



# CHARIN

## Position Paper of Charging Interface Initiative e.V.

Geometric Requirements for Charging Stations

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### Coordination Office

#### **CharIN e. V.**

c/o innos – Sperlich GmbH  
Schiffbauerdamm 12  
10117 Berlin

### Contact

André Kaufung

Phone: +49.30.288 8388-0  
Fax: +49.30.288 8388-19  
Mail: [coordination@charinev.org](mailto:coordination@charinev.org)  
Web: [www.charinev.org](http://www.charinev.org)



## Initial Situation

CharIN is dedicated to develop and establish the Combined Charging System (CCS) as the standard for charging Battery Electric Vehicles (BEVs) of all kinds.

The goal of CharIN is to create a simple and consistently positive customer experience during a charging process. In addition to interoperability, the geometry of charging stations and parking areas in particular can pose a challenge in this respect.

The construction of charging stations and the planning of parking areas on the basis of globally harmonized standards facilitates the improvement of the customer experience during the charging process in public places. This position paper represents a collection of practical observations with the overall goal of enriching the future development of the charging infrastructure with customer-oriented solutions. These should be taken into account in the planning and construction by future operators across all industries.

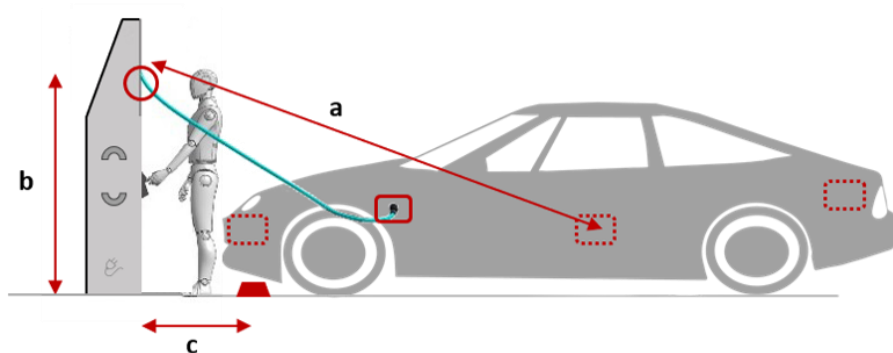
This position paper should primarily address the possible challenges with regard to

- 1) the geometry at the charging station and
- 2) the installation layout of charging stations

and, based on that, define consolidated and globally valid basic requirements for geometry.

## Problem Description

### 1) Geometry at the Charging Station



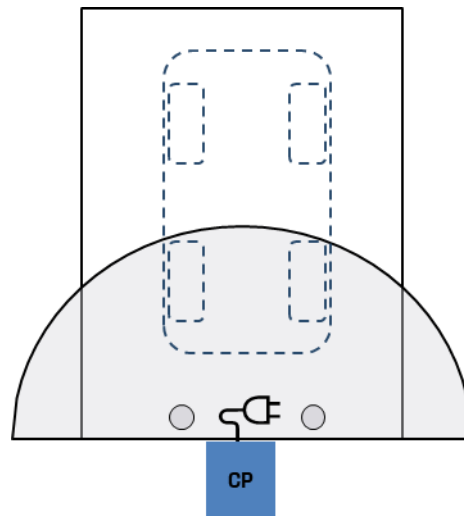
*Figure 1: Ergonomic properties*

The following three problems regarding the ergonomic properties of the charging station and the wheel-stops were identified during extensive testing:

- a) cable length
- b) height cable/plug connection
- c) distance between charging post and bollard or wheel-stops

#### a) Cable length

The charging plug of electric vehicles can be located in a wide variety of places. Therefore, the cable length has to be located in a way that guarantees to reach any point on a vehicle. Thereby the cable should not be tensioned in order to insert the plug into the vehicle with sufficient flexibility. This makes handling easier for the customer and allows operation with one hand.



*Figure 2: Cable radius*

To meet these requirements, a cable length of at least 4.2 m should be provided. Floor cables on the ground are to be avoided.



*Figure 3: Insufficient cable length*

b) Height of the cable suspension

A high cable stop at the charging station enables sufficient cable length without contact to the ground. This prevents pollution of the cable, provides protection against moisture and prevents the cable from being damaged, for example by inadvertently driving over it. In addition, the cable suspension takes into account the accessibility aspect, prevents any physical contact with the customer or the car and

provides convenient handling. In terms of cable length and suspension height, the application of a cable management system and a grip height of 85 -105 cm is recommended.



*Figure 4: Cable suspension height*

c) Distance between charging station and bollard or wheel-stops

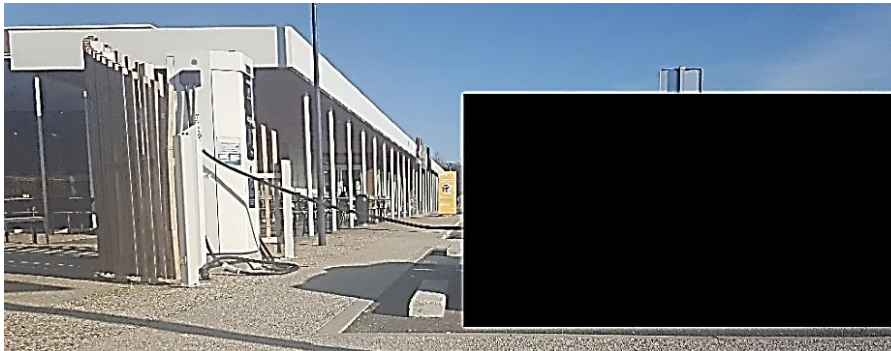
I. Wheel-stops

The wheel-stop assures a certain distance between the car and the charger, which helps to prevent a charger to be damaged by the car. It can also provide space for the user to operate the charger in a convenient way, especially when the charger's display is oriented towards the car in the parking bay. A free area of at least 70 cm should be maintained between the vehicle and the charging station. The free area should be in front of the charging station display. This can be next to or behind the charger, as well as between the vehicle and the charger. When the display is oriented towards the car in the parking bay, the user should be able to unplug the connector and put it back into the charger's connector holder without touching the car.



*Figure 5: Wheel-stops implementations*

Wheel-stops can be mounted on the parking area to protect such charging stations and also to facilitate the approach to the charging station. However, damage to the vehicle can also be caused. In some cases, the height of the Wheel-Stops can lead to damage especially for low-lying vehicles. In order to prevent such damages, some low-lying vehicles will not be able to come close enough to the charging station. The unintended increase of distance can have the effect that cables are not long enough. Therefore, a maximum wheel-stops height of 5 cm is recommended.



*Figure 6: Footpath between charging station and vehicle*

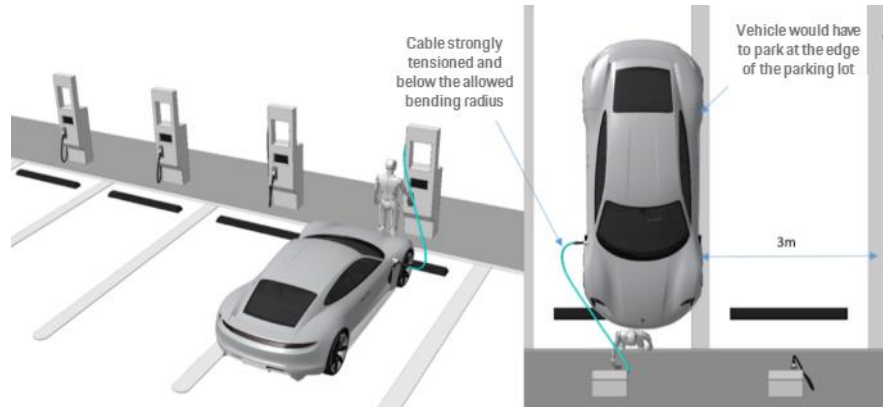
## II. Bollard

The use of bollards enables the reduction of the distance between the charging station and the vehicle to a minimum while providing the necessary protection for the charging station at the same time. The use of bollards is preferable to the use of wheel-stops for a variety of reasons. Damage to the vehicle is avoided, greater proximity to the charging station is ensured and the potential risk of vehicle damage due to a critical height of wheel-stops is mitigated.



*Figure 7: Installation of bollards to protect the charging stations*

## 2) Installation layout of charging stations



*Figure 8: Installation layout*

In addition to different layouts for orientation at a charging station, there are regulatory conditions that complicate the unambiguous assignment of charging points to a parking space.

Insufficient dimensions of the car park or a poor layout can lead to a strongly tensioned cable or a cable too closely fitted to the vehicle. In addition to the fact that it makes operation more difficult for the customer, the contact can also damage the vehicle. As a result, customers are forced to place the vehicle on the outer edge of the parking space.



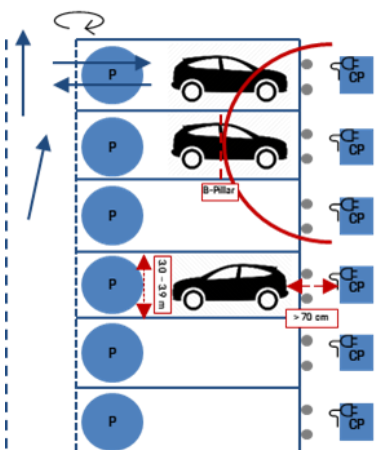
*Figure 9: Parking regulation*

The customer experience can be improved through a charging park layout. Instead of building car parks where wheel-stops or bollards are required, drive-through solutions can be implemented. As with petrol stations, customers can drive to a charging point that is optimally located for them. This reduces the risk of the cable being too short or damaging the vehicle.



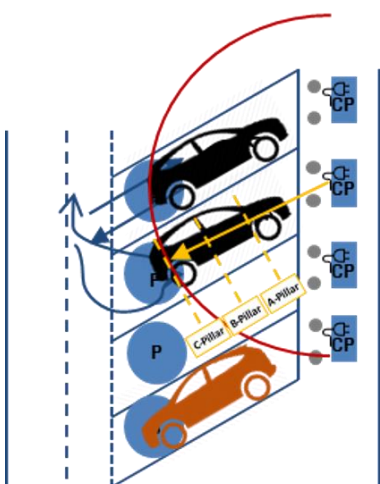
Figure 10: Drive-through solutions

## Schematic illustration of different location layouts



### End zone - 90° parking

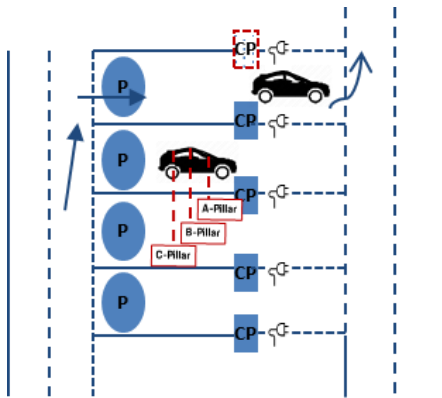
- Bollards or wheel-stops required
- Cable length must extend to the B-pillar on both sides of the vehicle
- Economical in terms of space and costs
- Free space in front of display to be considered
- Parking stand width between 3.0 and 3.9 m
- Charging with trailer is difficult
- To guarantee access to all inlet positions, reverse parking needs to be ensured (otherwise 6m cable length recommended)



### End zone - 60° parking (fishbone layout)

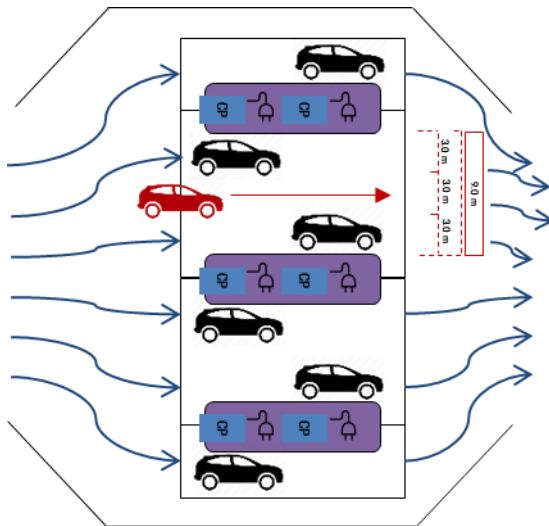
- Bollards or wheel-stops required
- Cable length must extend to the C-pillar on both sides of the vehicle
- Free space in front of display to be considered
- Inlet at B/C pillar difficult to reach
- Reverse parking poses problem / is not allowed
- To guarantee access to all inlet positions a cable length of 6.0 m is recommended





### Drive-through – Starter Gate

- No bollards or wheel-stops required
- Charging point available on both sides
- Short cable length sufficient for different inlet positions
- Inlet on A/B/C pillar easily accessible
- Increased space requirement
- Charging with trailer possible



### Drive-through - Petrol station design

- No bollards or wheel-stops required
- Charging point available on both sides
- Short cable length sufficient for different inlet positions
- Inlet on A/B/C pillar easily accessible
- Increased space requirement
- Charging with trailer possible
- Parking stand width (best case) : 9.0 m between the shelves of two charging islands (2 x 3.0 m parking space width + 1 x 3.0 m alley)