

Balustrades regulations compilation

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Introduction

This document is a summary of requirements and rules regarding balustrades available in BBR (Swedish National Board of Housing, Boverket's building regulations 2011:6, with additions to 2020:4) and in Eurocodes with Swedish application EKS11 (BFS2019:1 EKS11)

When the balustrades are needed

Ramps and stairs in public premises should have handrails on both sides. Other ramps and stairs with **more than three steps** should have handrails on both sides. Lower ramps and stairs should have at least one handrail according to BBR. (8:2322, BBR)

Balustrades dimensions

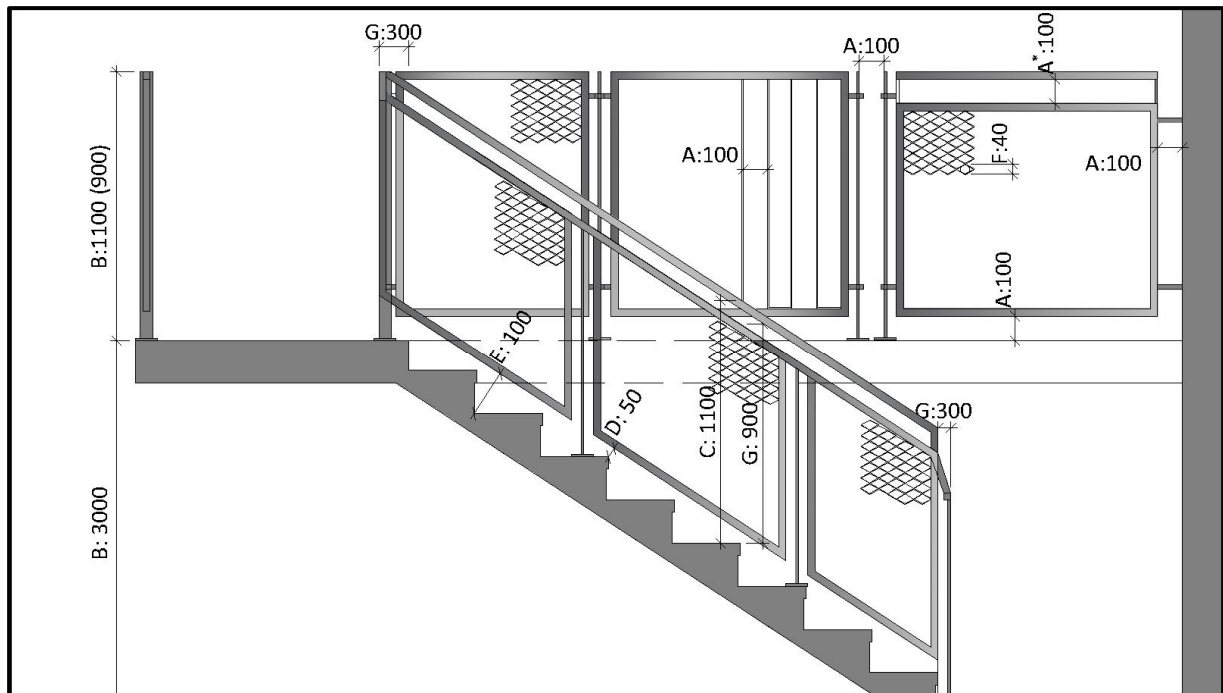


Figure 1. Illustration with dimensions for balustrades according to Boverket's building regulations 2011:6, BBR. Explanation of the dimension see, se A-G below.

A: Applies to balustrades where children may present²: A free measure not more than 100 mm. Applies between the lower edge of a balcony balustrade and the balcony floor, between the balustrade and the wall, between different balustrades. (8:2321, BBR)

A*: Applies to balustrades where children may present²: Horizontal openings above the front of a balcony should be designed to ensure children cannot get their heads stuck. Openings in the range 110–230 mm should be avoided.(8:2321, BBR)

B: Balustrades on flights should be not less than 0.9 meters high. If an opening on the side of a flight of stairs is greater than 0.4 meters in any one lengthwise direction and the height of the storey is more than 3.0 meters, measured from floor to floor, the balustrade should be at least 1.1 meters. Balustrades on landings outside of individual dwellings and balustrades on balconies and access balconies should be at least 1.1 meters high.

Balustrades on landings in an individual dwelling should be not less than 0.9 meters high. If the floor height is greater than 3.0 meters, measured from floor to floor, the balustrade should be at least 1.1 meters. (8:2321, BBR)

C: Balustrades on stair races should be not less than 0.9 meters high. Balustrades on flights should be not less than 0.9 meters high. If an opening on the side of a flight of stairs is greater than 0.4 meters in any one lengthwise direction and the height of the storey is more than 3.0 meters, measured from floor to floor, the balustrade should be at least 1.1 meters. (8:2321, BBR)

D, E: Applies to balustrades where children may present²: The clear space between the lower edge of a stair balustrade and the nosing of an individual stair should not be greater than 50 mm. The clear vertical space between the bottom of a balustrade on stairs and a landing or floor should not be greater than 100 mm. (8:2321, BBR)

F: Applies to balustrades where children may present²: Maximum opening diameter 40 mm (Annex A). Railings on balconies, trap floors and stair runs should, up to a height of 0.8 meters, be designed so that they cannot be climbed on. (8:2321, BBR)

G: Handrails should have a height of 0.9 meters. It should also be possible to hold the handrail past the attachment. They should extend beyond the beginning and end of the stairs or ramp by at least 30 cm. (8:2322, BBR)

Ramps and stairs in public premises should have handrails on both sides. Other ramps and stairs with **more than three steps** should have handrails on both sides. Lower ramps and stairs should have at least one handrail according to BBR. (8:2322, BBR)

In an individual dwelling, angled and curved stairs that are less than 0.9 meters wide can be arranged without an inner balustrade if there is instead a trellis, center post or something else that is easy to grasp. (8: 2322, BBR)

Child safety

² The term spaces where children may be present refers to such rooms, parts of rooms or spaces where children of pre-school age are allowed to be, or may be, present without permanent supervision of adults. Examples of such spaces include dwellings and common spaces in residential buildings such as corridors, stairways, laundry rooms and recreational premises. This also includes guest rooms in hotels and spaces in nursery schools, child care centres, children's clinics, libraries, shopping centres and other similar premises. Usually this does not apply to workplaces. (8:11, BBR)

Balustrades in spaces where children may spend time shall be designed to ensure children cannot injure themselves as a result of climbing or crawling. Balustrades should have the dimensions and designs shown in BBR, A-G above. Balustrades should not be climbable for small children, but there are no special dimensions specified in BBR. It's up to the developer to make an assessment of what may be considered appropriate. (Boverket.se, 2020)¹

¹ <https://www.boverket.se/sv/PBL-kunskapsbanken/regler-om-byggande/boverkets-byggregler/sakerhet-vid-anvandning/racken-och-ledstanger/>

To achieve non-climbable railing, a maximum opening diameter of 40 mm is required according to investigation by Jacob rope system: "Climbability of Webnet used as vertical safety net structure, 05 mai 2020". See Annex A.

²See text market with 2 in chapter child safety

Actions on balustrades

The loads acting on a balustrade is wind load and imposed loads, see Figure 2. Loads should be combined according to equation 6.10b in Table B-3 EKS11.

$$\gamma_d * 0,89 * 1,35 * G_{kj,sup} + 1 * G_{kj,inf} + \gamma_d * 1,5 * Q_{k,1} + \gamma_d * 1,5 * \Psi_{0,i} * Q_{k,1} \quad (\text{When variable load is unfavourable})$$

$$\gamma_d * 0,89 * 1,35 * G_{kj,sup} \quad (\text{When variable load is favourable})$$

In case of favourable self-weight: " $\gamma_d * 0,89 * 1,35$ " should be replaced with 1,0.

The reliability class for balustrades can be adopted on the safe side to class 3, major risk of serious personal injury.

Safety class 3:

$$\gamma_d = 1,0.$$

(14 § BFS2019:1 EKS11)

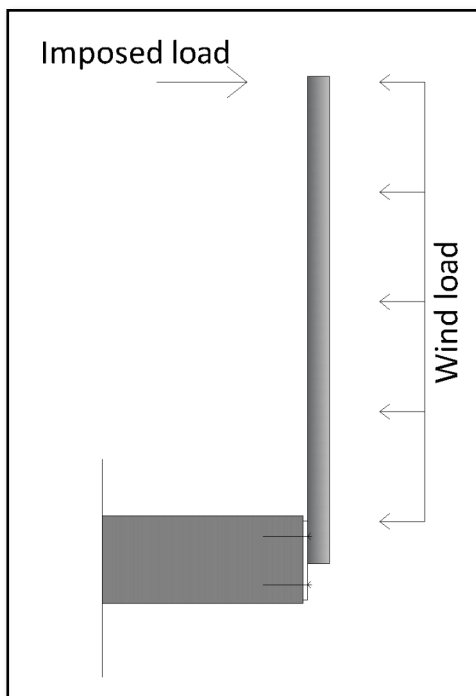


Figure 2. Actions on balustrades

Variable load, imposed load

The imposed load is determined in Eurocode 1, SS-EN 1991-1-1 with the Swedish application EKS11 (BFS2019:1 EKS11). The characteristic values of the line load acting at the height of the partition wall or parapets but not higher than 1,20 m should be taken from Table 6.12 in EKS11, see Table 1 below.

Table 1. Imposed load on balustrades, characteristic values, see Table 6.12 SS-EN 1991-1-1 Ψ_0 according to Table B-1 in EKS11.

Category of loaded areas	Load value	Unit	Ψ_0
A- Domestic and residential activities	0,5	kN/m	0,7
B- Office areas	0,5	kN/m	0,7

C1- Areas where people may congregate- Areas with tables	0,5	kN/m	0,7
C2- Areas where people may congregate- Areas with fixed seats	1	kN/m	0,7
C3- Areas where people may congregate- Areas without obstacles for moving people	1	kN/m	0,7
C4- Areas where people may congregate- Areas with possible physical activities	1	kN/m	0,7
C5- Areas where people may congregate- Areas with susceptible to large crowds	3	kN/m	0,7
D- Shopping areas	1	kN/m	0,7
E- Storage areas	2	kN/m	1,0

Variable load, wind load

The wind load is calculated depending on the building height, terrain category and geographical location of the building, according to Eurocode 4, SS-EN 1991-1-1-4 with Swedish application EKS11.

At balustrades where the wind and the imposed load operate in different directions, the wind can in most cases be assumed to be favorable and does not need to be included according to equation 6.10b in Table B-3 EKS11.

Wind loads on a railing with rope systems can in principle be disregarded because only about 16 % of the surface is covered. If the rope system can be exposed to snow and ice, the wind load may need to be considered.