisle with Two Front Sockets		Reference Drawing		
	Bay and Aisle Dimensions	2B1 a		
Ref	Check	Yes	No	NA
A	Vehicle Bay size at least 2.4m width x 4.8m length			
B	Outer Access Aisle 1.6m width			
C	Centre Access Aisle 1.6m width			
D	Rear Access Aisle 1.2m width			
E	Cross Aisle at head of bays 1.6m minimum depth (facilitates access to vehicles with front inlet socket)			
Charging Unit: One double-socket unit or two single-socket units facing along centre aisle				
Ref	Check	Yes	No	NA
1	Is the charging unit mounted at the same level as the vehicle bays' surface and located on the longitudinal centreline of Centre Access Aisle, shared by the two adjacent vehicle bays, as close as possible to the head of the aisle? (The preferred solution to avoid limitations on accessibility). If not, use the PIR Kerb Mounted Checklist 2B2a.			
2	Are the front-facing socket(s) located with their front face set as close as possible to the centre aisle and no further back than 50mm measured horizontally from the centre aisle?			

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3	Are the charging sockets centreline height located at the preferred height of 850mm above the Centre Aisle surface?			
4	Is the information screen located with the visible display between 1000mm and 1250mm above the CentreAisle surface?			
5	Is the card reader located between 900mm and 1000mm above the Centre Aisle surface, and preferably directly above the socket(s) location?			
6	Is a cable rest/ holder provided between the charging device mounting post and rear of the chargepoint protection bollards, at a height between 700mm and 750mm above the Centre Aisle surface?			
7	Is a minimum clear width of 1200mm maintained behind and past the chargepoint and any other obstruction within the Cross Aisle or any pedestrian route provided or retained?			
8	Does any reduction in clear width continue for less than 2m along the Cross Aisle / route length?			
Barrier Protection				
<p>The following measures are provided in order to prevent / minimise the potential of vehicle impact damage to the charging unit and vehicle encroachment onto Cross Aisle or pedestrian route at head of bays.</p> <p>Bollards / signposts should be located as close as practicable to the front edge of the vehicle charging bay and positioned as indicated in the companion diagram, to maximise close approach to the charging device by all users including wheelchair users. Bollard depth and width (or diameter) should not exceed 100mm.</p>				
Ref	Check	Yes	No	NA
1	Is the bollard / bollard-signpost provision as identified on the companion drawing to prevent vehicle overrun and provide charging device protection?			
2	Is an EV Charging Bay bollard-signpost located centrally at the head of each vehicle charging bay?			

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3	<p>Are the two chargepoint protection bollards installed with their height set between 600mm minimum and 650mm maximum above the centre aisle surface, located with their centres between 200mm – 250mm each side of the centre aisle centreline, and forward of the charging device face, such that the rear of the bollards are at least 40mm and preferably not more than 60mm forward of the power outlet socket(s) as far as practicable?</p> <p>Note: This is important to minimise any obstruction to interaction with the socket connections and charging device activation for wheelchair users, persons of short stature, and other persons with impaired mobility.</p>			
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Figure 11 - Level access cross aisle with two front sockets Diagram 2B1a

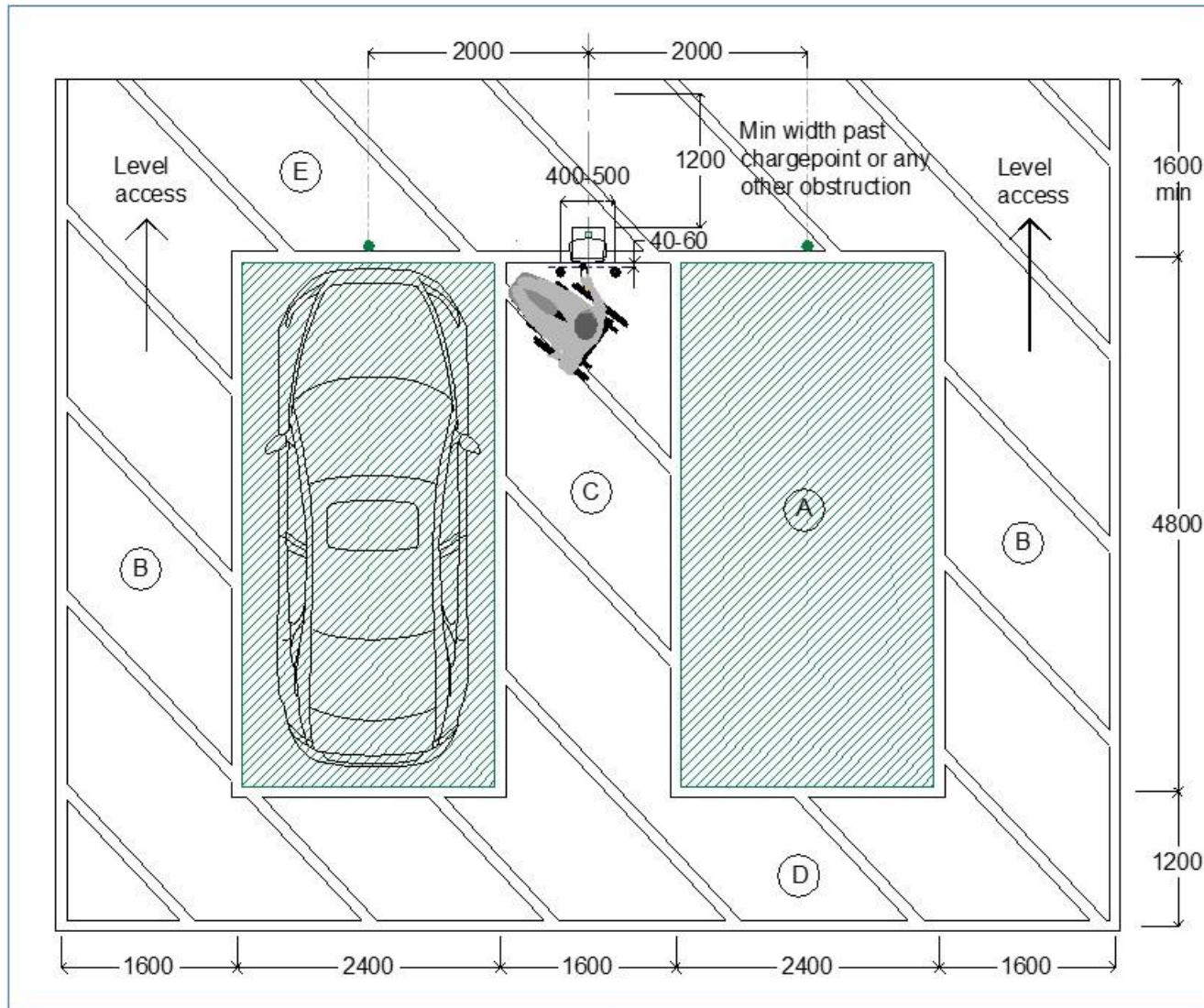


Figure 15 - PIR Accessibility Checklist 2B1b

Physical Installation Requirements: Level Cross Aisle with Two Side Sockets		Reference Drawing		
	Bay and Aisle Dimensions	2B1b		
Ref	Check	Yes	No	NA
A	Vehicle Bay size at least 2.4m width x 4.8m length			
B	Outer Access Aisle 1.6m width			
C	Centre Access Aisle 1.6m width			
D	Rear Access Aisle 1.2m width			
E	Cross Aisle at head of bay 1.6m minimum depth (facilitates access to vehicles with front inlet socket)			
Charging Unit: One double-socket unit or two single-socket units with side located sockets				
Ref	Check	Yes	No	NA
1	Is the charging unit mounted at the same level as the vehicle bays' surface and located on the longitudinal centreline of Centre Access Aisle, shared by the two adjacent vehicle bays? (The preferred solution to avoid limitations on accessibility). If not, use the PIR Kerb Mounted Checklists 2B2a.			
2	Are the charging sockets centreline height located at the preferred height of 850mm above the Centre Aisle surface?			
3	Are the extremities of charging device and mounting post base contained within 400mm of the Centre Aisle to minimise projection into the Cross Aisle at head of the charging bays?			
4	Is the information screen located with the visible display between 1000mm and 1250mm above the			

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	adjacent ground surface?			
5	Is the card reader located between 900mm and 1000mm above the adjacent ground surface, and preferably directly above the socket(s) location?			
6	Is a cable rest/holder provided between the charging device mounting post and rear of the chargepoint protection bollards, at a height between 700mm and 750mm above the Centre Aisle surface?			
7	Is a minimum clear width of 1200mm maintained behind and past the chargepoint and any other obstruction within the Cross Aisle or any pedestrian route provided or retained?			
8	Does any reduction in clear width continue for less than 2m along the Cross Aisle / route length?			
	Barrier Protection			
	The following measures are provided in order to prevent / minimise the potential of vehicle impact damage to the charging unit and vehicle encroachment onto Cross Aisle or pedestrian route at head of bays. Bollards / bollard-signposts should be located as close as practicable to the front edge of the vehicle charging bay and positioned as indicated in the companion diagram. Bollard depth and width (or diameter) should not exceed 100mm.			
Ref	Check	Yes	No	NA
1	Is there bollard / bollard-signpost provision as identified on the companion drawing to prevent vehicle overrun and provide charging device protection?			
2	Is an EV Charging Bay bollard-signpost located centrally at the head of each vehicle charging bay?			
3	Are the two chargepoint protection bollards installed with their height set between 600mm minimum and 650mm maximum above the vehicle bays surface level, located with their centres between 200mm – 250mm each side of the centre aisle centreline, and forward of the charging device by at least 40mm and preferably not more than 60mm as far as practicable? Note: This is important to minimise any obstruction to interaction with the socket connections and charging device activation for wheelchair users, persons of short stature, and other persons with impaired mobility.			

Diagram 2B1b: Level cross aisle with two side-sockets

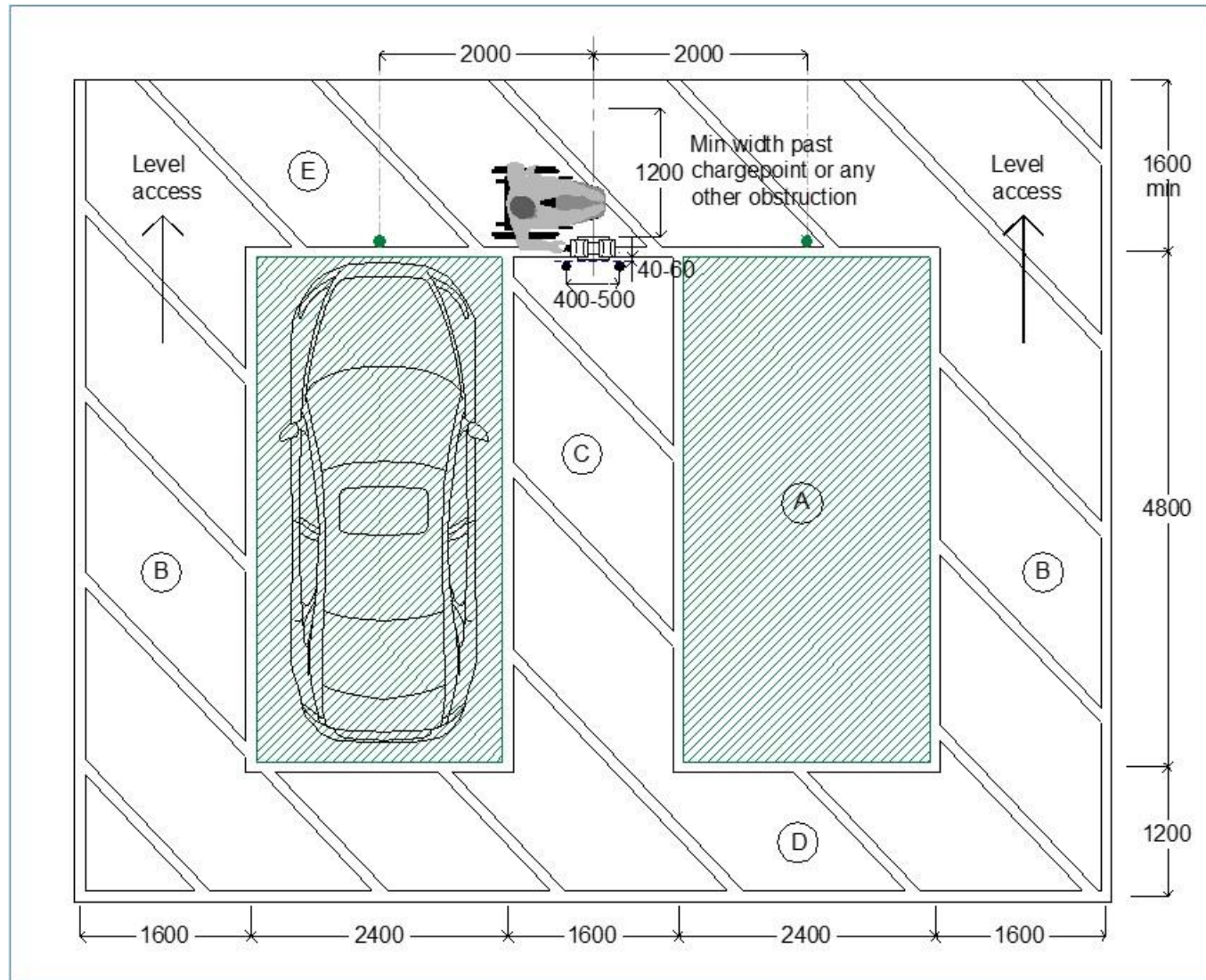


Figure 16 - PIR Accessibility Checklist 2B2a

Physical Installation Requirements: Footpath with Two Front Sockets on Kerb		Referenc eDrawing		
	Bay and Aisle Dimensions	2B2a		
Ref	Check	Yes	No	NA
A	Vehicle Bay size at least 2.4m width x 4.8m length			
B	Outer Access Aisle 1.6m width			
C	Centre Access Aisle 1.6m width			
D	Rear Access Aisle 1.2m width			
E	Footpath at head of bays 1.6m minimum depth			
Charging Unit: Two single-socket units or one double-socket unit facing Centre Aisle, located on a raised surface with pedestrian route adjacent to vehicle bays.				
Ref	Check	Yes	No	NA
1	Can the raised surface be lowered along its length across the width of vehicle charging bays and side aisles to the same level as the vehicle bay(s)? (Preferred solution) If yes go to PIR Checklist 2B4a			
2	Has the Local Authority approved the plan for the proposed change to footpath / footway, provision of dropped kerbs and any required changes to localised drainage to minimise potential of local ponding or flooding. (Dropped-kerbs are required at the side access aisles to facilitate access onto the pedestrian route for wheelchair users)			
3	Is access provided with dropped kerbs from side aisles onto a pedestrian route where the			

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	chargepoint(s) are to be located?			
	Note: Where charging unit is mounted on surface level higher than vehicle bays a shorter or modified height mounting arrangement may be required to achieve the required accessibility.			
4	Are charging sockets centreline height located at preferred height of 850mm above the Centre Aisle surface?			
5	Are the extremities of charging device and mounting post base contained within 400mm of the Centre Aisle to minimise projection into the adjacent pedestrian route? Note: This will likely require the charging device mounting post base to be located as close as possible to the kerb block and in some cases may require replacement of existing kerb block with a narrower depth of kerb. Close proximity of charging device to the kerb is very important to minimise any obstruction to interaction with the socket connections and charger activation for wheelchair users, persons of short stature, and other persons with impaired mobility.			
6	Is the information screen located with the visible display between 1000mm and 1250mm above the Centre Aisle surface? (It is assumed that the info screen will be on same side of charging device as the sockets)			
7	Is the card reader located between 900mm and 1000mm above the Centre Aisle surface, and preferably directly above the socket(s) location?			
8	Is a cable rest/holder provided between the charging device mounting post and rear of the chargepoint protection bollards, at a height between 700mm and 750mm above the Centre Aisle surface?			
9	Is a minimum clear width of 1200mm maintained behind and past the chargepoint and any other obstruction within the pedestrian route?			
10	Does any reduction in clear width continue for less than 2m along the Cross Aisle / route length?			
	Barrier Protection			
	The following measures are provided in order to prevent vehicle impact damage to the charging unit and vehicle encroachment onto a pedestrian route. Note: Bollards / bollard-signpost should be located as close as possible to the kerb edge and within a maximum depth of 400mm behind the kerb edge.			
Ref	Check	Yes	No	NA
1	Is an EV Charging Bay bollard-signpost located centrally at the head of each parking bay?			

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<p>2</p>	<p>Are the two chargepoint protection bollards installed: as close as possible to the face of the kerb edge; with their height set between 600mm minimum and 650mm maximum above the vehicle bays surface level; located forward of the power outlet sockets by at least 40mm (min.) and preferably by not more than 60mm measured along the centre aisle; with the bollard centres positioned between 200mm – 250mm each side of the centre aisle centreline?</p> <p>Note: This is important to minimise any obstruction to interaction with the socket connections and charger activation for wheelchair users, persons of short stature, and other persons with impaired mobility.</p>			
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Diagram 2B2a: Footpath with two front sockets on kerb

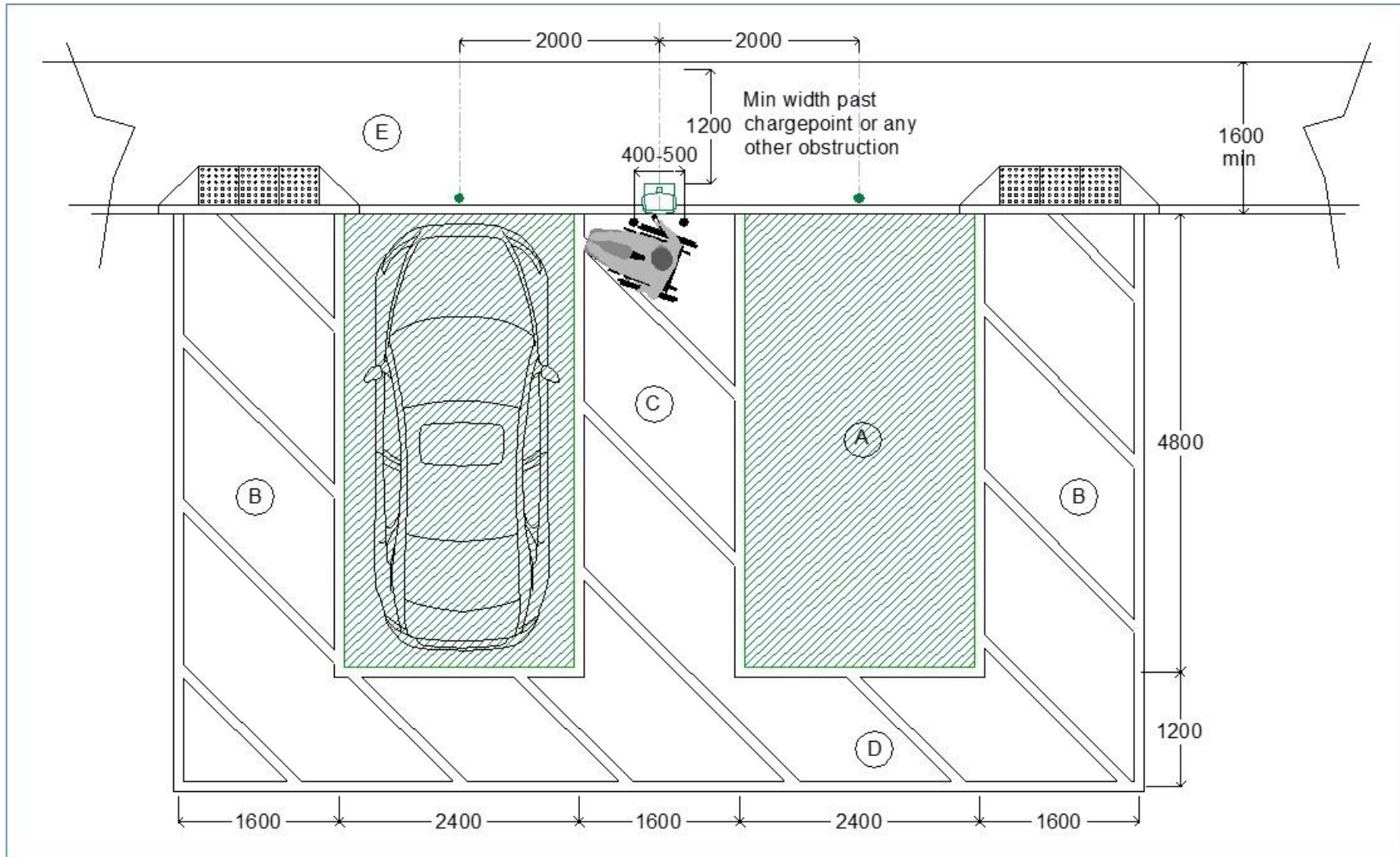


Figure 17 - PIR Accessibility Checklist 2B2b

Physical Installation Requirements: Footpath with Two Front Sockets in Aisle		Reference Drawing		
	Bay and Aisle Dimensions	2B2b		
Ref	Check	Yes	No	NA
A	Vehicle Bay size at least 2.4m width x 4.8m length			
B	Outer Access Aisle 1.6m width			
C	Centre Access Aisle 1.6m width			
D	Rear Access Aisle 1.2m width			
E	Footpath at head of bays 1.6m minimum depth			
Charging Unit: Two single-socket units or one double-socket unit located in centre aisle in front of pedestrian route, with sockets facing along centre aisle.				
Ref	Check	Yes	No	NA
1	Has the Local Authority approved plan for the proposed change to footpath / footway, provision of dropped kerbs and any required changes to localised drainage to minimise potential of local ponding or flooding. (Dropped-kerbs are required at the side access aisles to facilitate access for wheelchair users who require access to the pedestrian route)			
2	Is access provided with dropped kerbs from side aisles onto a pedestrian route?			

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Ref	Check	Yes	No	NA
3	Are charging sockets centreline heights located at preferred height of 850mm above the Centre Aisle surface?			
4	Is the information screen located with the visible display between 1000mm and 1250mm above the CentreAisle surface? (It is assumed that the info screen will be on same side of charging device as the sockets)			
5	Is the card reader located between 900mm and 1000mm above the Centre Aisle surface, and preferably directly above the socket(s) location?			
6	Is a cable rest/holder provided between the charging device mounting post and rear of the chargepoint protection bollards, at a height between 700mm and 750mm above the Centre Aisle surface?			
7	Is a minimum clear width of 1200mm maintained behind and past the chargepoint and any other obstruction within the pedestrian route?			
8	Does any reduction in clear width continue for less than 2m along the pedestrian route length?			
Barrier Protection				
The following measures are provided in order to prevent vehicle impact damage to the charging unit and vehicle encroachment onto a pedestrian route. Note: Bollards / bollard-signpost should be located as close as possible to the kerb edge and within a maximum depth of 400mm behind the kerb edge.				
Ref	Check	Yes	No	N A
1	Is an EV Charging Bay bollard-signpost located centrally at the head of each parking bay?			
2	Are the two chargepoint protection bollards installed with their height set between 600mm minimum and 650mm maximum above the Centre Aisle surface, located forward of the power outlet sockets by at least 40mm and preferably not more than 60mm measured along the centre aisle, with their centres between 200mm – 250mm each side of the centre aisle centreline? Note: This is important to minimise any obstruction to interaction with the socket connections and			

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	chargeractivation for wheelchair users, persons of short stature, and other persons with impaired mobility.			
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Diagram 2B2b: Footpath with two front sockets in aisle

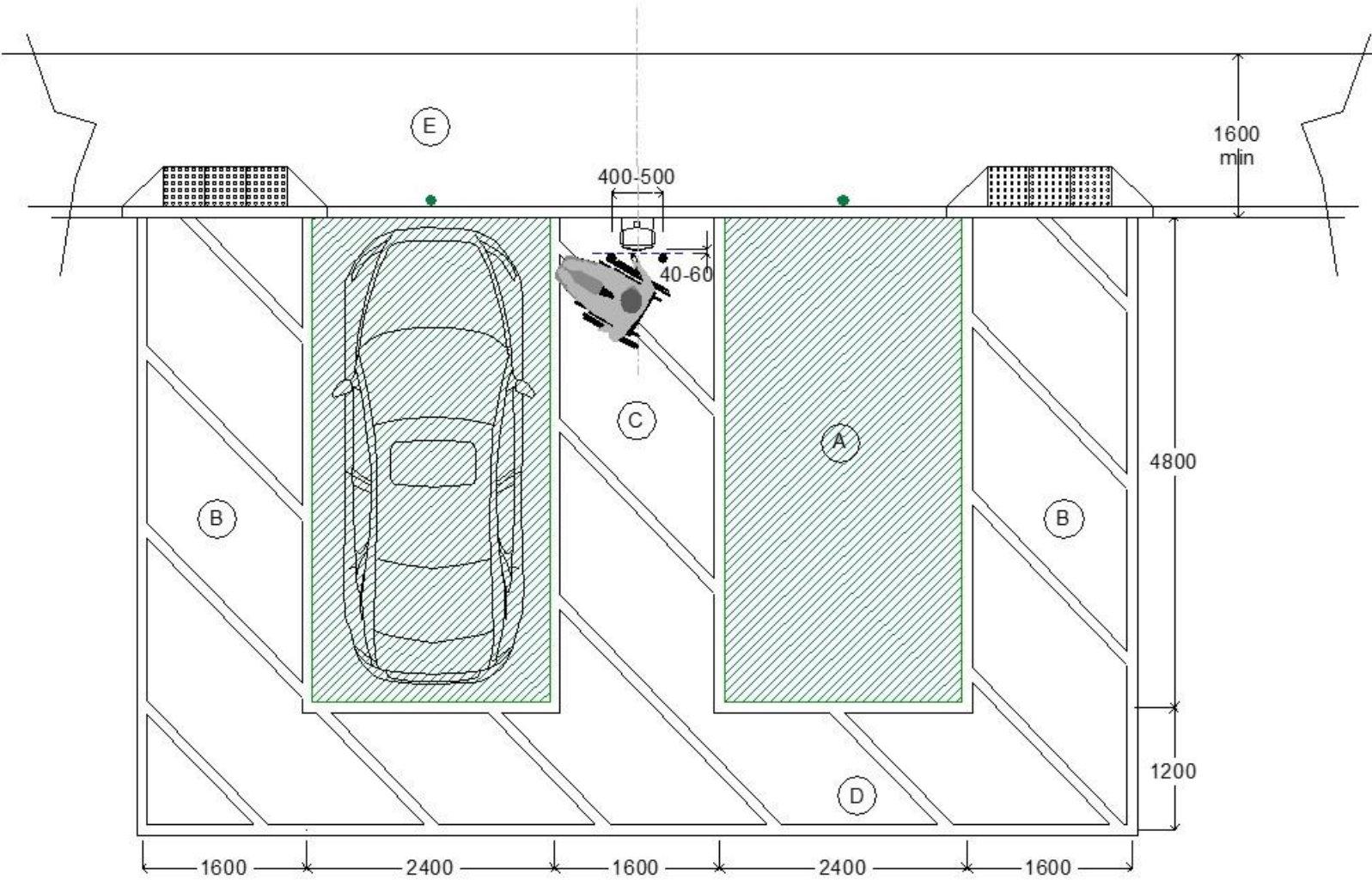


Figure 18 - PIR Accessibility Checklist 2B3a

Physical Installation Requirements: Border with Two Front Sockets in Aisle		Reference Drawing		
	Bay and Aisle Dimensions	2B3a		
Ref	Check	Yes	No	NA
A	Vehicle Bay size at least 2.4m width x 4.8m length			
B	Outer Access Aisle 1.6m width			
C	Centre Access Aisle 1.6m width			
D	Rear Access Aisle 1.2m width			
Charging Unit: Located in centre aisle in front of a kerb edge to a border, with sockets facing along centre aisle				
Ref	Check	Yes	No	NA
1	Is the charging unit mounted at the same level as the vehicle bays' surface and located on the longitudinal centreline of the Centre Access Aisle, shared by the two adjacent vehicle bays, as close as possible to the head of the aisle? If not, take the necessary actions to comply with Ref No's 2 to 6 below and required barrier protection, as far as practicable. Note: Where charging unit is mounted on a surface level higher than vehicle bay, a shorter or modified height mounting arrangement may be required to achieve the accessibility criteria at Ref's no's 3 to 6.			
2	Is the charging device located in the centre aisle as close as possible to the kerb with the charging socket(s) facing along the centre aisle?			
3	Are the charging sockets centreline height located at the preferred height of 850mm above the Centre Access Aisle?			

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4	Is the information screen located with the visible display between 1000mm and 1250mm above the Centre Aisle surface?			
5	Is the card reader located between 900mm and 1000mm above the Centre Aisle surface, and preferably directly above the socket(s) location?			
6	Is a cable rest/holder provided between the charging device mounting post and rear of the chargepoint protection bollards, at a height between 700mm and 750mm above the Centre Aisle surface?			

Barrier Protection				
<p>The following measures are provided in order to prevent / minimise the potential of vehicle encroachment onto a border or impact damage to the charging unit.</p> <p>Note: Bollards / bollard-signposts (other than chargepoint protection bollards) should be located within the border and as close as practicable to the kerb and positioned as indicated in the companion diagram. Chargepoint protection bollards should not exceed 100mm depth and width (or diameter).</p>				
Ref	Check	Yes	No	NA
1	Is there bollard / bollard-signpost provision as identified on the companion drawing to prevent vehicle overrun and provide charging device protection?			
2	Is an EV Charging Bay bollard-signpost located centrally at the head of each vehicle charging bay?			
3	<p>Are the two chargepoint protection bollards installed within the centre aisle as follows: with their height set between 600mm minimum and 650mm maximum above the centre aisle surface; located forward of the charging device face, such that the rear of the bollards are at least 40mm and preferably not more than 60mm forward of the power outlet socket(s) as far as practicable; and located with their centres between 200mm – 250mm each side of the centre aisle centreline?</p> <p>Note: The location of the protection bollards is important to minimise any obstruction to interaction with the socket connections and charger activation for wheelchair users, persons of short stature, and other persons with impaired mobility.</p>			

Diagram 2B3a: Border with two front sockets in centre aisle

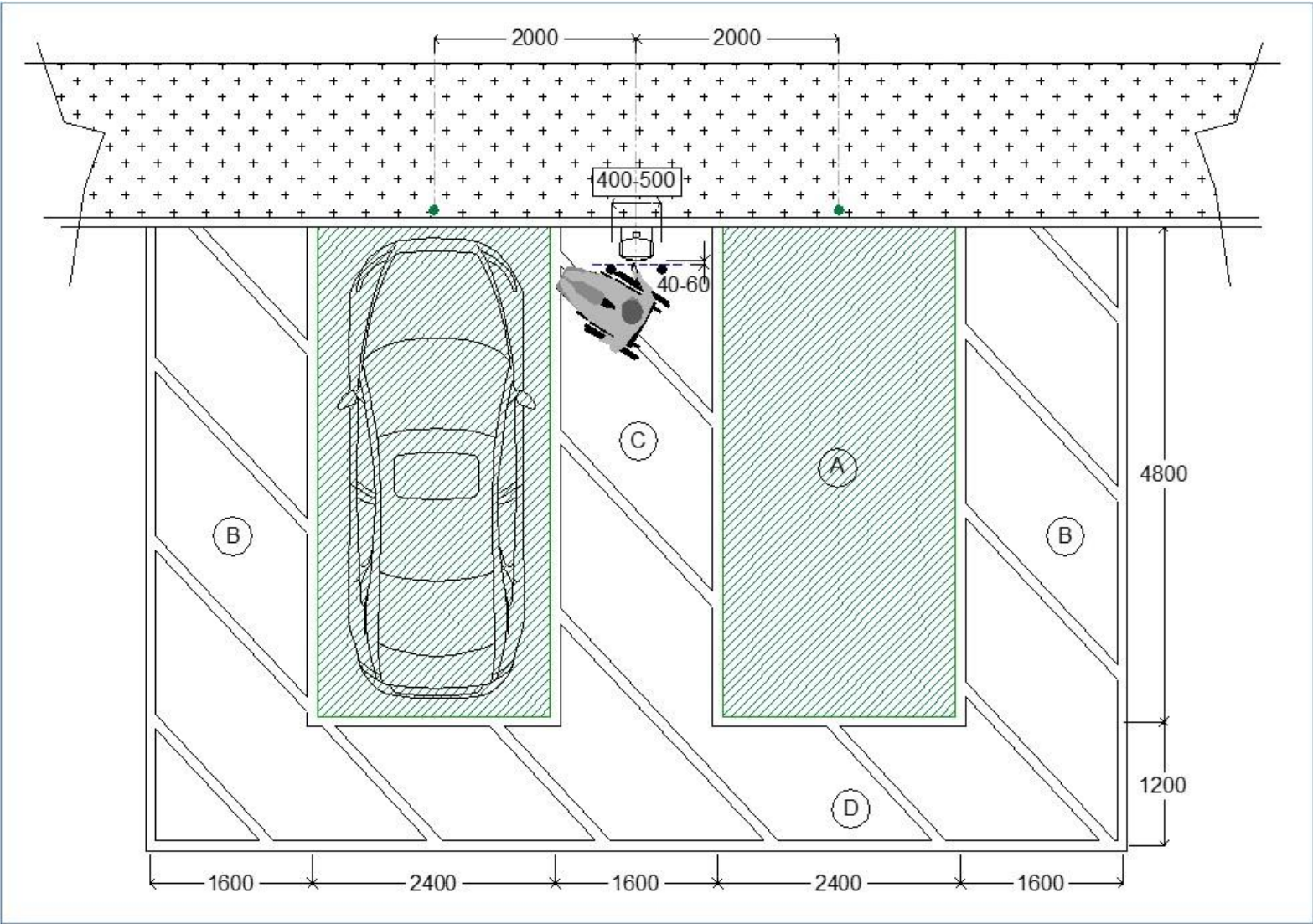


Figure 19 - PIR Accessibility Checklist 2B3b

Physical Installation Requirements: Border with Two Front Sockets Behind Kerb		Reference Drawing		
	Bay and Aisle Dimensions	2B3b		
Ref	Check	Yes	No	NA
A	Vehicle Bay size at least 2.4m width x 4.8m length			
B	Outer Access Aisle 1.6m width			
C	Centre Access Aisle 1.6m width			
D	Rear Access Aisle 1.2m width			
Charging Unit: Located in border behind kerb, with sockets facing along centre aisle				
Ref	Check	Yes	No	NA
1	Is the charging unit mounted at the same level as the vehicle bays' surface and located on the longitudinal centreline of the Centre Access Aisle, shared by the two adjacent vehicle bays, as close as possible to the head of the aisle? If not, take the necessary actions to comply with Ref No's 2 to 6 below and required barrier protection, as far as practicable. Note: Where charging unit is mounted on surface level higher than vehicle bay, a shorter or modified height mounting arrangement may be required to achieve the following accessibility criteria.			
2	Is the charging device located in border as close as possible to the kerb with the charging socket(s) facing along the centre aisle?			
3	Are the charging sockets centreline height located at the preferred height of 850mm above the Centre Access Aisle?			

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4	Is the information screen located with the visible display between 1000mm and 1250mm above the Centre Aisle surface?			
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5	Is the card reader located between 900mm and 1000mm above the Centre Aisle surface, and preferably directly above the socket(s) location?			
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6	Is a cable rest/holder provided between the charging device mounting post and rear of the chargepoint protection bollards, at a height between 700mm and 750mm above the Centre Aisle surface?			
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Barrier Protection				
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<p>The following measures are provided in order to prevent / minimise the potential of vehicle encroachment onto a border or impact damage to the charging unit.</p> <p>Note: Bollards / bollard-signposts (other than chargepoint protection bollards) should be located within the border and as close as practicable to the kerb and positioned as indicated in the companion diagram. Chargepoint protection bollards should not exceed 100mm depth and width (or diameter).</p>				
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Ref	Check	Yes	No	NA
1	Is there bollard / bollard-signpost provision as identified on the companion drawing to prevent vehicle overrun and provide charging device protection?			
2	Is an EV Charging Bay bollard-signpost located centrally at the head of each vehicle charging bay?			

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3	<p>Are the two chargepoint protection bollards installed within the centre aisle as follows: with their height set between 600mm minimum and 650mm maximum above the centre aisle surface; located forward of the charging device face, such that the rear of the bollards are at least 40mm and preferably not more than 60mm forward of the power outlet socket(s) as far as practicable; and with the bollard centres positioned between 200mm – 250mm each side of the centre aisle centreline?</p> <p>Note: The location of the protection bollards is important to minimise any obstruction to interaction with the socket connections and charger activation for wheelchair users, persons of short stature, and other persons with impaired mobility. However where larger single socket charging devices are used, or separation between the devices is increased by the size or location of the mounting base, the distance between the protection bollards may need to increase to compensate and minimise obstruction on approach to the devices.</p>			
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Diagram 2B3b: Border with two front sockets behind kerb

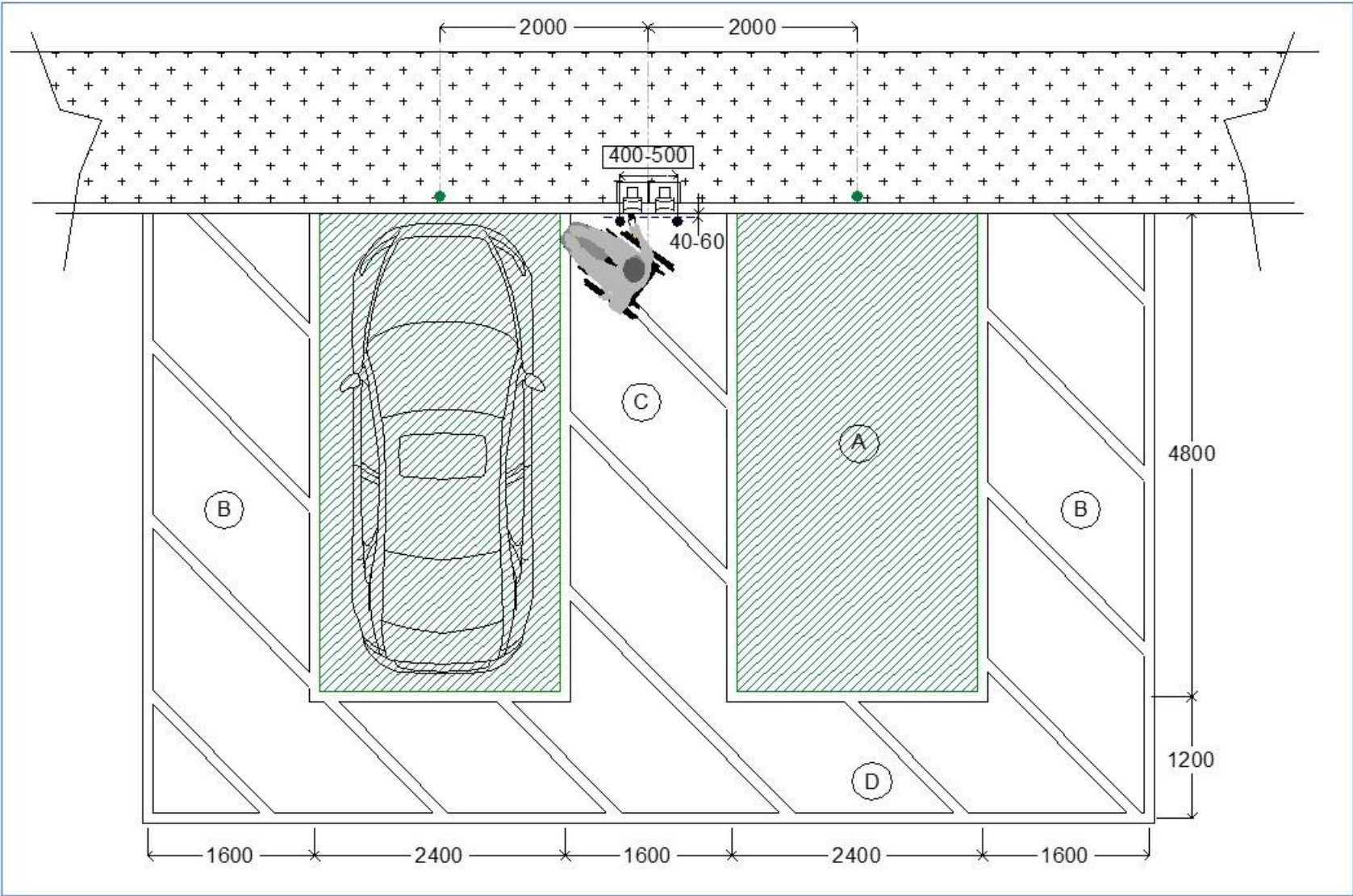


Figure 20 - PIR Accessibility Checklist 2B4a

Physical Installation Requirements: Dropped Footpath with Two Front Sockets		Reference Drawing		
	Bay and Aisle Dimensions	2B4a		
Ref	Check	Yes	No	NA
A	Vehicle Bay size at least 2.4m width x 4.8m length			
B	Outer Access Aisle 1.6m width			
C	Centre Access Aisle 1.6m width			
D	Rear Access Aisle 1.2m width			
E	Footpath at head of bays 1.6m minimum depth			
Charging Unit: Located on pedestrian route at same level as vehicle bays, with sockets facing along centre aisle				
Ref	Check	Yes	No	NA
1	Is the raised surface lowered along its length across the width of vehicle charging bays and side aisles to the same level as the vehicle bay(s)? (Preferred solution) If no refer to Checklist 2B2a and Reference Drawing 2B2a			
2	Has the Local Authority approved plan for the proposed lowering of footpath, including any required contrasting demarcation paving, and any required changes to localised drainage to minimise potential of local ponding or flooding?			

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3	Is contrasting demarcation paving provided along the entire section of the lowered route? (To aid identification of a change in pedestrian route access width for people with a visual impairment to encourage their avoidance of area with no kerb and potential obstructions, such as by bollards, signposts, charging devices, or lighting columns.)			
4	Are the extremities of charging device and mounting post base contained within the contrast Demarcation Zone to minimise projection into the adjacent pedestrian route, with the chargepoint located as close as possible to the kerb and the charging sockets facing the centre aisle? Note: This will likely require the charging device mounting post base to be located as close as possible to the kerb block and in some cases may require replacement of existing kerb block with a narrower depth of kerb to facilitate the sockets being within reach of wheelchair users, persons of short stature, and other persons with impaired mobility.			
5	Are the charging sockets centreline height located at preferred height of 850mm above Centre Aisle surface?			
6	Is the information screen located with the visible display between 1000mm and 1250mm above the Centre Aisle surface?			
7	Is the card reader located between 900mm and 1000mm above the Centre Aisle surface, and preferably directly above the socket(s) location?			
8	Is a cable rest/ holder provided between the charging device mounting post and rear of the chargepoint protection bollards, at a height between 700mm and 750mm above the Centre Aisle surface?			
9	Is a minimum clear width of 1200mm maintained behind and past the charging unit and any obstruction along the pedestrian route, for a distance of at least 2m length at each side?			
10	Does any reduction in clear width continue for less than 2m along the Cross Aisle / route length?			
Barrier Protection				
The following measures are provided in order to prevent / minimise the potential of vehicle encroachment onto pedestrian route or impact damage to the charging unit. Note: Bollards / bollard-signposts should be located as close as practicable to the kerb and positioned as indicated in the companion diagram. Bollard protection to charging device location should not exceed 100mm depth and width (or diameter) and be located as indicated on the companion drawing.				

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Ref	Check	Yes	No	NA
1	Is there bollard provision as identified on the companion drawing to provide charging device protection?			
2	Is an EV Charging Bay bollard-signpost located centrally at the head of each parking bay?			
3	<p>Are the two chargepoint protection bollards installed with their height set between 600mm minimum and 650mm maximum above the centre aisle surface, forward of the charging device face, such that the rear of the bollards are at least 40mm and preferably not more than 60mm forward of the power outlet socket(s) as far as practicable, and located with their centres between 200mm – 250mm each side of the centre aisle centreline?</p> <p>Note: This is important to minimise any obstruction to interaction with the socket connections and charger</p>			

Diagram 2B4a: Dropped footpath with two front sockets

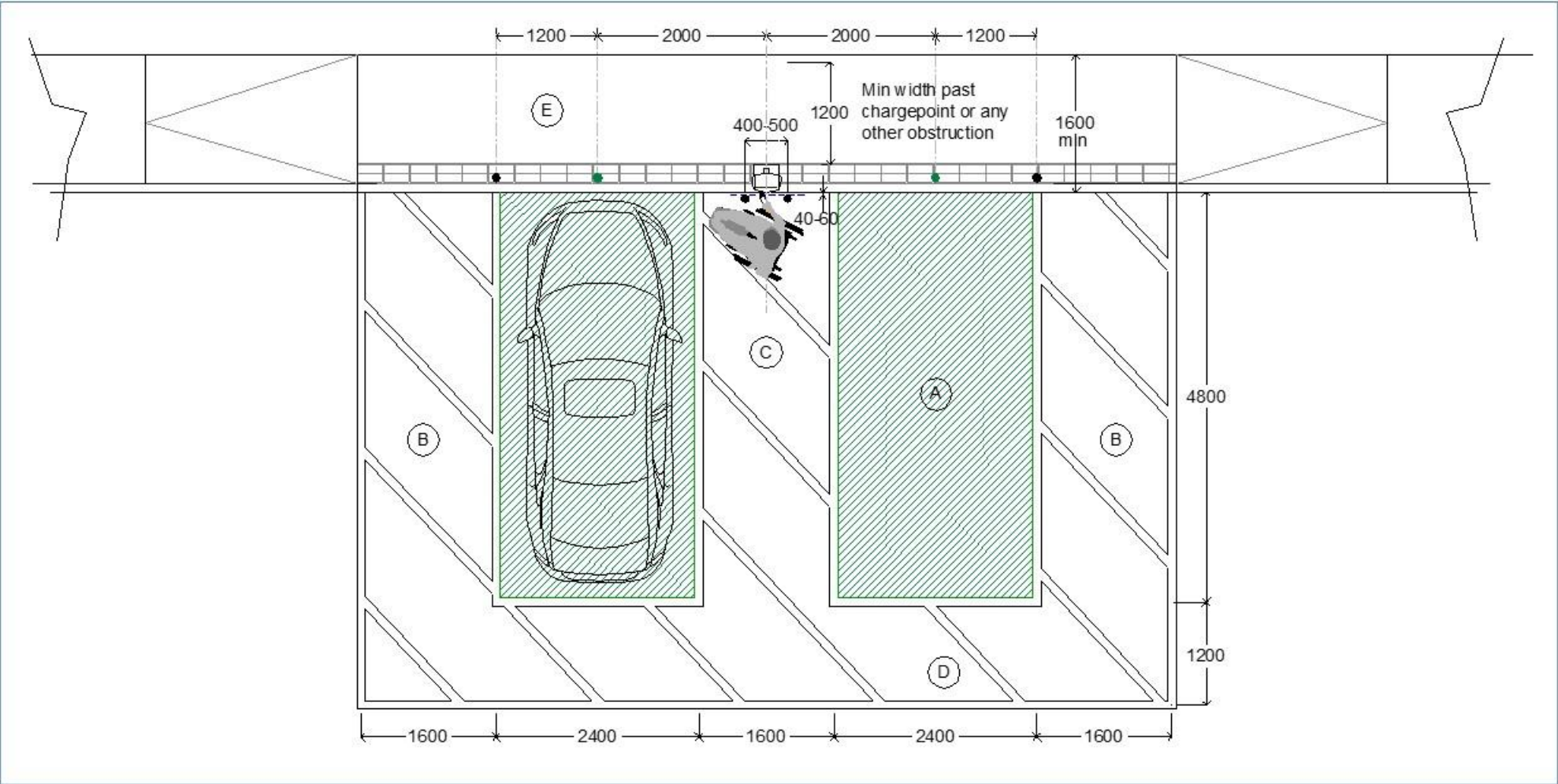


Figure 21 - PIR Accessibility Checklist 2B4b

Physical Installation Requirements: Dropped Footpath with Two Side Sockets			Reference Drawing		
	Bay and Aisle Dimensions		2B4b		
Ref	Check	This accommodates use of EO Genius as two side socket devices on single pole as well as PodPoint public chargers.	Yes	No	NA
A	Vehicle Bay size at least 2.4m width x 4.8m length				
B	Outer Access Aisle 1.6m width				
C	Centre Access Aisle 1.6m width				
D	Rear Access Aisle 1.2m width				
E	Footpath at head of bays 1.6m minimum depth				
Charging Unit: Located on pedestrian route at same level as vehicle bays, with sockets facing along pedestrian route					
Ref	Check		Yes	No	NA
1	Is the raised surface lowered along its length across the width of vehicle charging bays and side aisles to the same level as the vehicle bay(s)? (Preferred solution) If no refer to Checklist 2B2a and Reference Drawing 2B2a				
2	Has the Local Authority approved plan for the proposed lowering of footpath, including any required contrasting demarcation paving, and any required changes to localised drainage to minimise potential of local ponding or flooding?				

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3	Is contrasting demarcation paving provided along the entire section of the lowered route? (To aid identification of a change in pedestrian route access width for people with a visual impairment to encourage their avoidance of area with no kerb and potential obstructions such as by bollards, signposts, charging devices, or lighting columns.)			
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Charging Unit: Two Single-Socket Side-Facing Devices or a Double-Socket Side-Facing Device				
Ref	Check	Yes	No	NA
4	Are the extremities of the charging device and mounting post base contained within the Demarcation Zone to minimise projection into the adjacent pedestrian route and located in front of the centre aisle? Note: This may require the charging device mounting post base to be located as close as possible to the kerb block and in some cases may require replacement of existing kerb block with a narrower depth of kerb.			
5	Are the charging sockets centreline height located at preferred height of 850mm above Centre Aisle surface?			
6	Is the information screen located with the visible display between 1000mm and 1250mm above the Centre Aisle surface?			
7	Is the card reader located between 900mm and 1000mm above the Centre Aisle surface, and preferably directly above the socket(s) location?			
8	Is a cable rest/holder provided between the charging device mounting post and rear of the chargepoint protection bollards, at a height between 700mm and 750mm above the Centre Aisle surface?			
9	Is a minimum clear width of 1200mm maintained behind and past the charging unit and any obstruction along the pedestrian route, for a distance of at least 2m length at each side?			
10	Does any reduction in clear width continue for less than 2m along the Cross Aisle / route length? .			
Barrier Protection				
The following measures are provided in order to prevent / minimise the potential of vehicle encroachment onto pedestrian route or impact damage to the charging unit. Note: Bollards / bollard- signposts should be located as close as practicable to the kerb and positioned as indicated in the companion diagram. Bollard protection to charging device location should not exceed 100mm depth and width (or diameter) and be located as indicated on the companion drawing.				
Ref	Check	Yes	No	NA

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1	Is there bollard provision as identified on the companion drawing to provide charging device protection?			
2	Is an EV Charging Bay bollard-signpost located centrally at the head of each parking bay?			
3	Are the two chargepoint protection bollards installed with their height set between 600mm minimum and 650mm maximum above the centre aisle surface, located with their centres between 200mm – 250mm each side of the centre aisle centreline, and located as close as possible to the kerb in the centre aisle? Note: This is important to minimise any obstruction to interaction with the socket connections and charger activation for wheelchair users, persons of short stature, and other persons with impaired mobility.			

Diagram 2B4b: Dropped footpath with two side sockets

