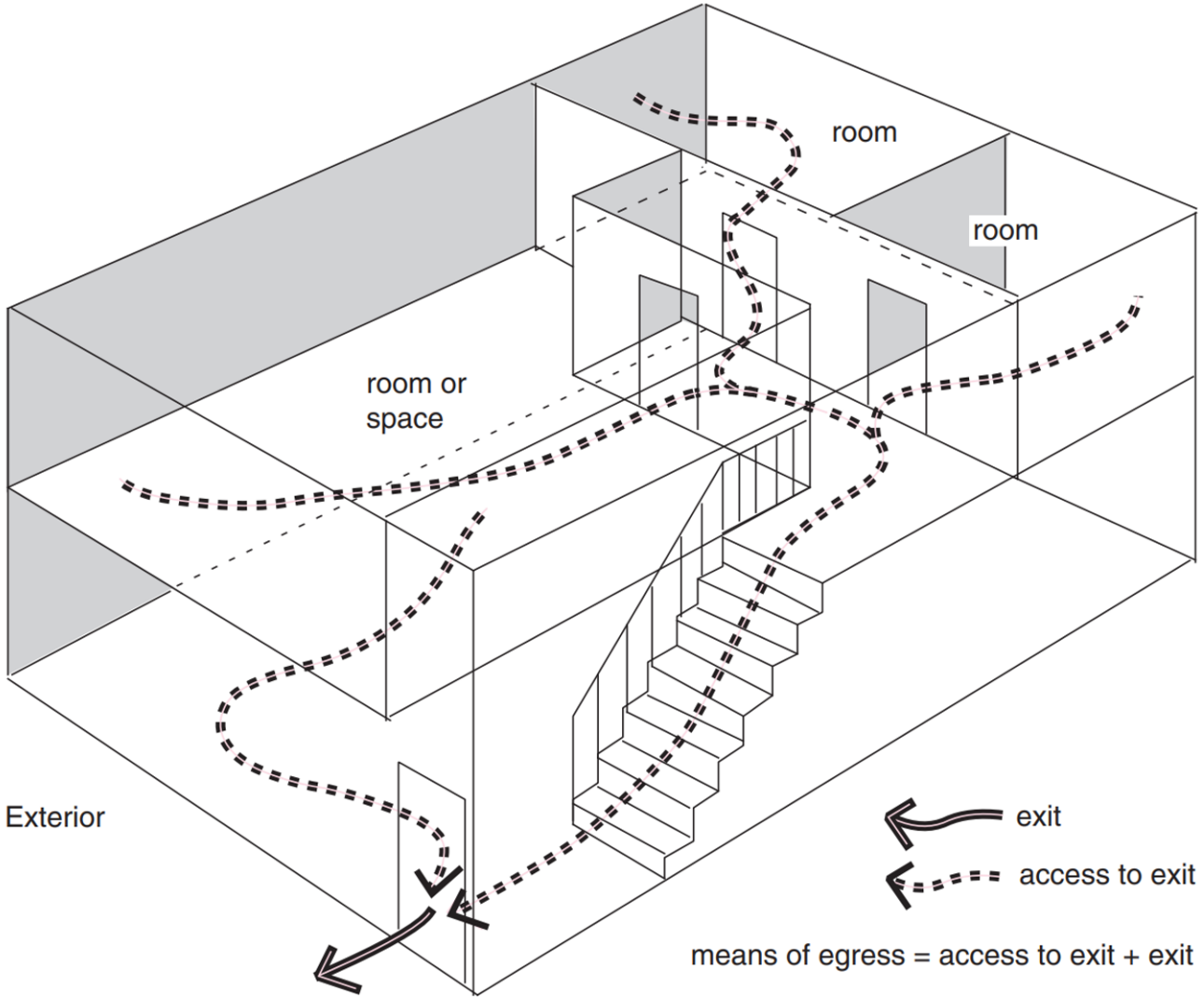
Plumbing Officials Association of British Columbia

Webinar – Guards & Handrails – Revisited

Presented by: Tony Bartko, BTech, BCQ

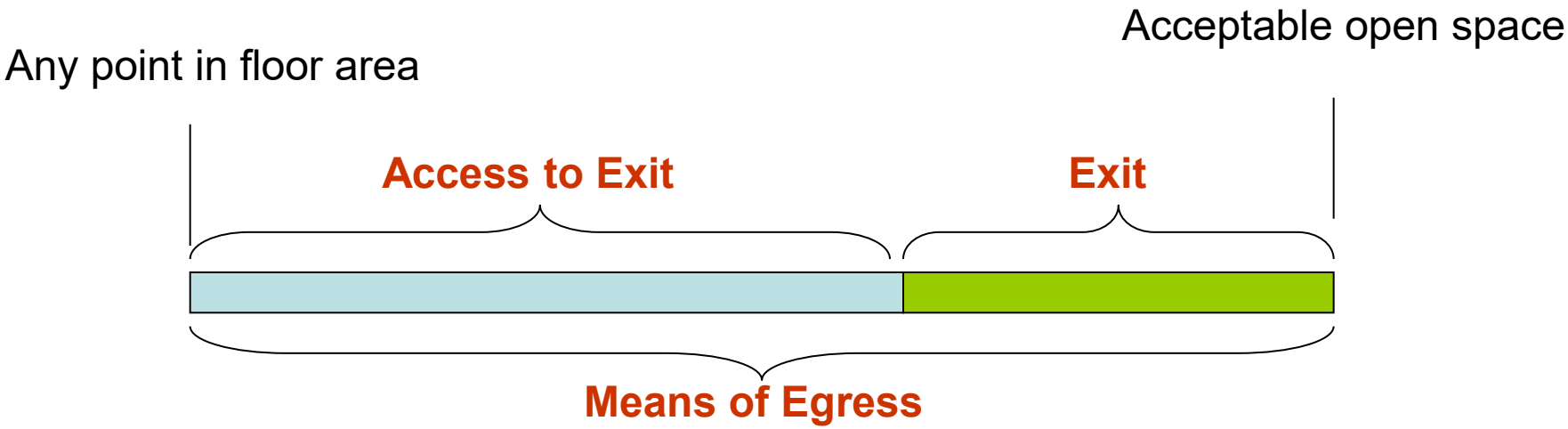
AGENDA

1. Egress vs Exit
2. Part 3 / Part 9
3. Handrails – serving stairs
4. Permitted projections into required egress/exit width
5. Guards
6. Case Studies

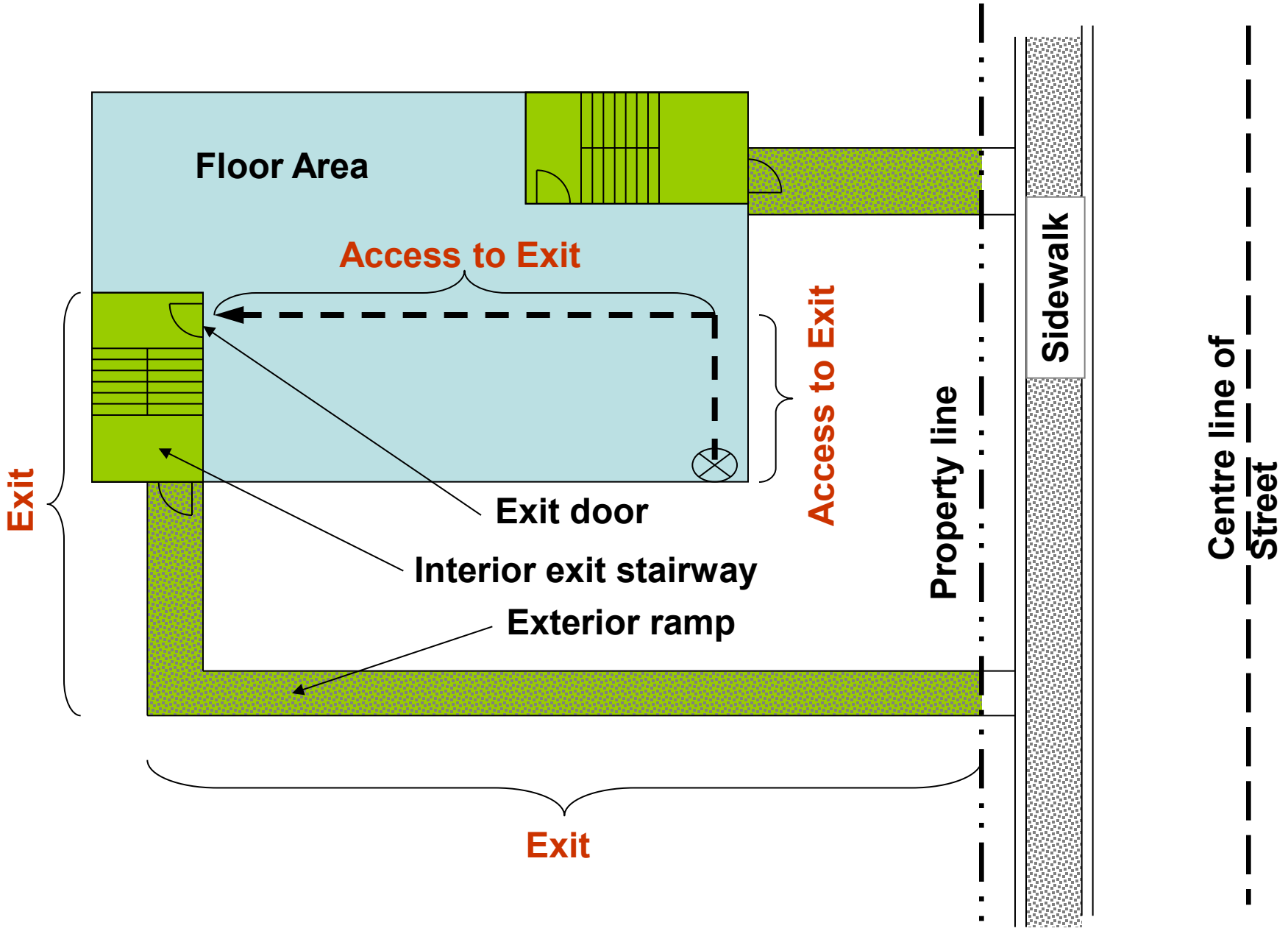


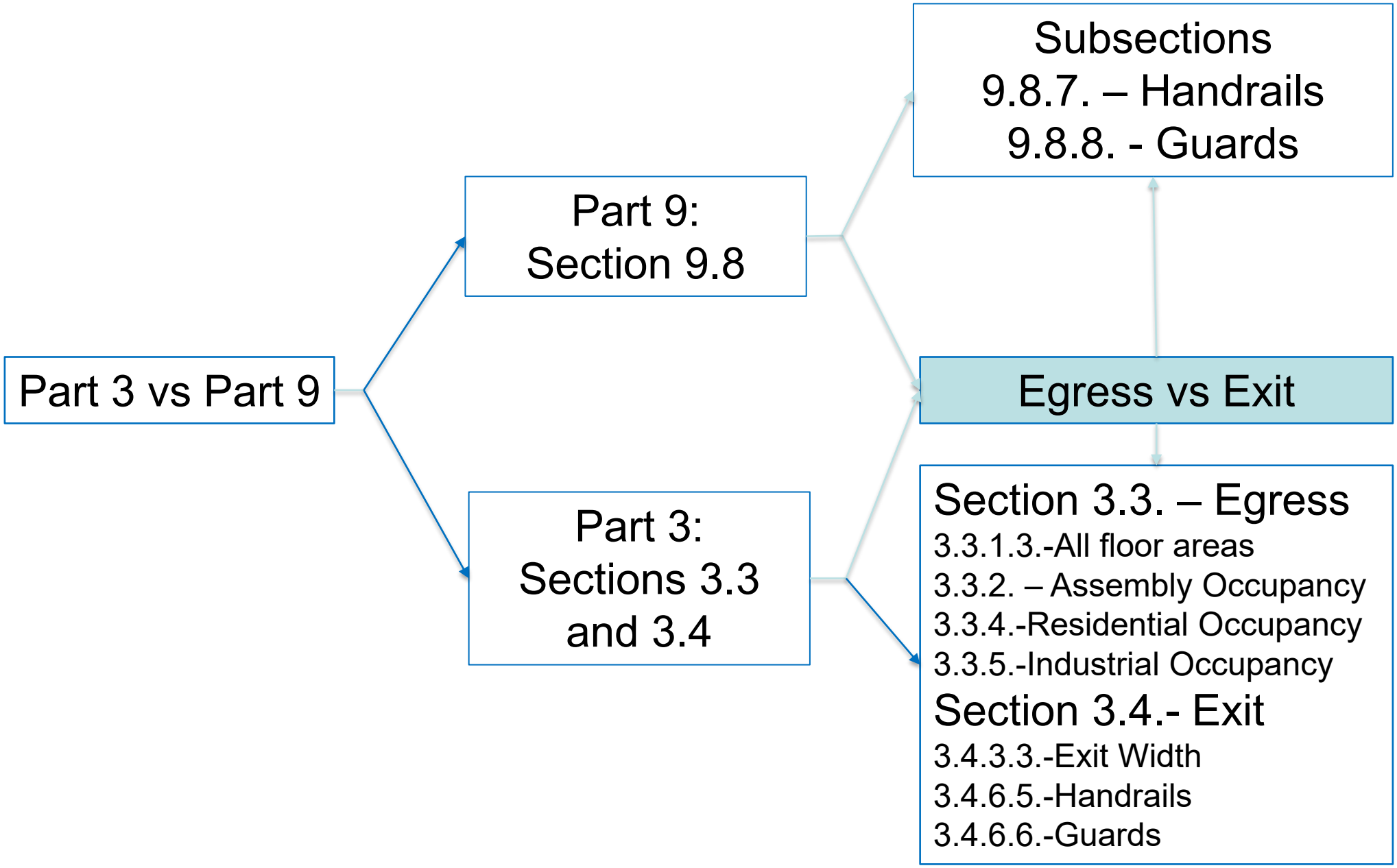
Means of egress means a continuous path of travel provided for the escape of persons from any point in a building or contained open space to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare. Means of egress includes exits and access to exits.

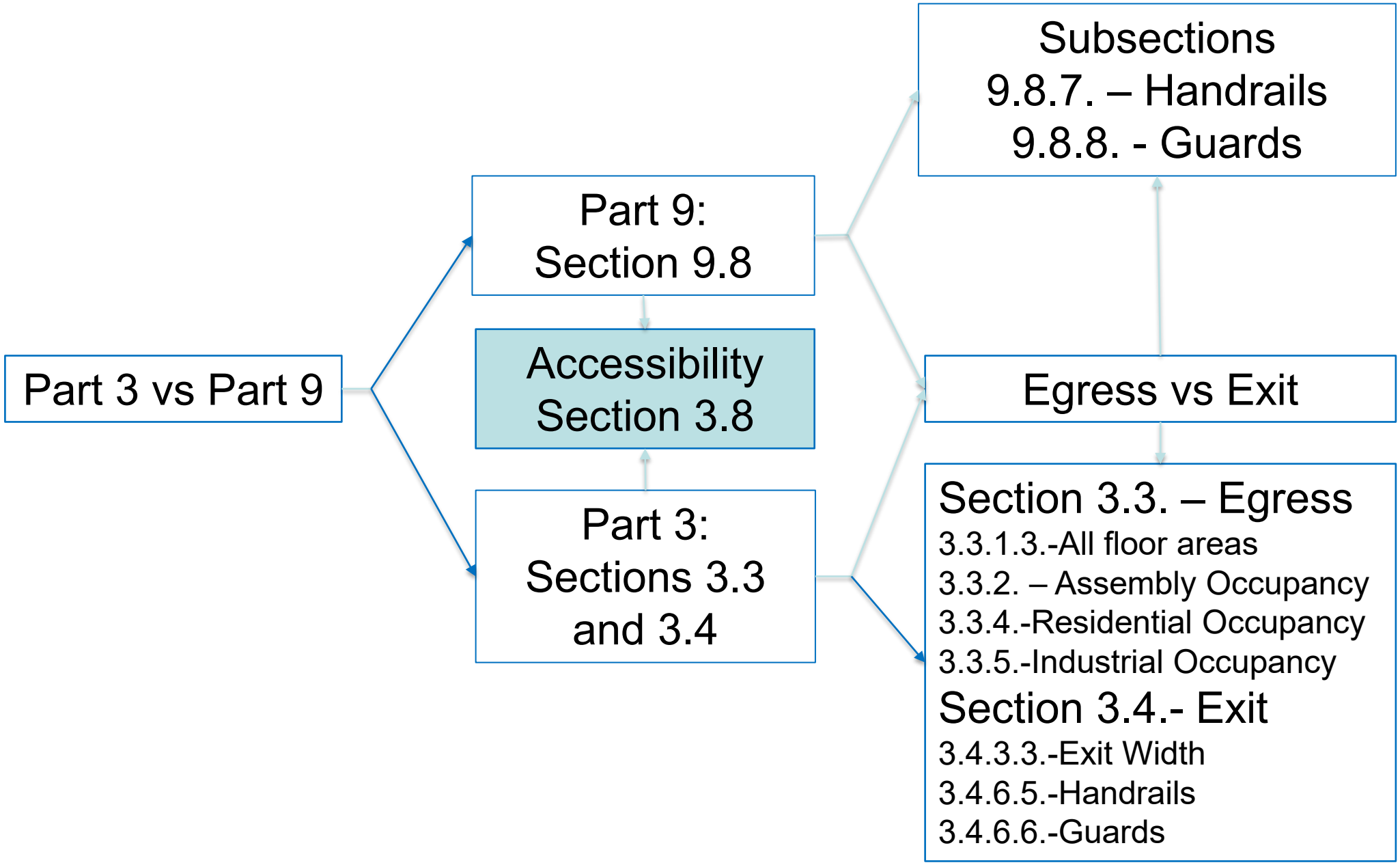
- Definitions
  - *Means of egress….*
  - *Access to exit…*
  - *Exit….*



Means of Egress, Access to Exit and Exits




Part 3 vs Part 9
Part 9:
Section 9.8
Part 3:
Sections 3.3
and 3.4
Subsections
9.8.7. – Handrails
9.8.8. - Guards
Egress vs Exit
Section 3.3. – Egress
3.3.1.3.-All floor areas
3.3.2. – Assembly Occupancy
3.3.4.-Residential Occupancy
3.3.5.-Industrial Occupancy
Section 3.4.- Exit
3.4.3.3.-Exit Width
3.4.6.5.-Handrails
3.4.6.6.-Guards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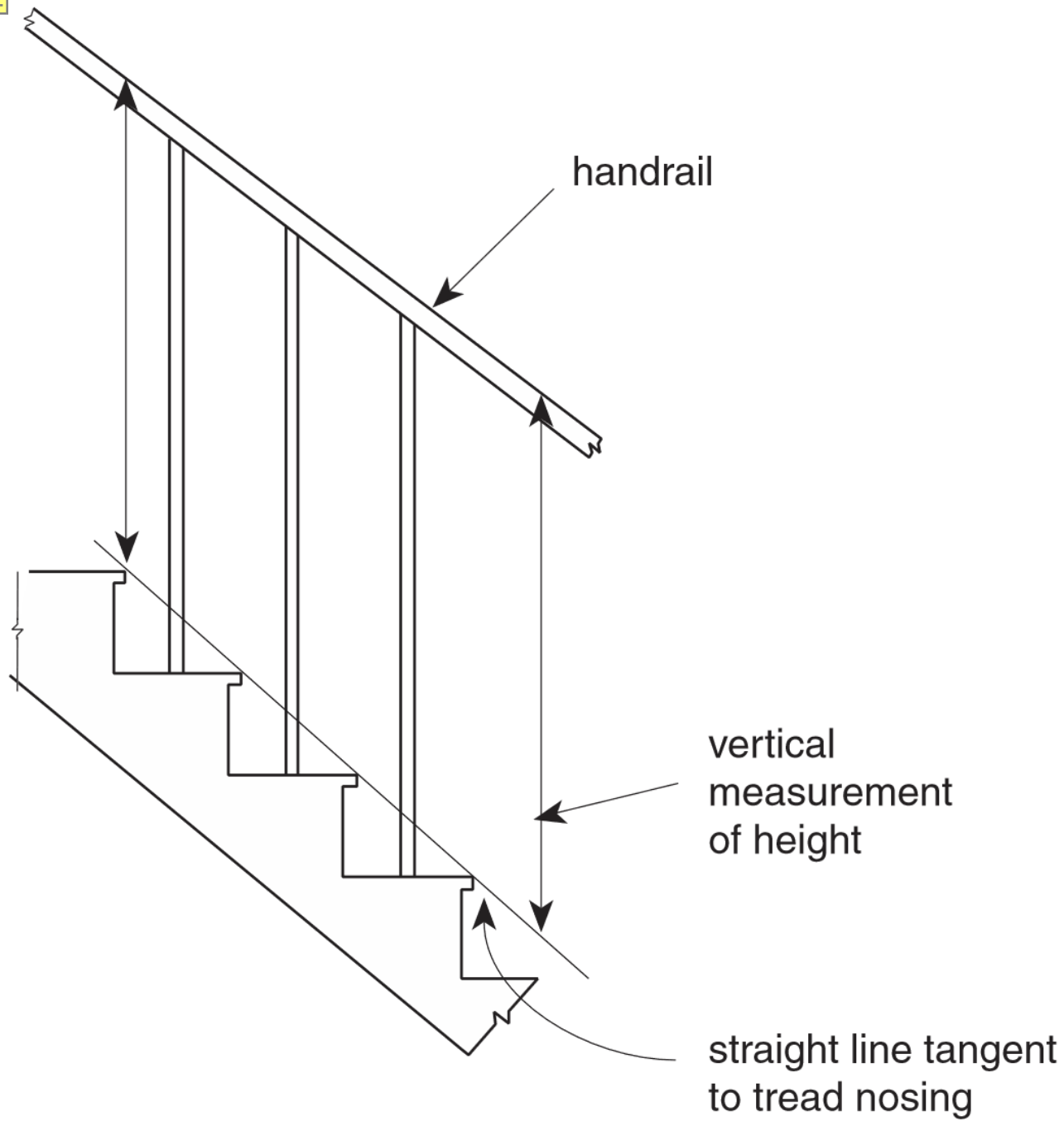
Section 3.4.- Exit
3.4.3.3.-Exit Width
3.4.6.5.-Handrails
3.4.6.6.-Guards

Part 3 vs Part 9

- Part 9: Section 9.8
- Part 3: Sections 3.3 and 3.4

Part 9 versus Part 3…
Is there a difference?
Not really with the exception of whether the project is within a dwelling unit.

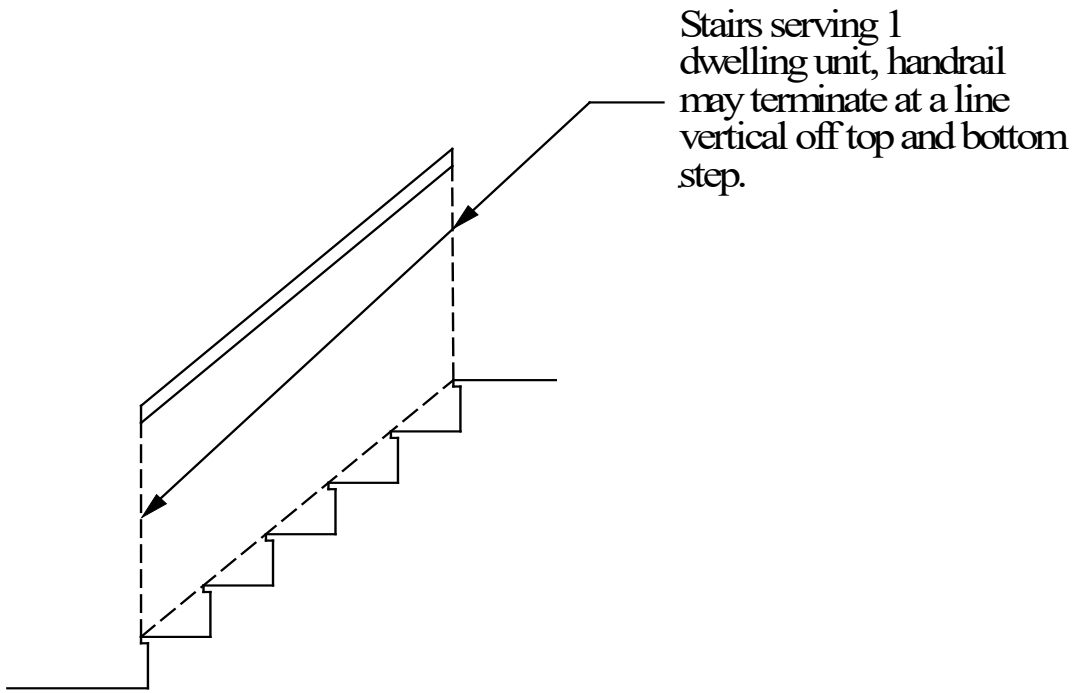


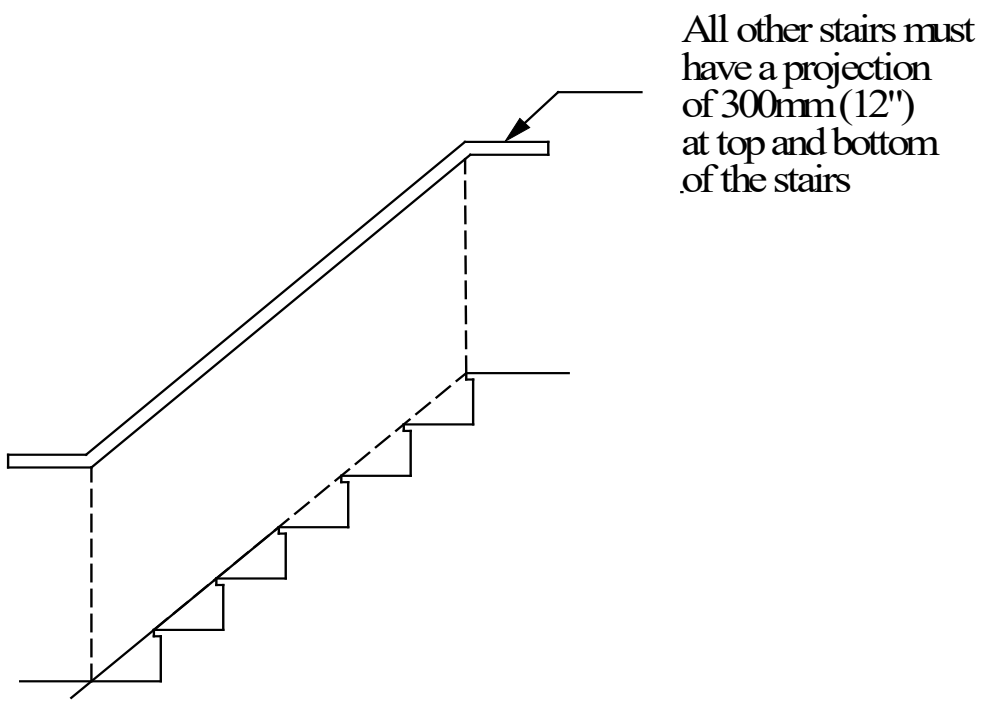
Subsection 9.8.7. addresses handrails in Part 9 buildings.

Article 3.3.4.7 addresses handrails within dwelling units.

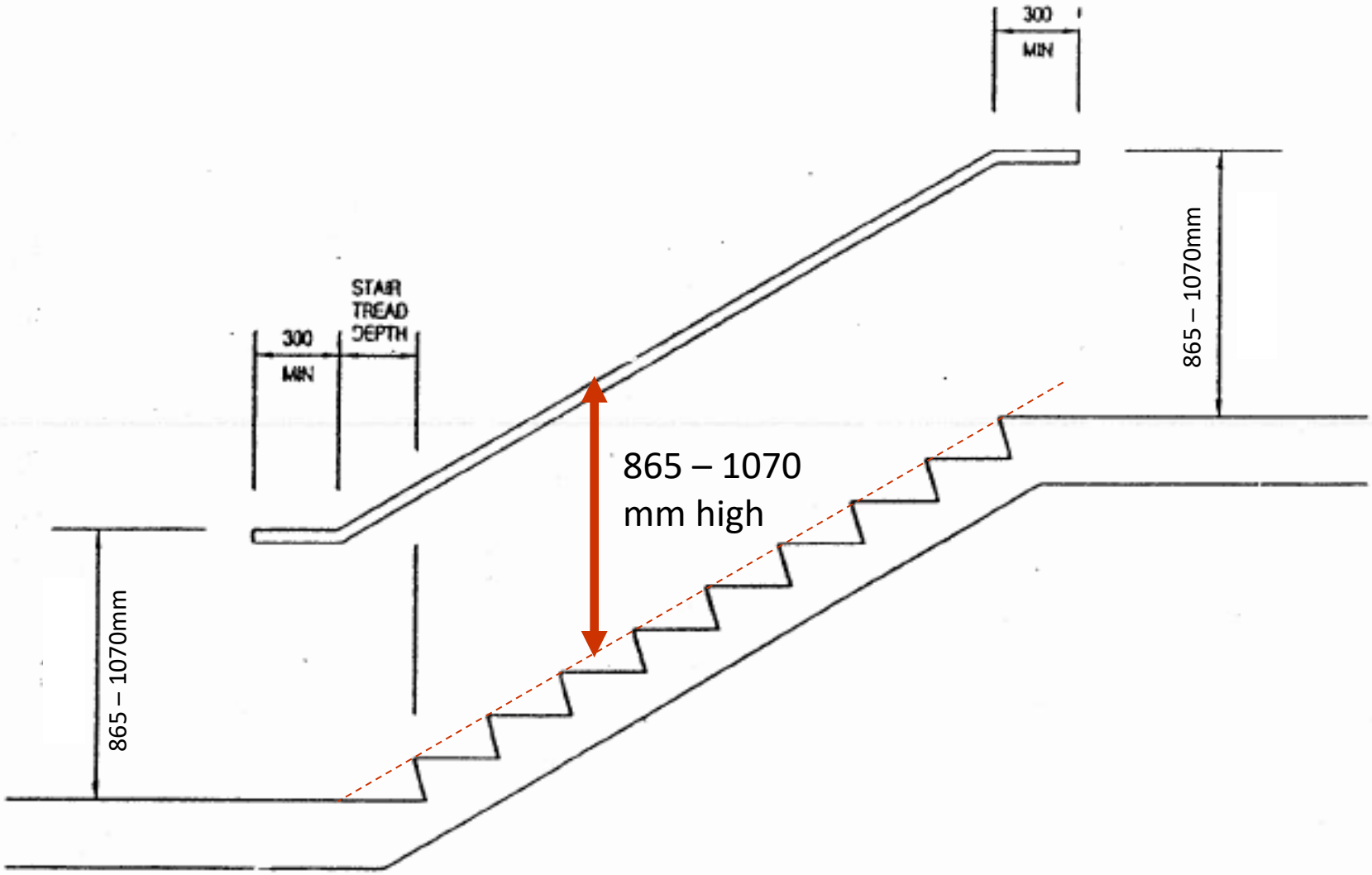
Article 3.4.6.5. addresses handrails in Part 3 buildings.

Depicted below are examples of a handrail within a dwelling unit (left) and a handrail not in a dwelling unit.





The sloped portion of the handrail must be extended beyond the edge of the first tread a distance equivalent to the depth of a tread. The 300 mm horizontal extension is measured from this point.



3.4.6.5. Handrails

1) One handrail shall be provided on stairs that are less than 1 100 mm in width.

2) One handrail shall be provided on each side of

a) stairs that are 1 100 mm or more in width,

b) curved flights of any width, **and**

c) ramps.

3) In addition to Sentence (2), intermediate handrails shall be provided so that

a) a handrail is reachable within 750 mm of all portions of the required exit width,

b) at least one portion of the stair or ramp between two handrails is the minimum width required for stairways or ramps (see Sentences 3.4.3.2.(8) [minimum widths of exits] and 3.4.3.3.(4) [Permitted 100mm projection into required means of egress]), **and**

c) all other portions of the stair or ramp between two handrails have a clear width of 510 mm or more.

Let's have a closer look at this (next slide)

4) Where a stair or ramp is wider than its required exit width, handrails shall be located along the most direct path of travel. (See Note A-3.4.6.5.(4).)

5) Handrails shall be continuously graspable along their entire length, be free of any sharp or abrasive elements, and have

a) a circular cross-section with an outside diameter not less than 30 mm and not more than 50 mm,

or

b) a non-circular cross-section with a perimeter not less than 100 mm and not more than 160 mm and whose largest cross-sectional dimension is not more than 57 mm.

Comparison of "graspable" requirements in the 2024 vs. 2018 BCBC

BCBC 2024

3.4.6.5.(5) **Handrails shall be continuously graspable along their entire length, be free of any sharp or abrasive elements, and have**

a) a circular cross-section with an outside diameter not less than 30 mm and not more than **50mm**, or

b) a non-circular cross-section with a perimeter not less than 100 mm and not more than **160 mm** and whose largest cross-sectional dimension is not more than **57 mm**.

BCBC Notes to Sentence 9.8.7.5.(2) addressing ergonomics and grasp-ability notes: Handrails are intended to provide guidance and support to stair users. To fulfil this objective, handrails must be "graspable." [SEE NEXT SLIDE]

BCBC 2018

3.4.6.5.(5) **Handrails shall be continuously graspable along their entire length, be free of any sharp or abrasive elements, and have**

a) a circular cross-section with an outside diameter not less than 30 mm and not more than **43mm**, or

b) a non-circular cross-section with a perimeter not less than 100 mm and not more than **125 mm** and whose largest cross-sectional dimension is not more than **45 mm**.

BCAB 1937 – Ergonomic design of handrails (to be graspable)

At the exterior, the top rails of aluminum guards serve as the handrails. The top rails are constructed of a common extruded aluminum profile and the cross-sectional dimensions of the handrails are shown in Figure 1.
There are no separate handrails.

Interior handrails are a custom design and are constructed of solid wood. The cross-sectional dimensions of the handrails are shown in Figure 2.

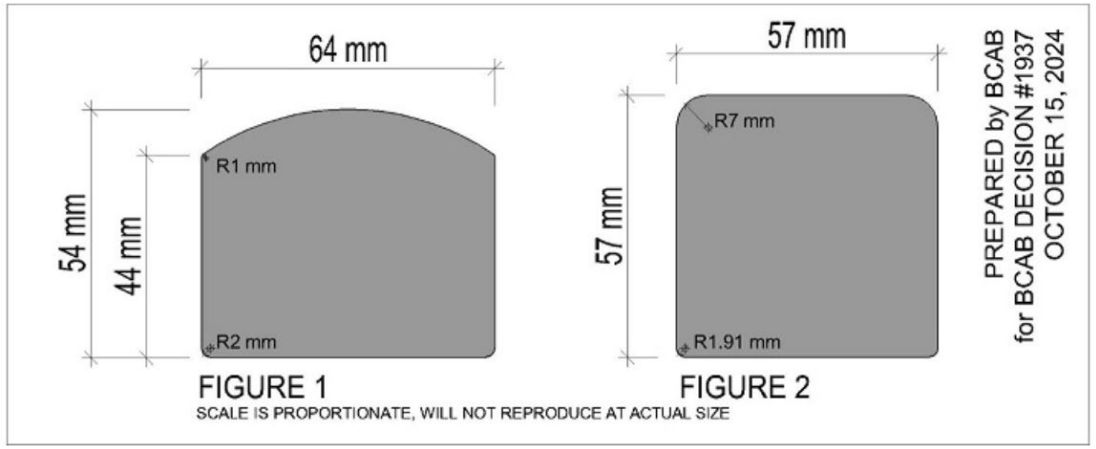


FIGURE 1 FIGURE 2
SCALE IS PROPORTIONATE, WILL NOT REPRODUCE AT ACTUAL SIZE

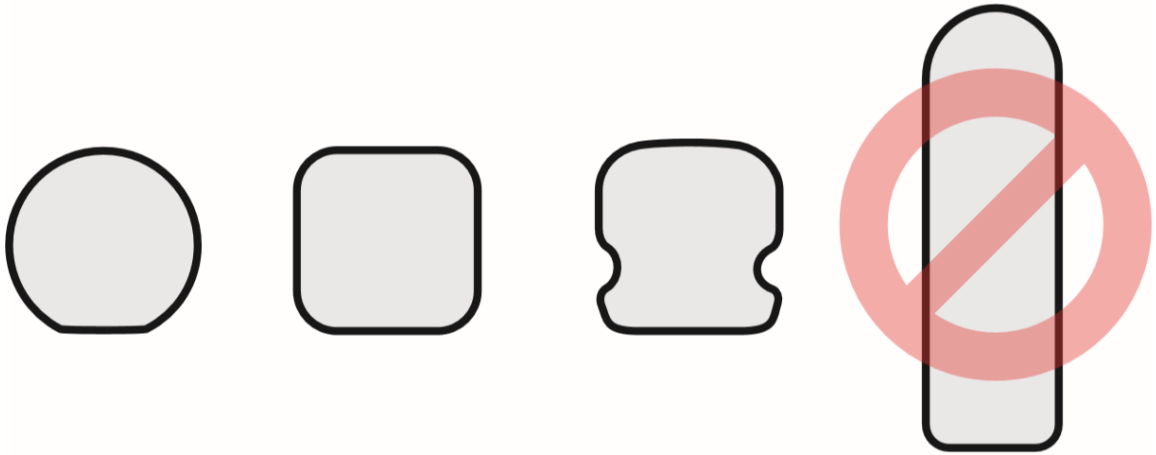
Appellant's position
The handrails meet the intent of the Code; they are fully functional, safe, and allow for proper gripping as described in the Code. The designs avoid sharp edges and allow for easy gripping. The Code does not provide specific dimensions which has led to a subjective interpretation by the Local Authority.

It is the determination of the Board that both the interior and exterior handrails consist of regular profiles, containing no graspable recesses, that are too large in cross-sectional dimension to allow a person's fingers and thumb to curl under part or all of the handrails.

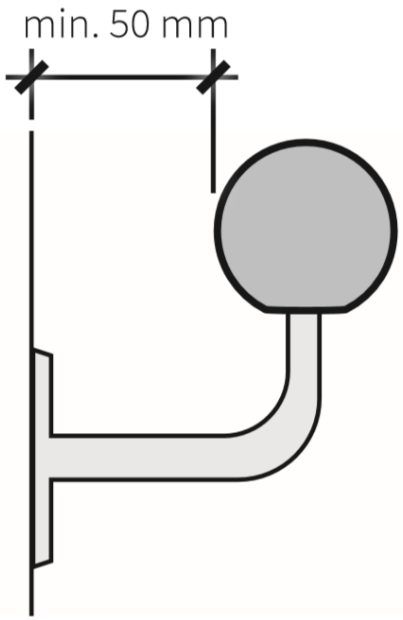
9.8.7.5.(2) Con't.

The graspable portion of a handrail should allow a person to comfortably and firmly grab hold by allowing their fingers and thumb to curl under part or all of the handrail. Where the configuration or dimensions of the handrail do not allow a person's fingers and thumb to reach the bottom of it, recesses that are sufficiently wide and deep to accommodate a person's fingers and thumb must be provided on both sides of the handrail, at the bottom of the graspable portion, which must not have any sharp edges.

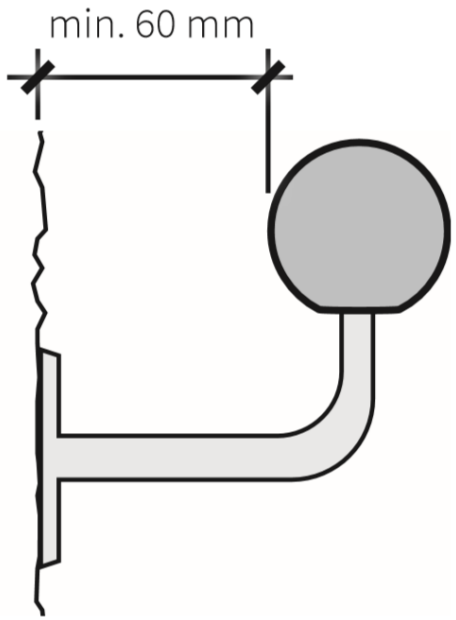
Handrail Types and Clearance to wall surface



Handrails must be **continuously graspable** and allow fingers and thumb to curl under part or all of it



Handrail adjacent to **smooth** surface



Handrail adjacent to **rough** or **abrasive** surface

6) The **height** of handrails on stairs, on aisles with steps and on ramps shall be measured vertically from the top of the handrail to

a) a straight line drawn tangent to the tread nosings of the stair or aisle step served by the handrail (see Note A-9.8.7.4.), **or**

b) the surface of the ramp, floor or landing served by the handrail.

7) Except as provided in Sentence (8) and Clause 3.8.3.5.(1)(e), the **height** of handrails on stairs, on aisles with steps and on ramps shall be

a) not less than 865 mm, **and**

b) not more than 1 070 mm.

Interpretation 18-0223 clarifies a "cautions" approach to variable heights of handrails above stairs served, citing previous ruling by the **BC Appeal Board** (#1667). Also refer to Interpretation 18-0243 (next slide).

"The BCBC 2018 (and BCBC 2024) provides a range of handrail installation heights from 865mm to 1070mm. There is no requirement that this height be uniform along the length of the stair flight, landing or ramp. However, the handrail must provide a steady support for persons using it and a change in height along the flight of stairs, ramp or landing may cause a loss of balance. It is highly recommended that the height of the handrail be consistent throughout the length of each flight of stairs, ramps and landings. In some locations, such as at the change of stair direction, it may be better to slope the handrail between two successive flights instead of creating a vertical drop in the handrail, as this rapid change in height may be more destabilizing or break the grip of the user.

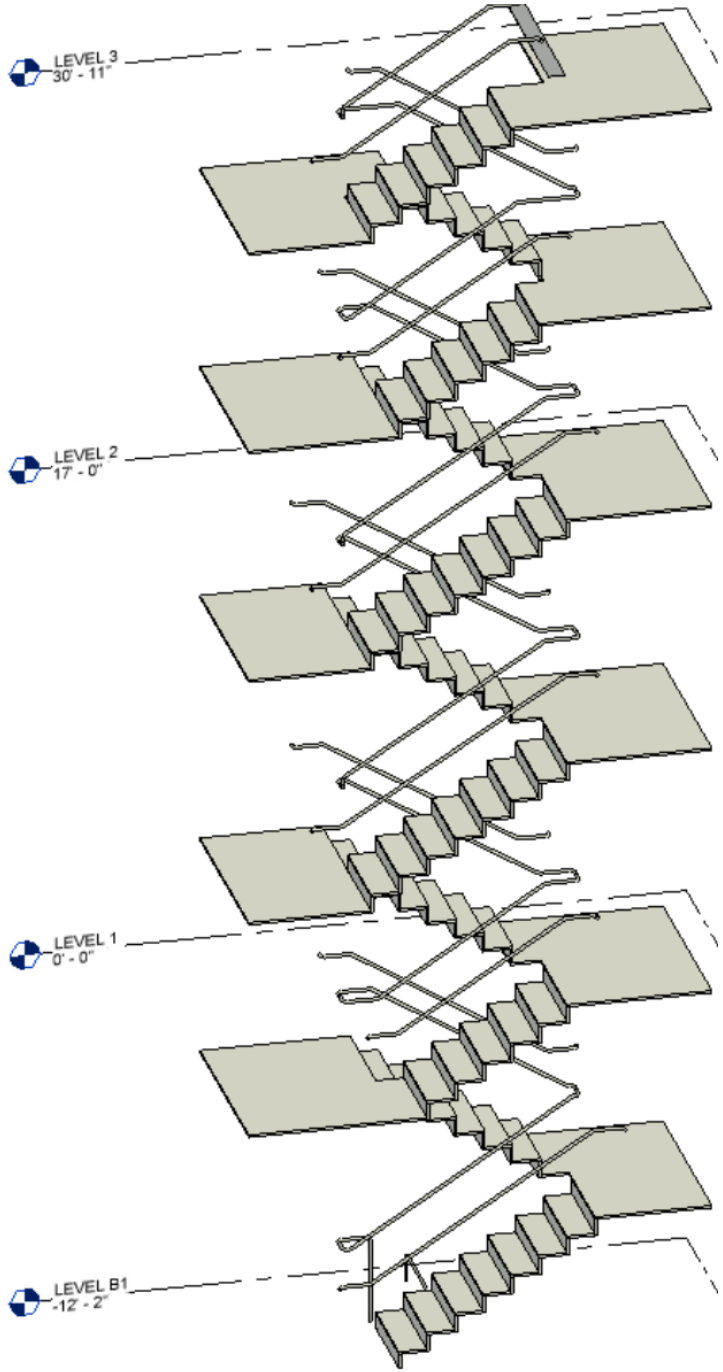
This principle was accepted by BC Appeal Board Ruling #1667."

Interpretation File No. 18-0243

“Although the 2018 BCBC [by extension BCBC 2024] does not mandate a uniform height of a handrail throughout the entire stair flight, it is good design practice to maintain such uniformity, including at the 300 mm handrail extension.

A sudden change in the height of the handrail could interrupt the continuous graspability as required by Sentence 3.4.6.5.(9) which would not meet the intent of the code.

It may be necessary to vary the handrail height when a stair turns 90^{o} or 180^{o} with a sloping transition which is preferable to a vertical “gooseneck” because the sloping transition is continuously graspable.”

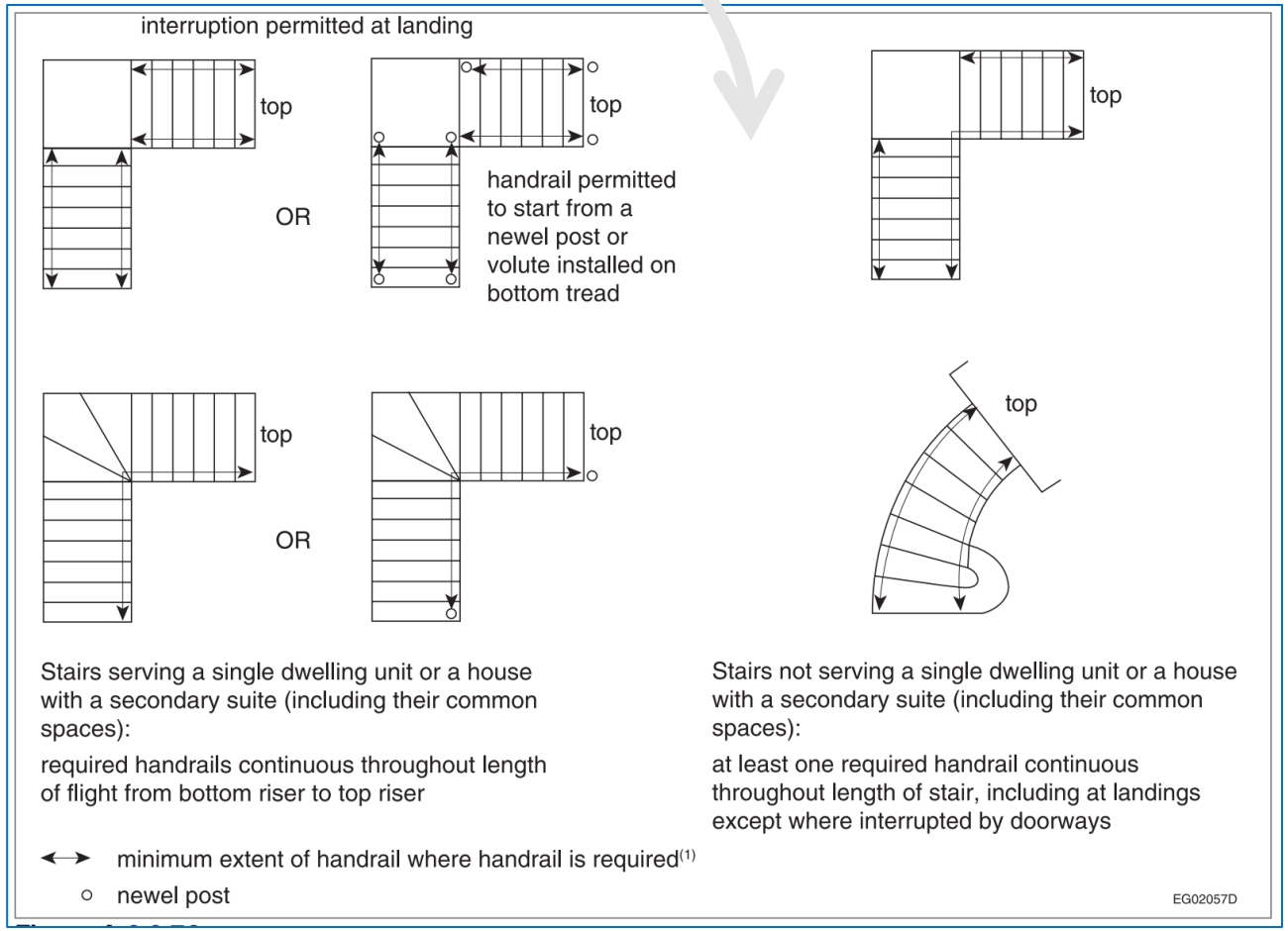


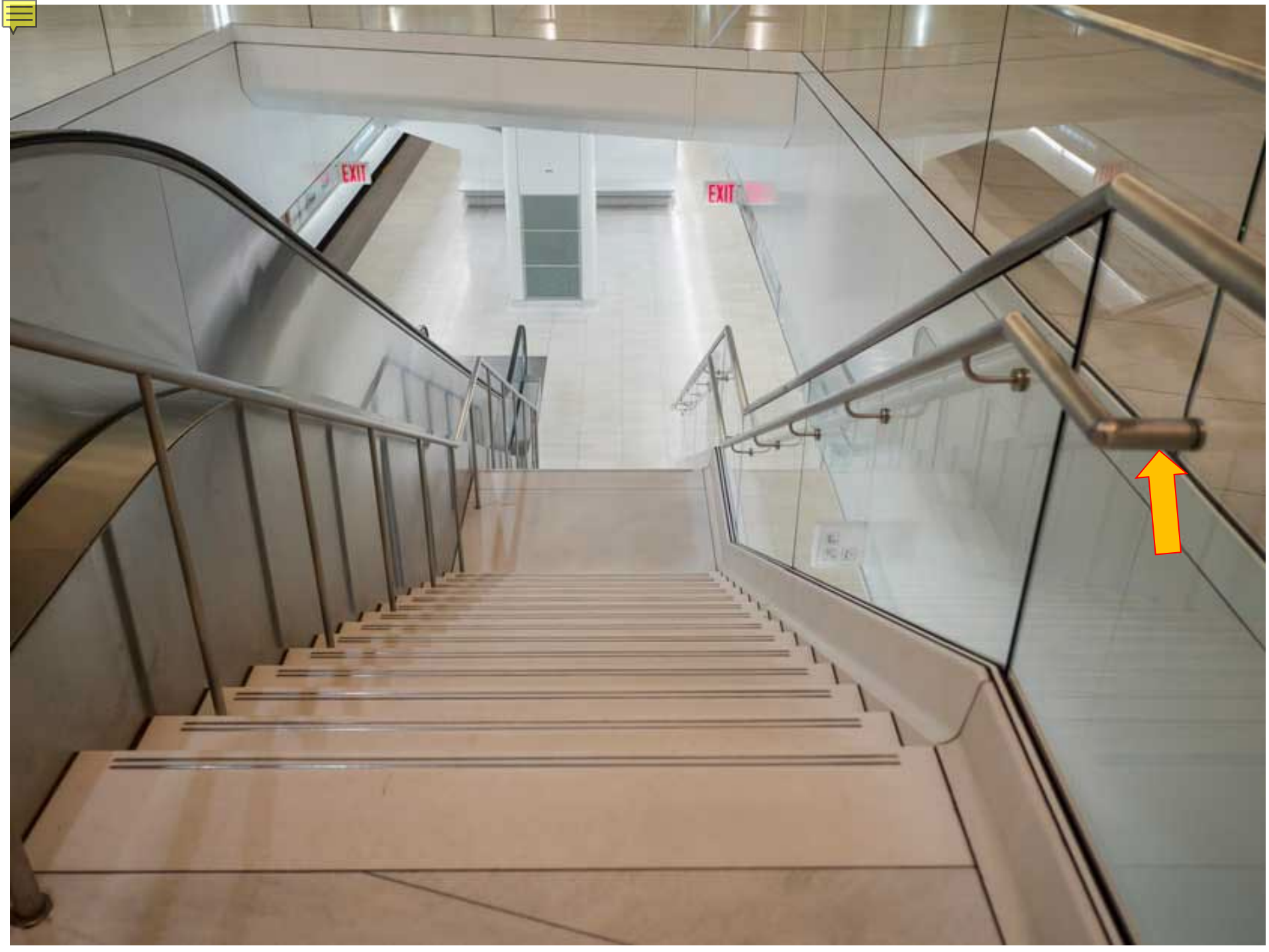
9) Required handrails shall be continuously graspable throughout the length of

a) a ramp, **and**

b) a flight of stairs, from the bottom riser to the top riser. (See Note A-9.8.7.2.)

10) Except where interrupted by doorways, at least one handrail shall be continuous throughout the length of a stairway or ramp, including at landings.





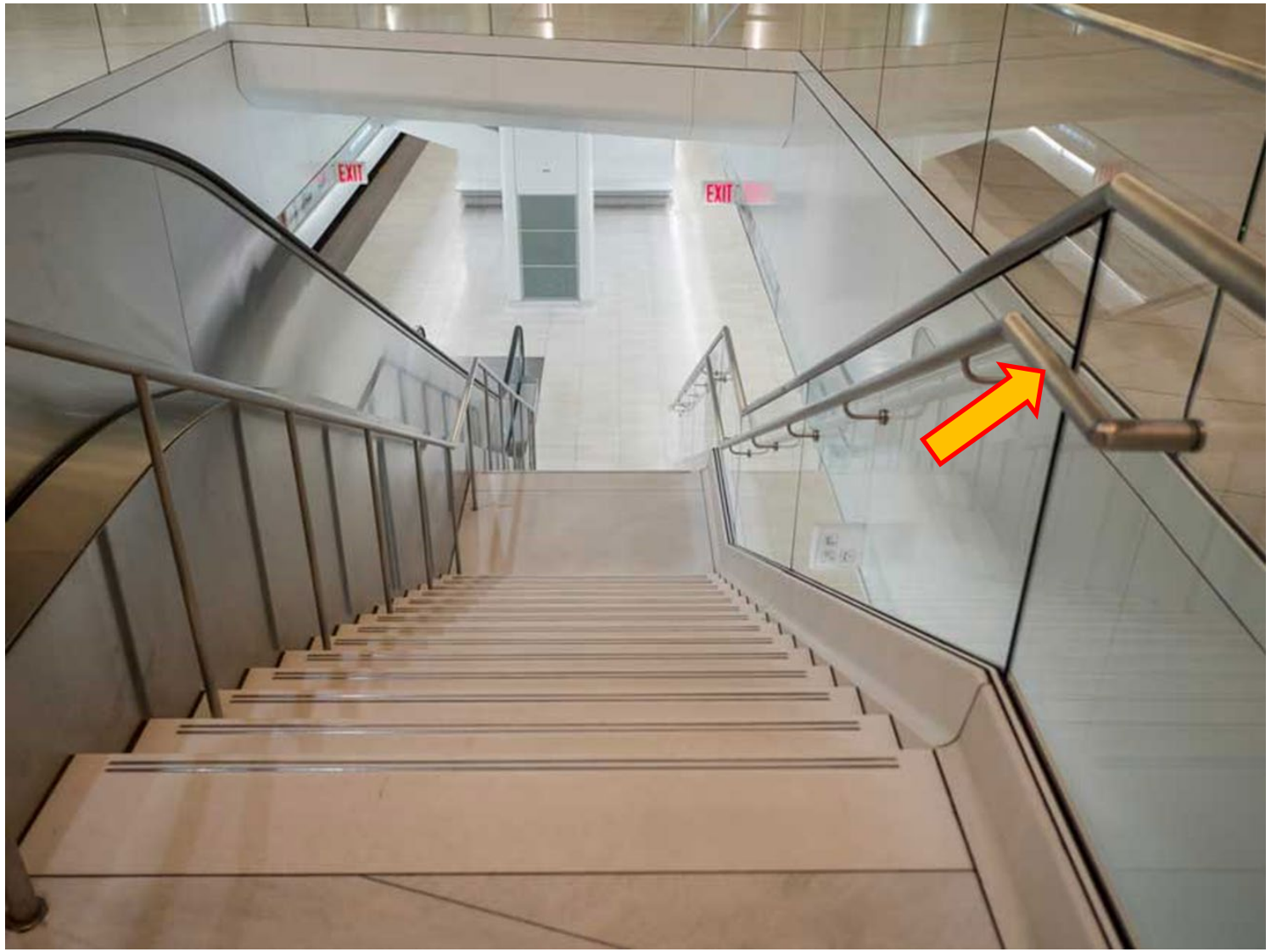
Termination of Handrails

Terminate so it's not a hazard, by return to

- Wall
- Floor
- Post

3.4.6.5.(11) Handrails shall be terminated in a manner that will not obstruct pedestrian travel or create a hazard. (See Note A-3.4.6.5.(11)).

3.4.6.5.(12) At least one handrail at the side of a stairway or ramp shall extend horizontally not less than 300 mm beyond the top and bottom of the stairway or ramp.



Horizontal handrail extensions

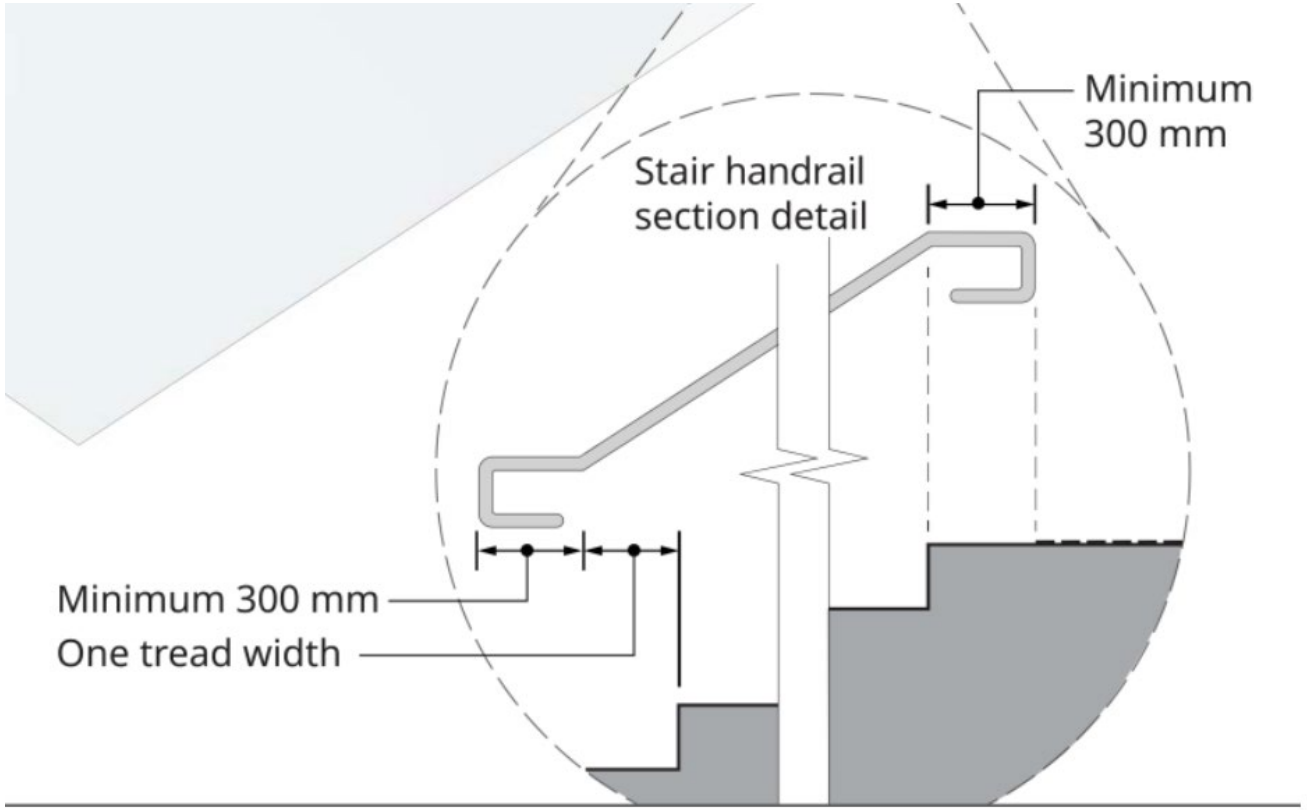
Why?

INTERPRETATION File No. 18-0243 (Con't.)

The location of the transition from a sloping handrail to a horizontal extension is particularly important for persons with visual impairments because the transition provides a warning to the occupant of the stair termination at the bottom stair landing.

If the transition occurs before reaching the bottom stair landing, it gives a false impression that the descent of the stair flight is complete.

The sloping handrail extended one run past the last riser will result in the Horizontal extension to be at the same height as the sloping handrail which is the preferred design.



Refer to associated Figure from the 2020 Building Accessibility Handbook [3.8.3.5.(1)- C]

3.4.6.5.(14) Handrails and their supports shall be designed and constructed to withstand the loading values specified in Sentence 4.1.5.14.(7).

FYI

4.1.5.14.(7) Handrails and their supports shall be designed and constructed to withstand the following minimum specified live loads, which need not be considered to act simultaneously:

a) 0.9 kN applied at any point and in any direction for all handrails, and

b) 0.7 kN/m applied in any direction for handrails not located within dwelling units.

9.8.7.7.(1) Handrails and their supports shall be designed and constructed to withstand the following loads, which need not be considered to act simultaneously:

a) a concentrated load of not less than 0.9 kN applied at any point and in any direction for all handrails, and

b) for handrails other than those serving a single dwelling unit, a uniform load of not less than 0.7 kN/m.

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2) Where exterior or interior handrails serving a single dwelling unit or a house with a secondary suite including their common spaces are attached to wood studs or blocking, the attachment shall be deemed to comply with Sentence (1), where

a) the attachment points are spaced not more than 1.2 m apart measured on the horizontal plane,

b) the first attachment point at either end is located no more than 300 mm from the end of the handrail, and

c) the fasteners consist of not less than 2 No. 8 wood screws at each point, penetrating not less than 32 mm into solid wood

Minimum stair width (exit / egress) is determined by the greater of either, the minimum stairway width of the width determined by the occupant load.

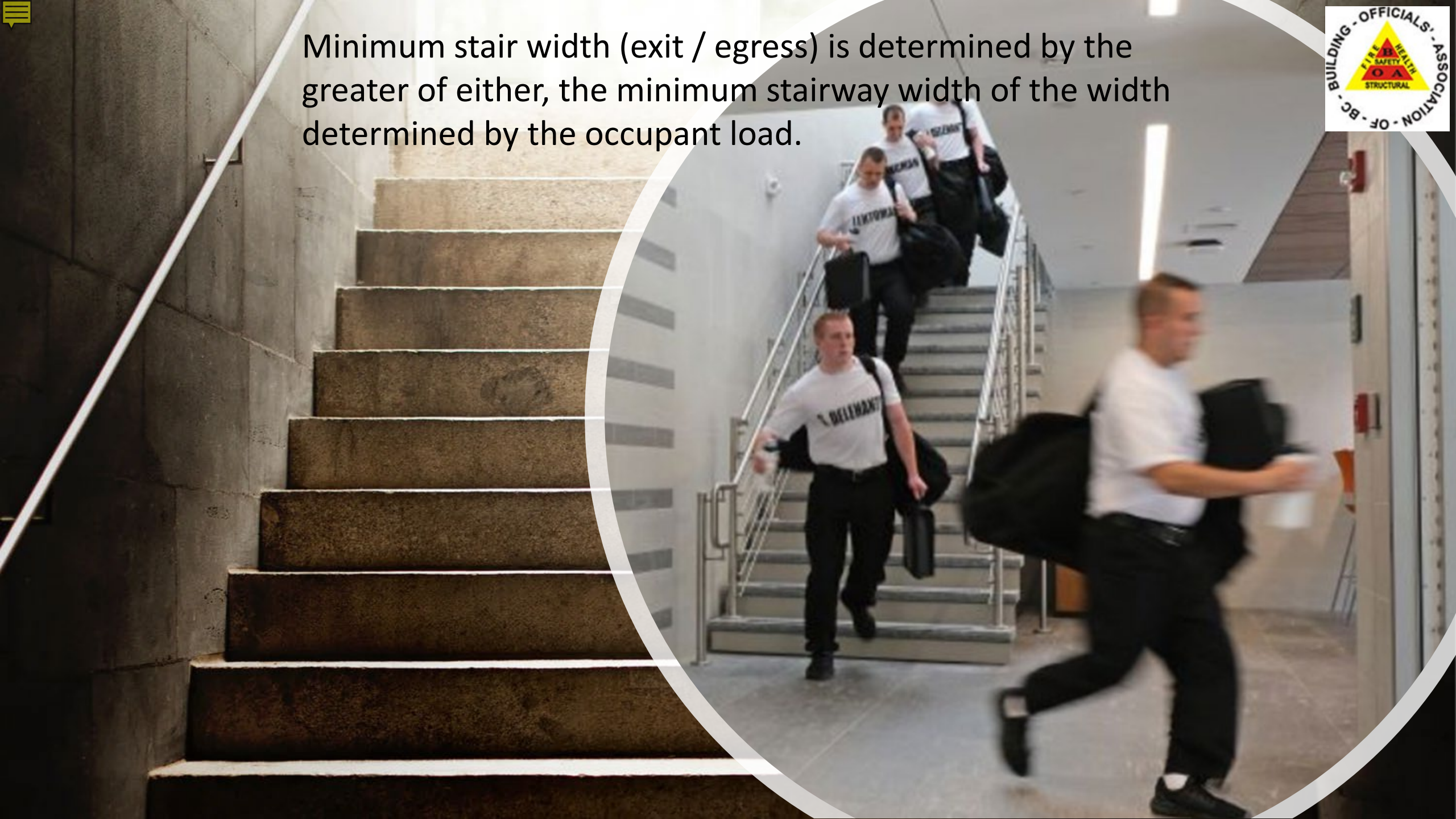


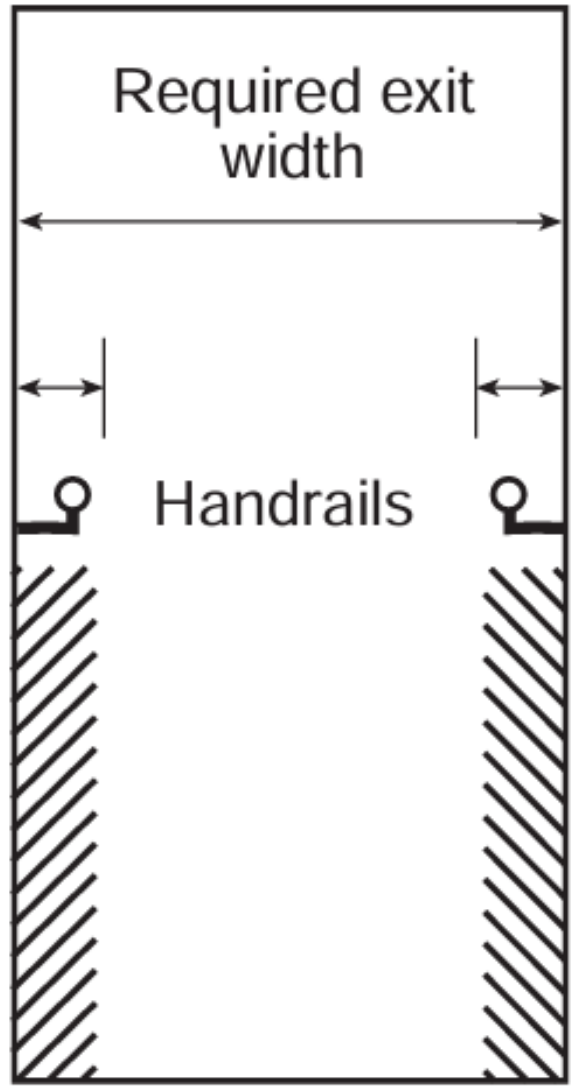
Table 3.4.3.2.-A
Minimum Widths of Exit Corridors, Passageways, Ramps, Stairs and Doorways in Group A, Group B, Division 1, and Groups C, D, E and F Occupancies
Forming Part of Sentence 3.4.3.2.(8)

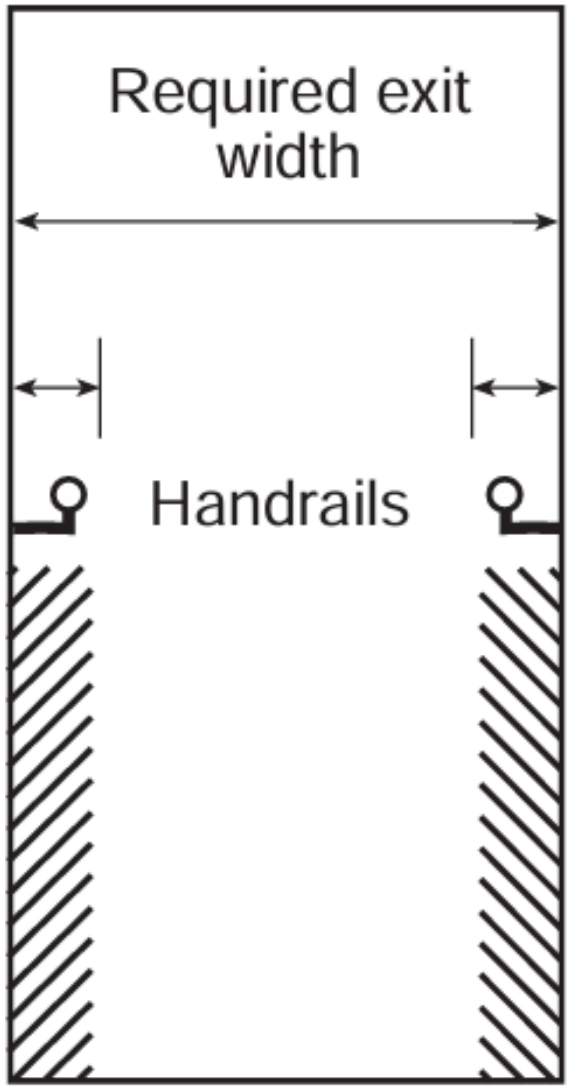
Occupancy Classification	*Exit* Corridors and Passageways, mm	*Ramps*, mm	Stairs, mm	Doorways, mm
Group A, Group B, Division 1, Group C, Group D, Group E, Group F	1 100	1 100	900 (1) 1 100 (2)	850

Notes to Table 3.4.3.2.-A:

(1) Serving not more than 2 *storeys* above the lowest *exit level* or not more than 1 *storey* below the lowest *exit level*.

(2) Serving more than 2 *storeys* above the lowest *exit level* or more than 1 *storey* below the lowest *exit level*.


Required exit width
Handrails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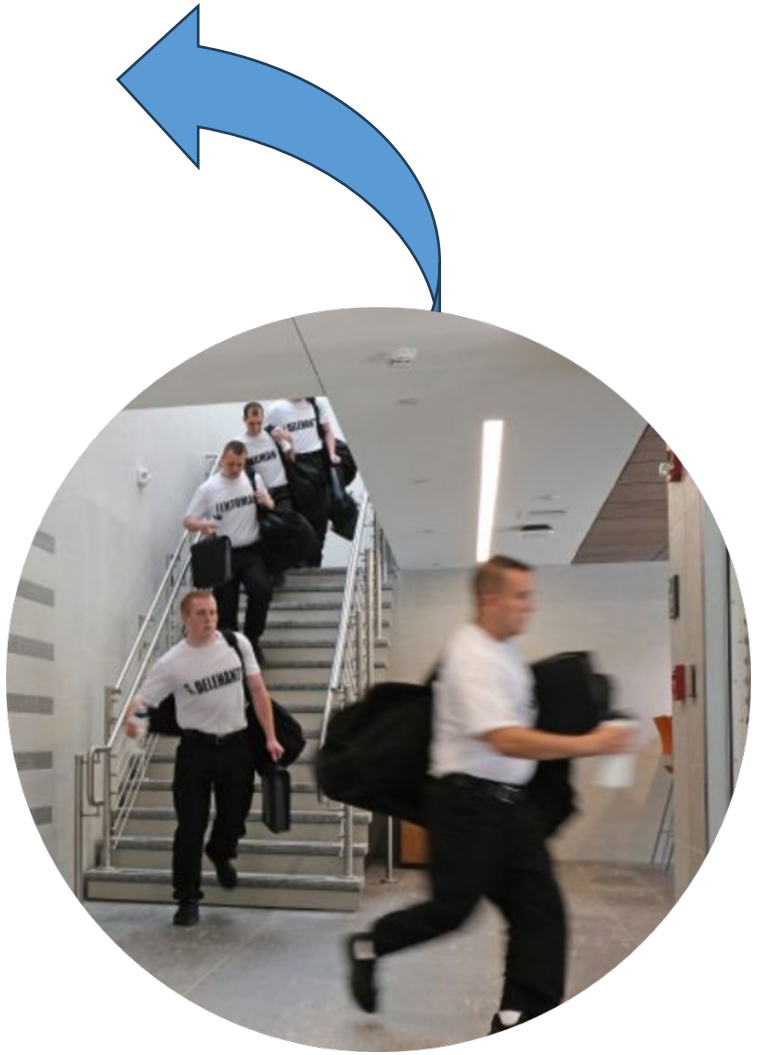

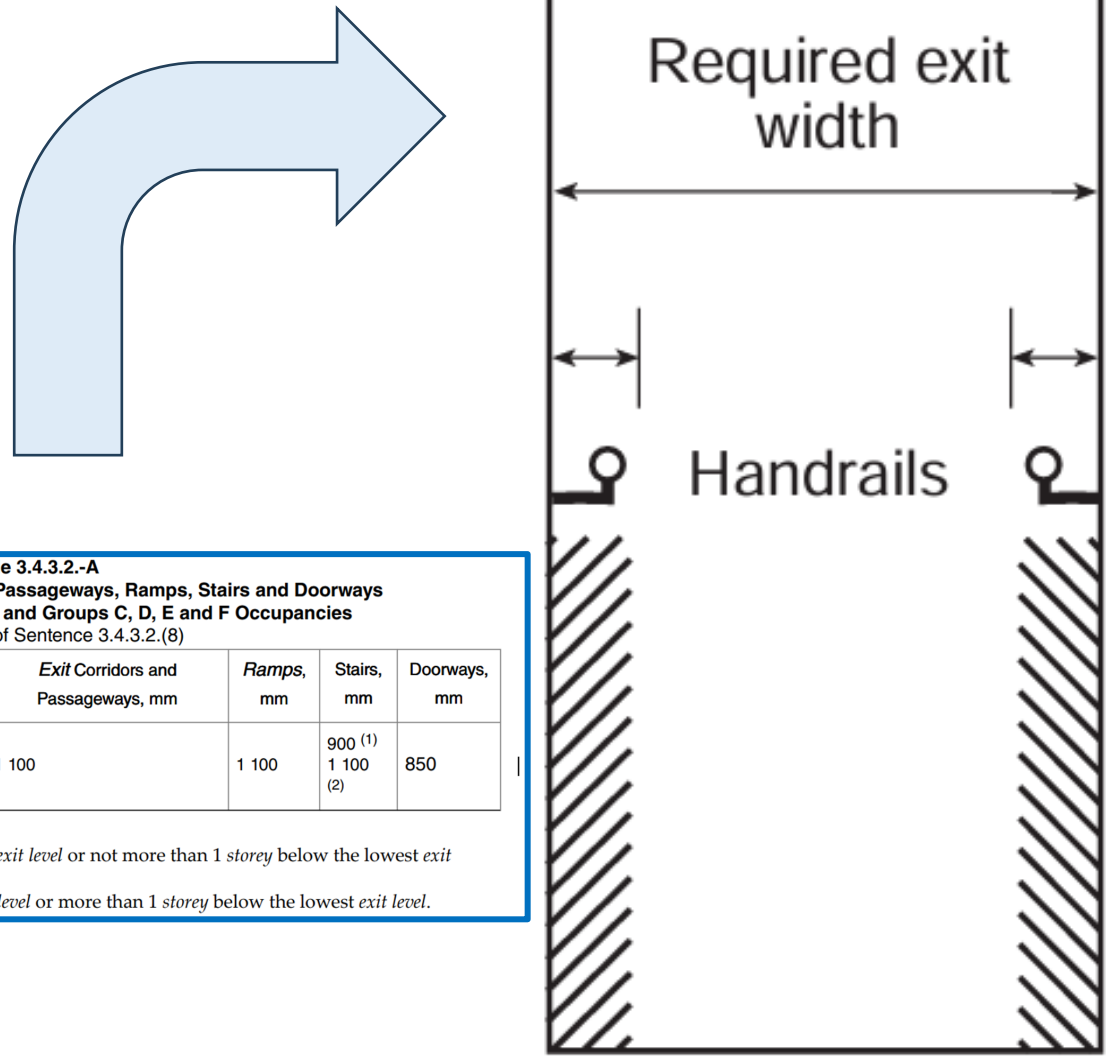

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Minimum Widths of Exit Corridors, Passageways, Ramps, Stairs and Doorways in Group A, Group B, Division 1, and Groups C, D, E and F Occupancies
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Occupancy Classification	*Exit* Corridors and Passageways, mm	*Ramps*, mm	Stairs, mm	Doorways, mm
Group A, Group B, Division 1, Group C, Group D, Group E, Group F	1 100	1 100	900 (1) 1 100 (2)	850

Notes to Table 3.4.3.2.-A:
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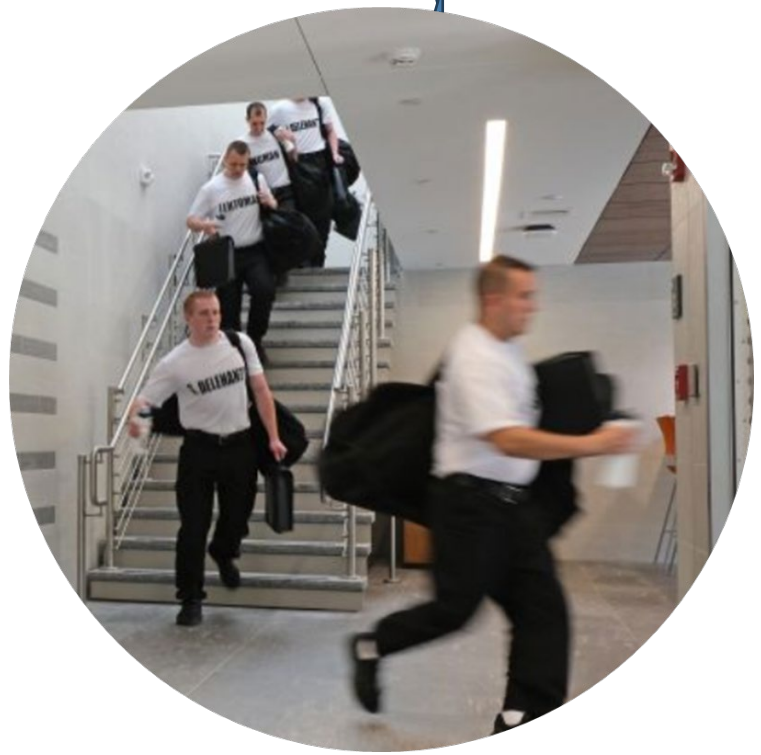


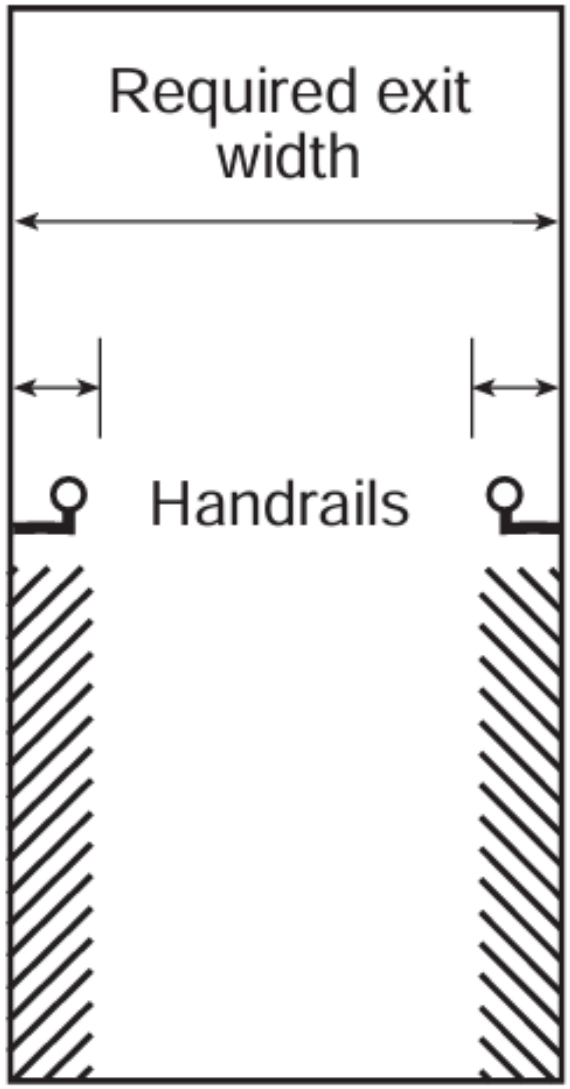
PERMITTED PROJECTIONS INTO REQUIRED EXIT WIDTH, BACKGROUND:

Sentence 3.4.3.3.(4) of 2012 BCBC specified that the projections was allowed “on each side” of the required width.

To harmonize with the NBC the phrase was removed in 2018 BCBC, however, the intent has not changed.

The adjoining sketch from the “User’s Guide to Part 3 of NBC 1995” shows the 100 mm projections on both sides of a stair.

Similar sketch in the User’s Guide to Part 9 of NBC 2015 show detail of the 100 mm projection of the handrail from the wall.



PERMITTED PROJECTIONS INTO REQUIRED EXIT WIDTH, BACKGROUND:

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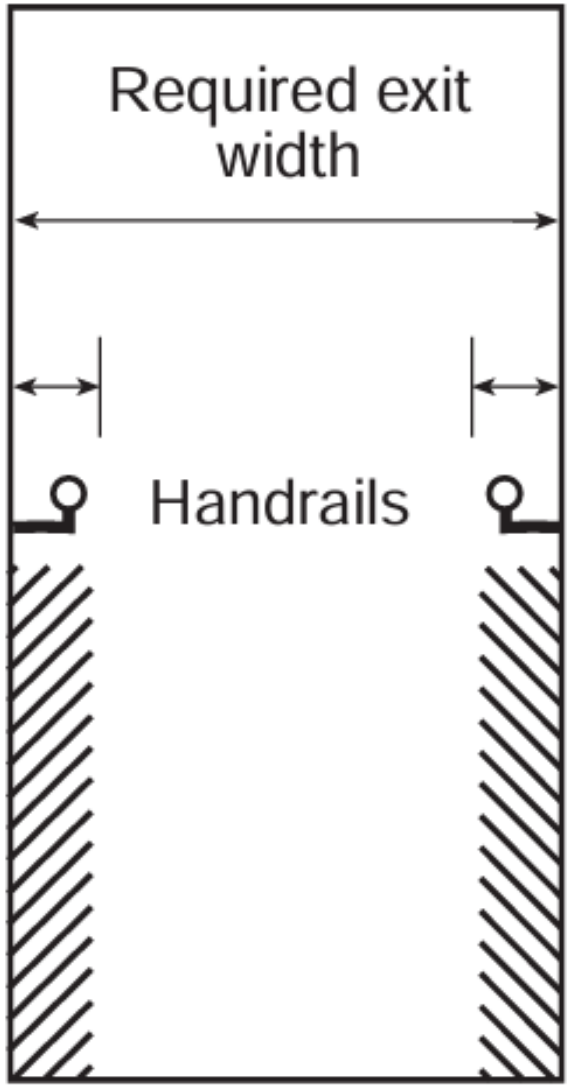
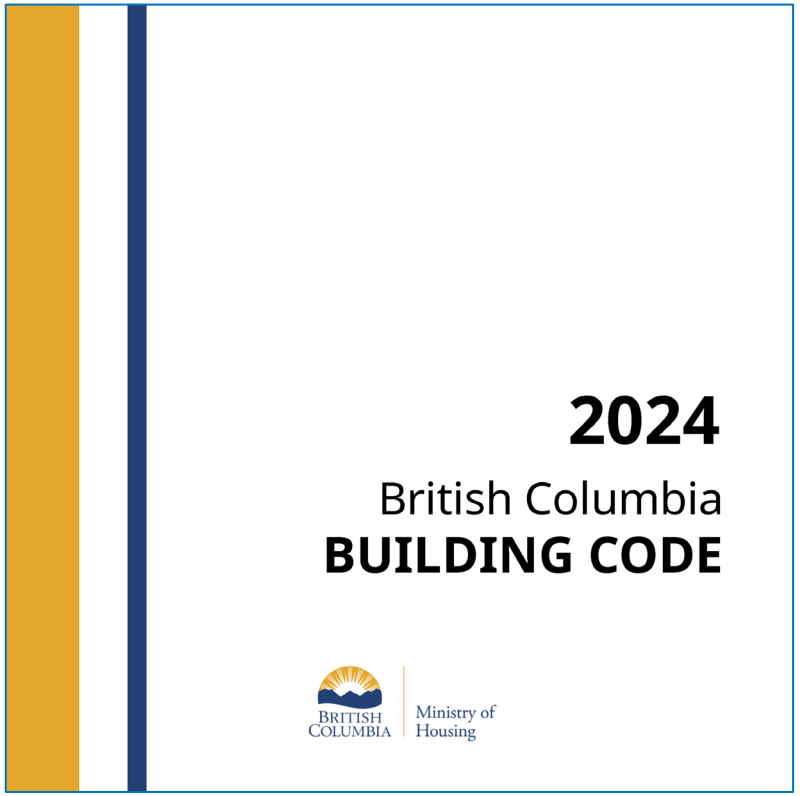




3.4.3.3.(4) Handrails and construction below handrails, including handrail supports and stair stringers, shall not project more than 100 mm into the required width of a means of egress.


CODES CANADA
Build on expertise
2015
Illustrated
User's Guide
NBC 2015 Part 9 of Division B
Housing and Small Buildings
Canadian Commission on Building
and Fire Codes
Canada

Guards - Egress versus Exit

Remember:

Section 3.3 speaks to EGRESS

Section 3.4 speaks to EXITS

Subsection 9.8.8. speaks to guards as well.

Guards
Egress vs Exit

Remember:

Section 3.3. Safety within Floor Areas - GUARDS:

In general, 3.3.1.18.(1) "…a guard **not less than 1 070mm high** shall be provided,"
c) at each raised floor, mezzanine, balcony, gallery, interior or exterior vehicular ramp, and at other locations where (see Note A-9.8.8.1.)

i) the **difference in elevation is more than 600 mm** between the walking surface and the adjacent surface, or

ii) the adjacent surface within 1.2 m of the walking surface has a slope of more than 1 in 2

3.3.1.20.(8) A window in a public area that extends to **less than 1 000 mm above the floor** and is located **above the second storey** in a **building of residential occupancy**, shall be **protected** by a barrier or railing to **not less than 1 070 mm above the floor**, or be **non-openable** and designed to **resist** lateral design loads for balcony guards required by **Article 4.1.5.14**.

BC BUILDING CODE INTERPRETATION COMMITTEE
A joint committee with members representing AIBC, EGBC, BOABC

File No: **24-0010 INTERPRETATION**
3.3.1.18.(4) Climbable Objects and Steps near Guards

Question:
Are permanently fixed objects permitted near guards if they form a climbable element that is between 140 mm to 900 mm above the level protected by the guard?

No (unless the fall is less than 4.2m).

For **Part 3** buildings, Sentence 3.3.1.18.(4) prohibits climbable elements on guards between 140 mm and 900 mm above the level protected by the guard when the fall is greater than 4.2m.
For **Part 9** buildings, Sentence 9.8.8.6.(1) has a similar requirement.

The **intent** of 3.1.18.(4) is:
"To limit the probability that preschool aged children will climb a guard and fall, which could lead to harm to persons" Although these two Sentences only address climbable elements which form part of the guard itself and do not regulate other permanent fixtures that are near the guard, to meet the intent of the code and for safety reason it is recommended to apply this requirement to permanently fixed objects that are near a guard (such as planters, shelving, windowsills, door thresholds).

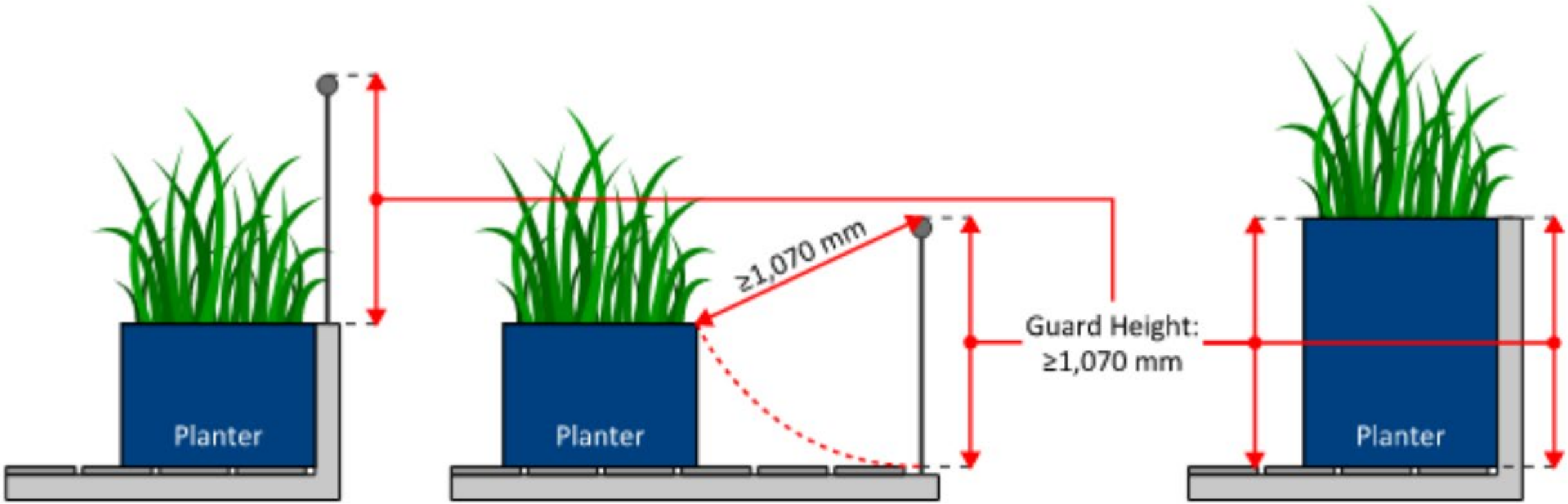
BC BUILDING CODE INTERPRETATION COMMITTEE
A joint committee with members representing
AIBC, EGBC, BOABC
File No: 24-0010 INTERPRETATION
3.3.1.18.(4) Climbable Objects and Steps near Guards

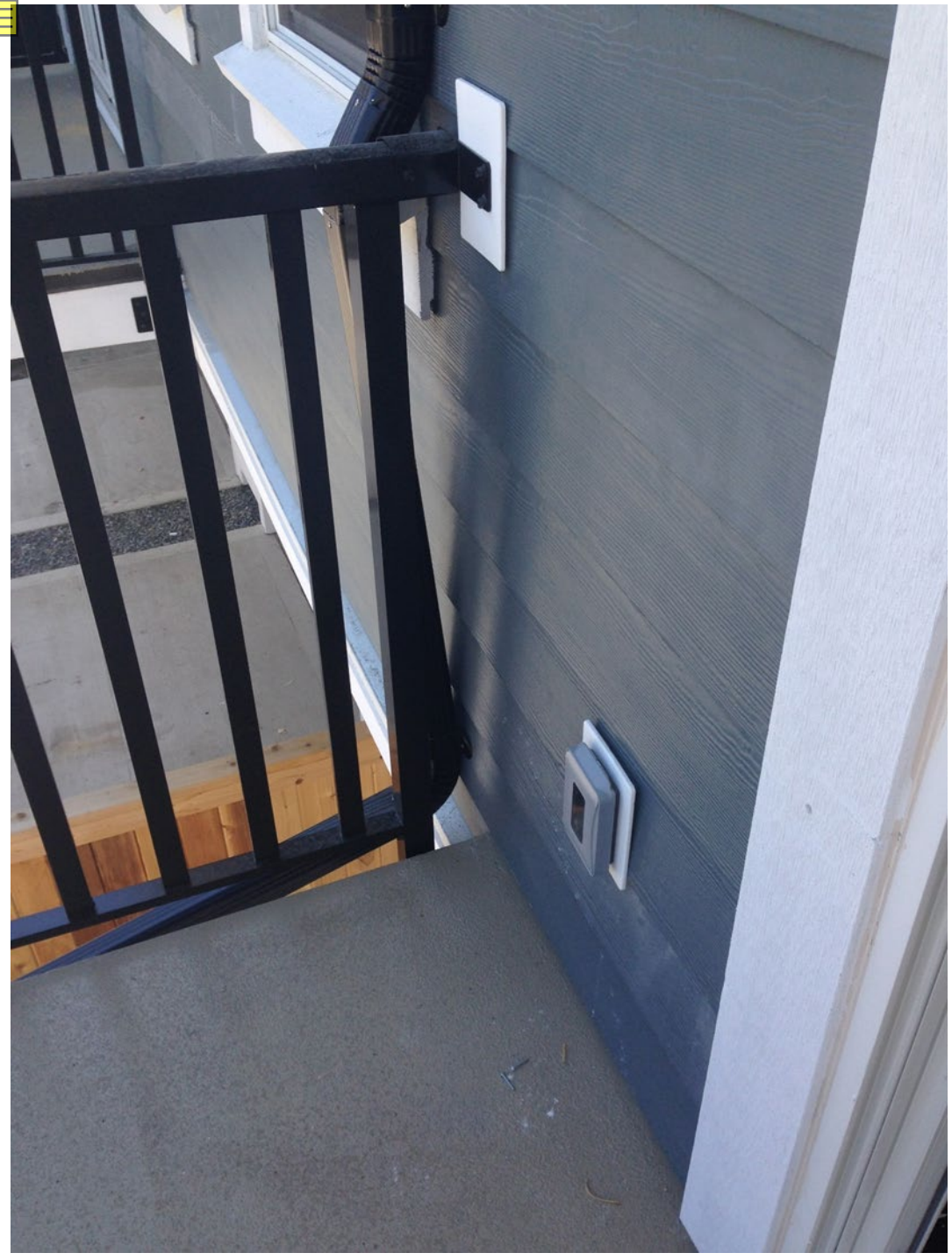
This recommendation is supported by EGBC's professional practice guidelines "Designing Guards For Building Projects"

PP Guidelines - Designing Guards for Building Projects V.2.0 (egbc.ca)

The Guide states that :
"Guards should be designed to meet the requirements for non-climbable guards, as defined in the governing building code and this standard. Additionally, steps and curbs must be considered, and must not reduce the required height of the Guard. In general, the height of the Guard must not be less than the radial distance from the highest and nearest point on the step."

It is recommended that the climbable objects should be setback from the guard, or the guard height be increased so that the diagonal dimension from the top of the object to the top of the guard is a minimum 1070 mm as illustrated in the following slide.


Planter
≥1,070 mm
Planter
Guard Height:
≥1,070 mm
Planter




Ne pas utilise

Section 3.3. Safety within Floor Areas - GUARDS:

3.3.2. Assembly Occupancy

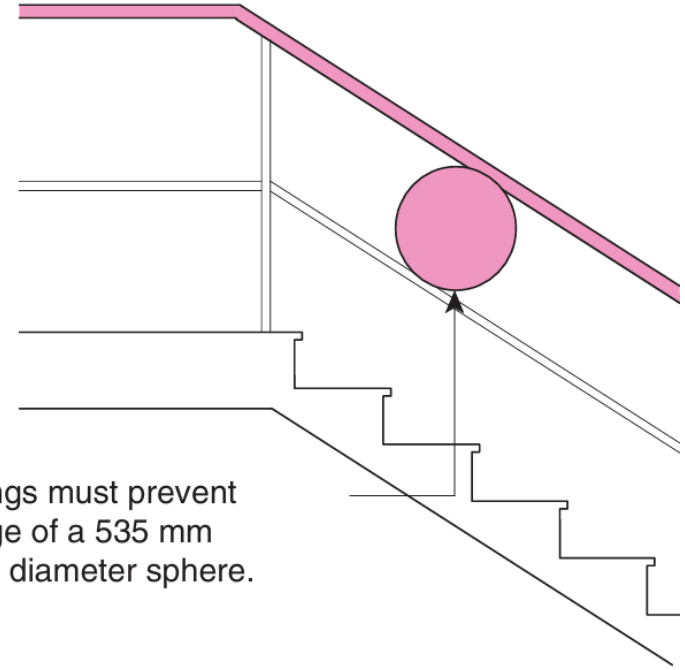
3.3.2.9. Guards, bleacher seating / outdoor places of assembly

3.3.4. Residential Occupancy

3.3.4.7. Stairs, Ramps, Landings, Handrails and Guards for Dwelling Units to conform to Section 9.8

3.3.5. Industrial Occupancy

3.3.5.10.



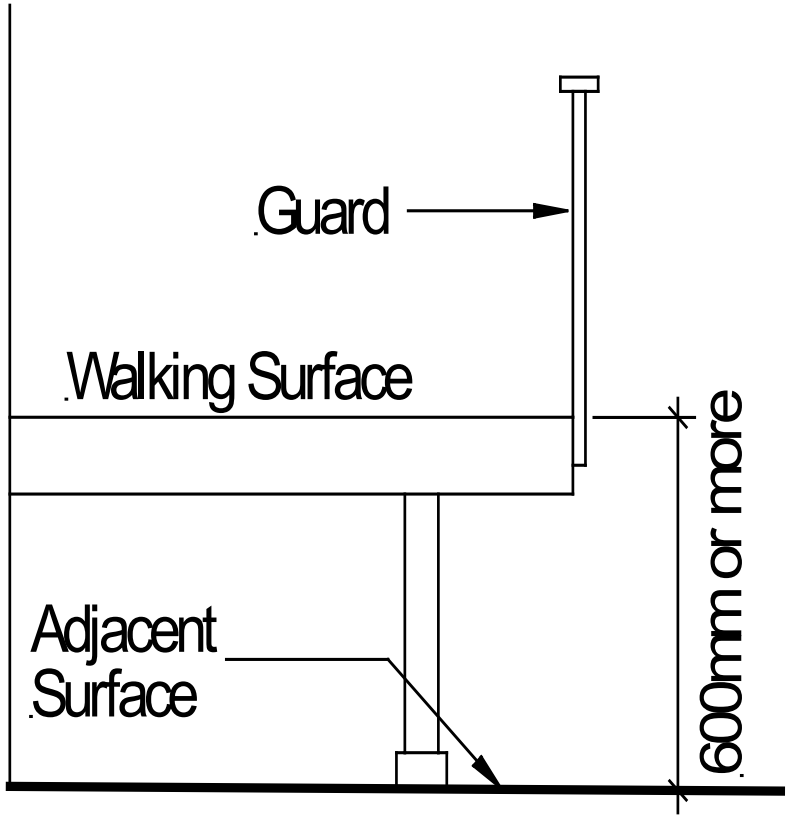
Guards in industrial occupancies, not serving storage garages

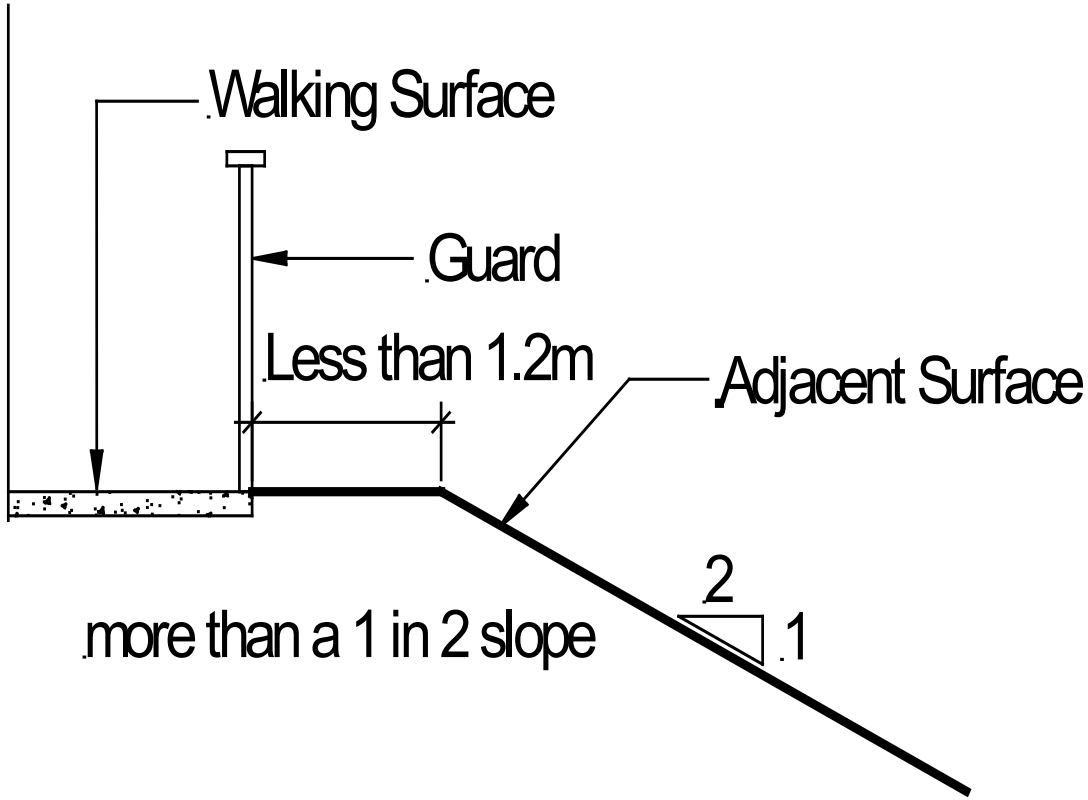
3.4.6.6. Guards

1) **Every exit shall have a wall or a well-secured guard on each side**, where

a) there is a **difference in elevation of more than 600 mm** between the walking surface and the adjacent surface, or

b) the adjacent surface within 1.2 m of the walking surface has a slope of more than 1 in 2.



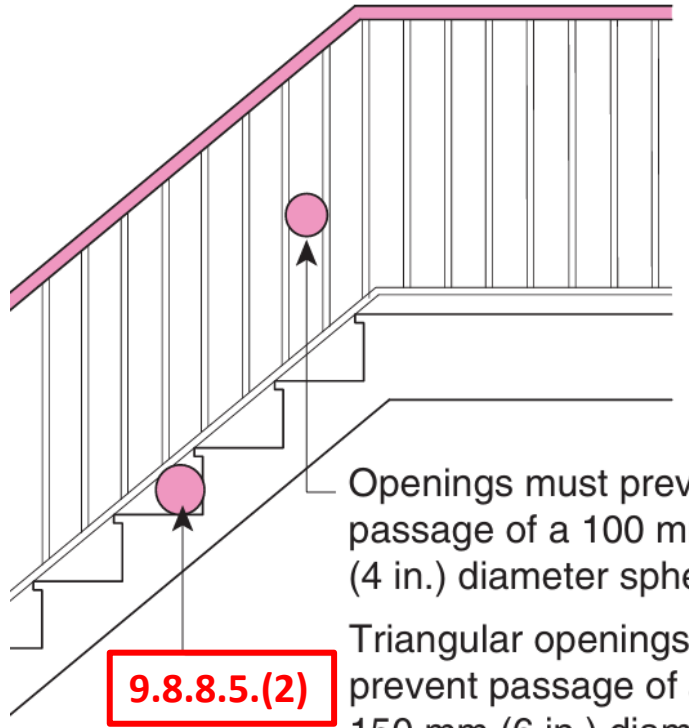


3.4.6.6. Guards

2) Except as required by Sentence (4), the **height of guards** for exit stairs and exit ramps as well as their landings shall be not less than **1 070 mm**

4) The height of guards for exterior stairs and landings more than 10 m above adjacent ground level shall be not less than **1 500 mm** measured vertically to the top of the guard from the surface of the landing or from a line drawn through the outside edges of the stair nosings

5) Except as provided in Sentence 3.3.1.18.(3) and Articles 3.3.4.7. and 3.3.5.10., guards in exits shall not have any openings that permit the passage of a spherical object whose diameter is more than **100 mm**.

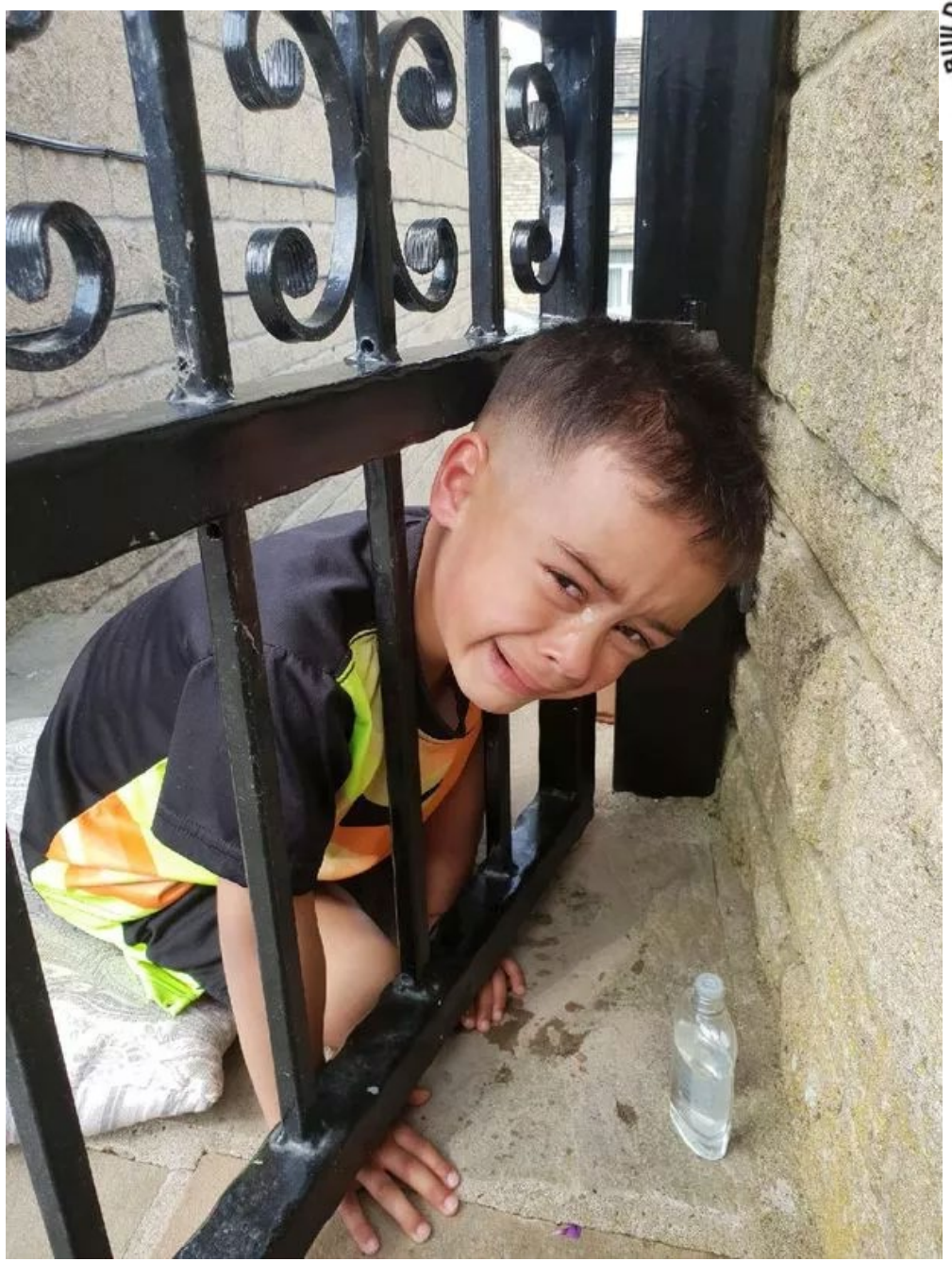


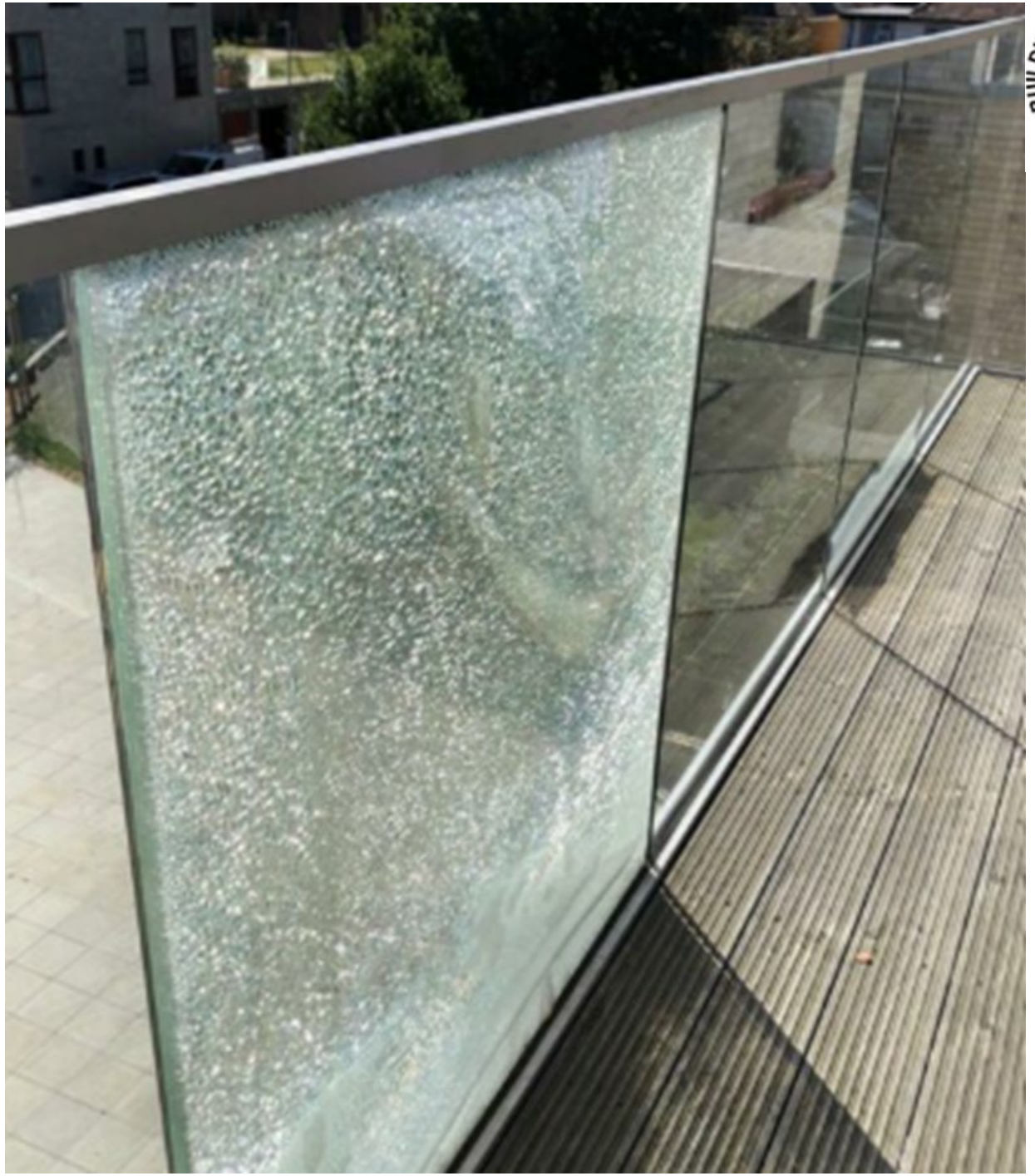
A-9.8.8.5.(1) and (3) Risk of Falling through Guards.

The risk of falling through a guard is especially prevalent for children. Therefore, the requirements are stringent for guards in all buildings except industrial buildings, where children are unlikely to be present except under strict supervision

A-9.8.8.5.(4) Risk of Children Getting Their Head Stuck between Balusters.

The requirements to prevent children falling through guards also serve to provide adequate protection against this problem. However, guards are often installed where they are not required by the Code; i.e., in places where the difference in elevation is less than 600 mm. In these cases, there is no need to require the openings between balusters to be less than 100 mm. However, there is a range of openings between 100 mm and 200 mm in which children can get their head stuck. Therefore, openings in this range are not permitted except in buildings of industrial occupancy, where children are unlikely to be present except under strict supervision.





BUILDING - OFFICIALS' - ASSOCIATION - OF - BC

All glass guard installation (in the City of Vancouver):

Glass guards without the top edge protection will not be permitted unless a report that explicitly justifies how the glass guard complies with structural redundancy in **CAN/CGSB-12.20-M** is prepared by the Structural Engineer.

In accordance with the APEGBC Professional Practice Guidelines "Designing Guards for Buildings," a Professional Engineer or Architect shall submit Letters of Assurance (Schedules B and C-B) taking responsibility for structural conformance with CAN/CGSB-12.20-M in relation to factored design loads after failure of alternate lights and the connection to the base building, including the effect on the base building.

In accordance with APEGBC guidelines, a Registered Professional of Record completing Schedule B shall cross off and initial items that do not apply to his/her scope of responsibility in that project.

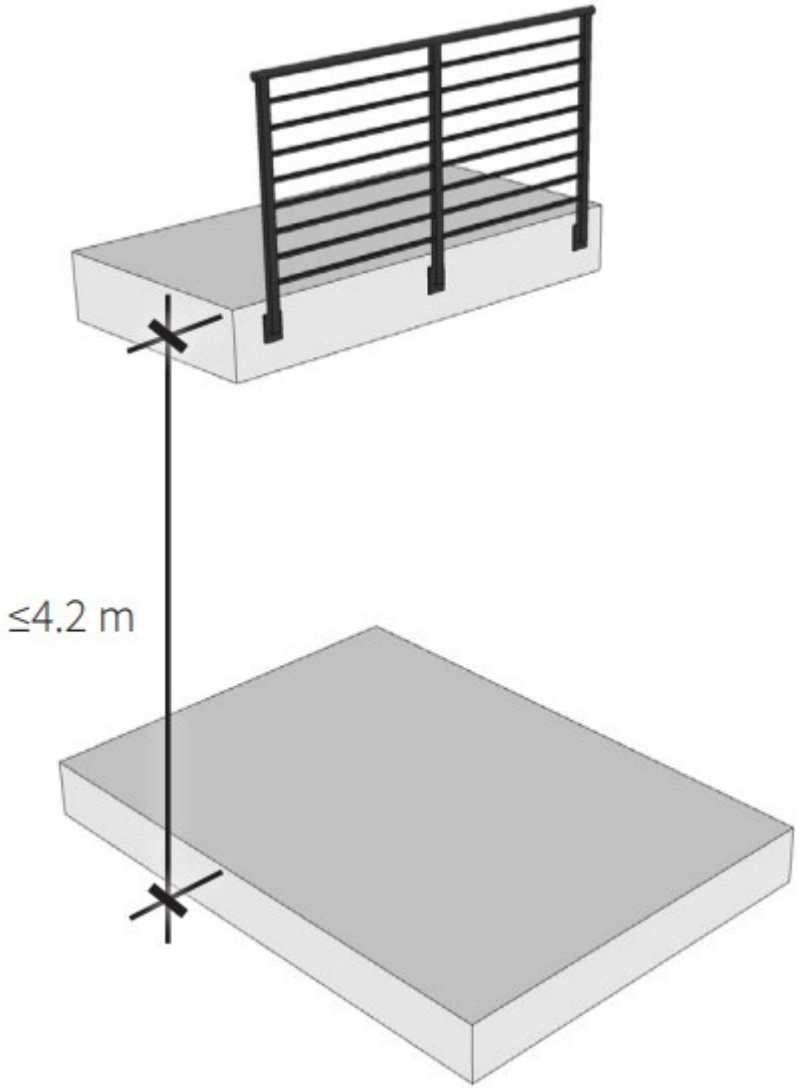
https://vancouver.ca/files/cov/2015-009-glass-guards.pdf

9.8.8.7. Glass in Guards

All glass in guards must be either safety glass of laminated or tempered type or wired glass conforming to the applicable Standards in Clauses (a) and (b). In addition, all guards must be designed to withstand the anticipated lateral loads as required in Subsection 9.8.8.2. It should be noted that tempered glass, although meeting load requirements, due to its sensitivity with certain materials can simply shatter with less than the design load. Due to this potential, jurisdictions may – depending on location and type of construction – restrict the glass type to laminated or wired glass.

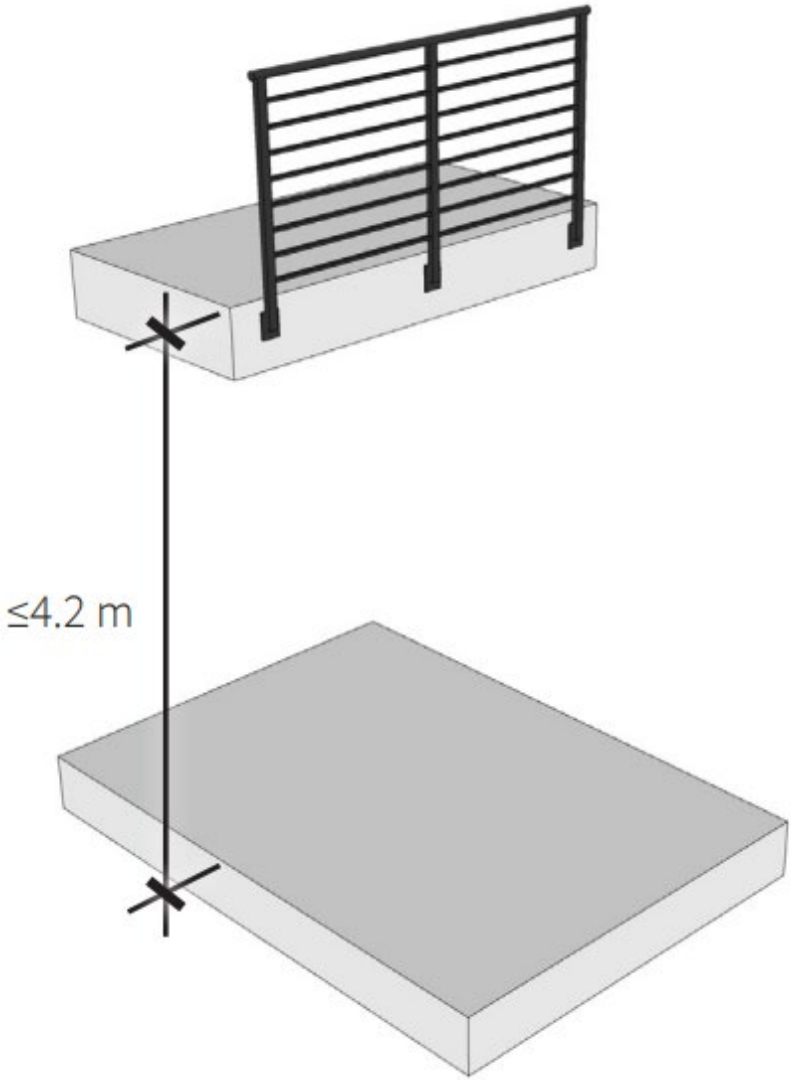
3.4.6.6.(7) Guards

Except for guards conforming to Article 3.3.5.10. serving a storage garage, guards that **protect a level located more than one storey or 4.2 m above the adjacent level** shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above the level being protected by the guard facilitates climbing. (See Note A-9.8.8.6.(1).)

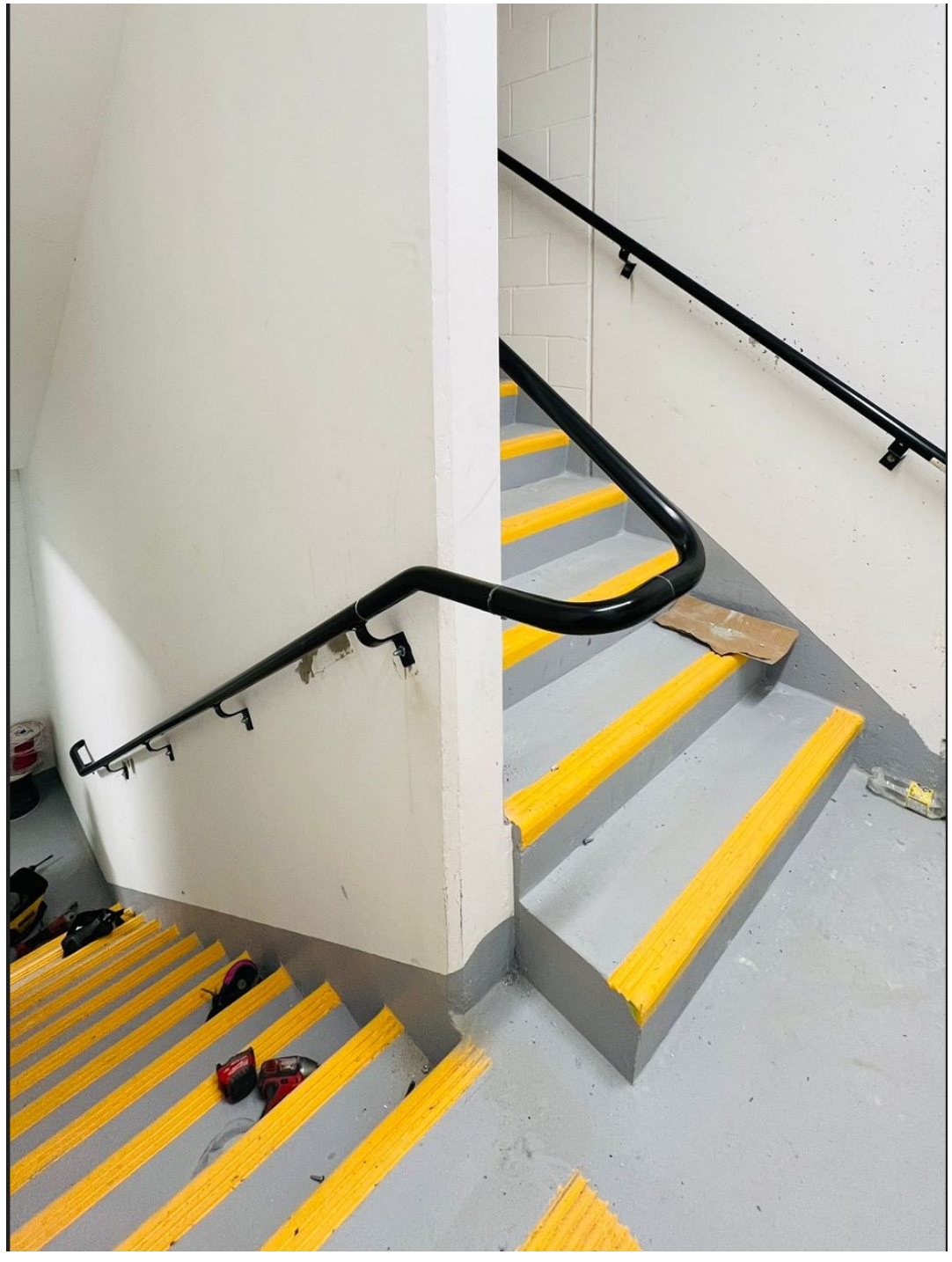


9.8.8.6.(1) Design of Guards to Not Facilitate Climbing

Except for guards in industrial occupancies, guards required by Article 9.8.8.1. that **protect a level located more than 4.2 m above the adjacent level** shall be designed so that no member, attachment or opening located between 140 mm and 900 mm above the level protected by the guard facilitates climbing. (See Note A-9.8.8.6.(1).)



3.4.6.6.(7) Guards + 9.8.8.6.(1) Design of Guards to Not Facilitate Climbing




BC - BUILDING - OFFICIALS' - ASSOCIATION - OF - BC
FIRE
HEALTH
SAFETY
STRUCTURAL

Guards…

Are they required?

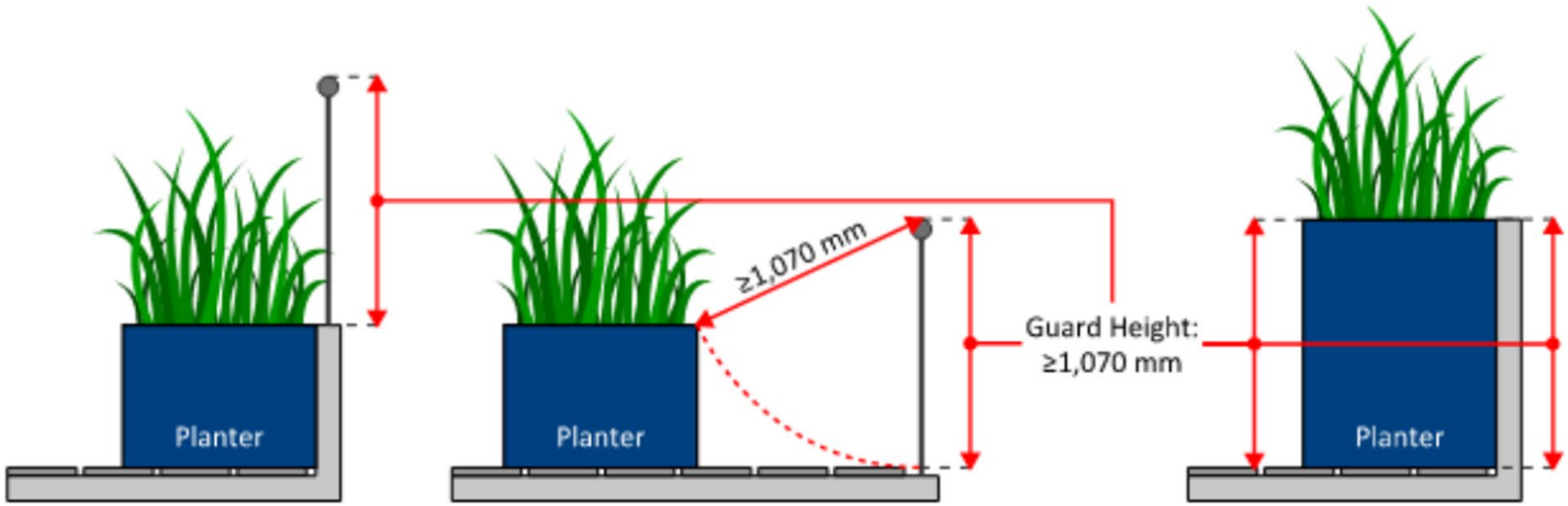
Part 3 Building;

Drop off from deck…

3.3.1.18.(1) "…a guard not less than 1 070mm high shall be provided,"
c) at each raised floor, mezzanine, balcony, gallery, interior or exterior vehicular ramp, and at other locations where (see Note A-9.8.8.1.)

i) the difference in elevation is more than 600 mm between the walking surface and the adjacent surface, or…

Let’s have a look at the photo shared by a manufacturer, within the context of building code requirements for guards.


Planter
≥1,070 mm
Planter
Guard Height:
≥1,070 mm
Planter

Roof top space – could be amenity space.

Is the building a Part 3 or Part 9?

Note the shaft opening. Is it a problem?

Does the shaft opening require a guard to prevent falling into it?

Why is there a guard around the shaft opening?

What would be the height of the roof perimeter guard?

Roof top space – could be amenity space.

Is the building a **Part 3** or Part 9?

Note the shaft opening.
Is it a problem? **No.**

Does the shaft opening require a guard to prevent falling into it? **No**

Why is there a guard around the shaft opening? Prevent access to the top of the shaft upstand.

What would be the height of the roof perimeter guard? 1500mm AFF

The End... Thank You!