STRUCTURAL ENGINEER APPROVED

Balustrade + Handrail

SANS Codes Summary

Balustrade + Handrail
SANS Codes Summary

Index:

Balustrade + Handrail
SANS Codes Summary

Definitions:

1. NBR – National Building Regulations
2. SABS – South African Bureau of Standards
3. SANS – South African National Standard
4. Competent Person – person who is qualified by virtue of his education, training, experience and contextual knowledge to make a determination regarding the performance of a building or part thereof in relation to a functional regulation or to undertake such duties as may be assigned to him in terms of The National Building Regulations.
5. Competent Person Glazing – competent person who is recognized by an institute, which has specialist expertise in the field of glazing, as generally having the necessary experience and training to determine glazing requirements in accordance with the requirements of SANS 10137.
6. Rational assessment – assessment by a competent person of the adequacy of the performance of a solution in relation to requirements including as necessary, a process of reasoning, calculation, and consideration of accepted analytical principles, based on a combination of deductions from available information, research and data, appropriate testing and service experience.
7. Rational Design – design by a competent person involving a process of reasoning and calculation and which may include a design based on the use of a standard or other suitable document.
8. Occupancy – particular use or the type of use to which a building or portion thereof is normally put or intended to be put.
9. Deemed to Satisfy Requirement – non-mandatory requirement, the compliance with which ensure compliance with a functional regulation.
10. Handrail – rail used in circulation areas, such as corridors, passageways, ramps or stairways, to assist continuous and safe movement.

Balustrade + Handrail
SANS Codes Summary

SANS 10104 (SABS 0104)
Handrailing and Balustrading (safety aspects)

SANS 10400-A: 2010 Edition 3
NBR - General Principals and Requirements

This part of SANS 10400 is intended to enable:

a. Designers to design buildings that comply with the requirements of The National Building Regulations,
b. Contractors to construct buildings and their subsystems using conventional materials and construction techniques in accordance with practices which are deemed to satisfy such regulations, and
c. Local authorities to establish compliance with the Regulations in a uniform and consistent manner.

A19 Appointment of Persons Responsible for Design, Inspection and Assessment Duties.

1. Where in terms of these regulations and in respect of the erection of any building-
   a. a rational design or rational assessment is required in terms of:
   ii a part of SANS 10400;
4. The owner of any building who is required by these regulations to appoint an approved competent person shall state in term of the appointment for the competent person that such person shall undertake all duties and responsibilities required by these regulations. Such persons shall declare his or her cceptance of these responsibilities in the relevant portion of Form 2 contained in SANS 10400-A
8iv. Each designer of a part of a system shall on completion of the erection or installation thereof, if called upon to do so by the approved competent person, complete and submit the section of Form 3 relating to inspection contained in SANS 10400-A.

Balustrade + Handrail
SANS Codes Summary

SANS 10400-B: 2012 Edition 3
NBR- Structural design

1. This part of SANS 10400 provides deemed to satisfy requirements for compliance with Part B (Structural Design) of the National Building Regulations.

Normative references

2. The following referenced documents are indispensable for the application of this document: (in part)
SABS 0104 Edition2 1991 - Handrailing and Balustrading (safety aspects)
SANS 10160-All Parts - Basis of structural design
SANS 10400-M: 2011 Edition 3 - NBR- Stairways
SANS 10400-N: 2010 Edition 3 - NBR- Glazing

4.2.2. **Rational designs in respect of building systems comprising materials and elements the properties, characteristics and behaviour of which are well known.**

4.2.2.1. The competent person (structures), in order to demonstrate that the functional regulations contained in part B of the NBR pertaining to the structural system or part thereof are satisfied, shall undertake a rational design in accordance with the following South African national standards, or in accordance with recognised engineering principles, as applicable:

SABS 0104 Edition2 1991 - Handrailing and Balustrading (safety aspects)
SANS 10160 - for the general procedures and loading to be adopted in the design of a building

4.2.2.3. The competent person (structures) responsible for the rational design shall, if called upon by an owner of a building constructed in accordance with the rational design, or by local authority within a period of 10 years after completion of the building system or art thereof, produce documentation (including assumptions made, loads applied and calculations) that demonstrates that the building system complies with part B of the NBR for the performance parameters contained in **Table 3**.

Balustrade + Handrail
SANS Codes Summary

SANS 10400-D: 2011 Edition 3
NBR- Public safety

This part of the SANS 10400 provides deemed-to-satisfy requirements for compliance with part D (public safety) of the NBR.

4. Requirements

4.2 Change in Level

4.2.1. Any balustrade or wall provided to protect a change in level shall comply with the requirements of SANS 10400-B.

4.2.2. The edge of a balcony, bridge, flat roof or similar place more than 1 metre above the adjacent floor or ground level shall be provided with a balustrade or parapet wall not less than 1 metre in height, unless unauthorised access of persons thereto has been excluded by a physical barrier properly erected and maintained.

4.2.3. In the case of an interior balcony or mezzanine floor, such balcony or floor shall be provided with a balustrade or wall not less than 1 metre in height, provided that where such balcony or floor is used for public seating in rows, such height may be reduced to not less than 800mm opposite the seating in the front row.

4.2.4. A balustrade or wall provided as protection at a change in level in any occupancy classified as E2, E3, E4, H1, H2, H3, H4 or H5 (according to SANS 10400-A Table 1), shall not have any opening that permits the passage of a 100mm diameter ball, provided that such protection in any occupancy that is not an occupancy classified as E2, E3, E4, H1, H2, H3, H4 or H5 (according to SANS 10400-A Table 1), shall consist of at least a handrail and one other rail midway between such handrail and the floor.

See **Table 1** on the next page.

Balustrade + Handrail
SANS Codes Summary
Table 1- Occupancy or Building Classification

1 - Class of occupancy	2 - Occupancy
A1	**Entertainment and public assembly** Occupancy where persons gather to eat, drink, dance or participate in other recreation.
A2	**Theatrical and indoor sport** Occupancy where persons gather for the viewing of theatrical, operatic, orchestral, choral, cinematographical or sport performances.
A3	**Places of Instruction** Occupancy where school children, students or other persons assemble for the purpose of tuition or learning.
A4	**Worship** Occupancy where persons assemble for the purpose of worshipping.
A5	**Outdoor sport** Occupancy where persons view outdoor sports events.
B1	**High risk commercial service** Occupancy where a non-industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions.
B2	**Moderate risk commercial service** Occupancy where a non-industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with moderate rapidity but is not likely to give rise to poisonous fumes, or cause explosions.
B3	**Low risk commercial service** Occupancy where a non-industrial process is carried out and where neither the material handled nor the process carried out falls into the high or moderate risk category.
C1	**Exhibition hall** Occupancy where goods are displayed primarily for viewing by the public.
C2	**Museum** Occupancy comprising a museum, art gallery or library.
D1	**High risk industrial** Occupancy where an industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions.
D2	**Moder-ate risk industrial** Occupancy where an industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with moderate rapidity but is not likely to give rise to poisonous fumes, or cause explosions.
D3	**Low risk industrial** Occupancy where an industrial process is carried out and where neither the material handled nor the process carried out falls into the high or moderate risk category.
D4	**Plant room** Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building.
E1	**Place of detention** Occupancy where people are detained for punitive or corrective reasons or because of their mental condition.
E2	**Hospital** Occupancy where people are cared for or treated because of physical or mental disabilities and where they are generally bedridden.
E3	**Other institutional (residential)** Occupancy where groups of people who either are not fully fit, or who are restricted in their movements or their ability to make decisions, reside and are cared for.

Balustrade + Handrail
SANS Codes Summary

1 - Class of occupancy	2 - Occupancy
E4	**Health care** Occupancy which is a common place of long term or transient living for a number of unrelated persons consisting of a single unit on its own site who, due to varying degrees of incapacity, are provided with personal care services or are undergoing medical treatment.
F1	**Large shop** Occupancy where merchandise is displayed and offered for sale to the public and the floor area exceeds 250 m^2.
F2	**Small shop** Occupancy where merchandise is displayed and offered for sale to the public and the floor area does not exceed 250 m^2.
F3	**Wholesalers' store** Occupancy where goods are displayed and stored and where only a limited selected group of persons is present at any one time.
G1	**Offices** Occupancy comprising offices, banks, consulting rooms and other similar usage.
H1	**Hotel** Occupancy where persons rent furnished rooms, not being dwelling units.
H2	**Dormitory** Occupancy where groups of people are accommodated in one room.
H3	**Domestic residence** Occupancy consisting of two or more dwelling units on a single site.
H4	**Dwelling house** Occupancy consisting of a dwelling unit on its own site, including a garage and other domestic outbuildings, if any.
H5	**Hospitality** Occupancy where unrelated persons rent furnished rooms on a transient basis within a dwelling house or domestic residence with sleeping accommodation for not more than 16 persons within a dwelling unit.
J1	**High risk storage** Occupancy where material is stored and where the stored material is liable, in the event of fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions.
J2	**Moderate risk storage** Occupancy where material is stored and where the stored material is liable, in the event of fire, to cause combustion with moderate rapidity but is not likely to give rise to poisonous fumes, or cause explosions.
J3	**Low risk storage** Occupancy where the material stored does not fall into the high or moderate risk category.
J4	**Parking garage** Occupancy used for storing or parking of more than 10 motor vehicles.

Balustrade + Handrail
SANS Codes Summary

4.4. Swimming pools and swimming baths

4.4.1. A wall or fence shall be provided by the owner of a site which contains a swimming pool or a swimming bath to ensure that no person can have access to such pool or bath from any street or public place or any adjoining site other than through

a. a self-closing and self-latching gate with provision for locking in such wall or fence, or

b. building where such building forms part of such a wall or fence.

4.4.2. a wall or fence shall be provided in any interconnected complex which contains a swimming pool or swimming bath to ensure that no person can have access to such pool or bath from any street or public place or anywhere within the complex other than through a self-closing and self-latching gate with provision for locking in such wall or fence.

4.4.3. such wall or fence and any such gate therein shall not be less than 1.2 metres high measured from the ground level, and shall not contain any opening that will permit the passage of a 100mm diameter ball.

Balustrade + Handrail
SANS Codes Summary

SANS 10400-M: 2011 Edition 3
NBR - Stairways

4. Requirements

4.1 General

4.1.1. The functional regulations pertaining to stairways contained in Part M of the NBR (See Annex A below) shall be deemed to satisfy where

a. the stairway, including any handrail to such stairway, is in accordance with the requirements of 4.2 and 4.3

b. the stairway complies with the requirements of

1) SANS 10400-B and 10400-T, or

2) in the case of occupancies classified as H3 and H4 (see regulation A20 in SANS 10400-A) in single storey and double storey buildings, 4.4 or 4.5 and

c. any wall, screen, railing or balustrade to such stairway is in accordance with the requirements of either SANS 10400-B or SANS 10400-K and SANS 10400-T.

4.1.2. Specific requirements for stairways in buildings in which facilities for persons with disabilities are provided, shall be in accordance with SANS 10400-S.

Note 1: SANS 10400-S reduces the rise of the step, increases the width of the stairway and the length of the landing, requires solid risers where stairs overlap the next lower read, and requires handrails on both sides of the stairway.

Note 2: SANS 10400-T, in the case of emergency routes, increases the width of the stairways, prohibits the use of spiral stairways, and requires solid risers on any class of building other than D4.

4.2. Dimensional requirements

4.2.1. the width of a stairway, measured to any enclosing wall or balustrade, shall not be less than 750mm.

4.3 Protection against falling

4.3.1. Any flight of steps which contains more than three risers shall have protection on both sides provided by a secure wall, screen, railing or balustrade which shall be not less than 1 metre high and so erected that any such wall, screen, railing or balustrade in any occupancy classified as E2, E3, E4, H1, H2, H3, H4, or H5 (according to SANS 10400-A Table 1) shall not have any opening above the pitch line that permits the passage of a 100mm diameter ball; provided that such protection in any occupancy that is not an occupancy classified as E2, E3, E4, H1, H2, H3, H4 or H5 shall consist of at least a handrail and one other rail midway between such handrail and the stair tread(according to SANS 10400-A Table 1).

Balustrade + Handrail
SANS Codes Summary

SANS 10400-M: 2011 Edition 3
NBR- Stairways

4.3.2. any flight of stairs which contains more than five risers shall be provided with at least one continuous handrail extending the full length of such flight, provided that this requirement shall not apply to any building classified as H4 (according to SANS 10400-A Table 1), or within individual dwelling units in an occupancy classified as H3 (according to SANS 10400-A Table 1).

4.3.3. the handrail to any flight of stairs provided in terms of 4.3.2 shall be:

a. on at least one side of the flight where the width of the flight is less than 1.1 metres, and on both sides where the width exceeds 1.1 metres

b. securely fixed to such wall, screen, railing or balustrade at a height of not less than 850mm and not more than 1 metre measured vertically from the pitch line to the upper surface of the handrail, and

c. of such a design and so fixed that there shall be no obstructions on, above or near to it which might obstruct the movement of a hand moving along it.

M1 General Requirement

Any stairway, including and wall, screen, railing or balustrade to such stairway shall:

a. be capable of safely sustaining any actions which can reasonably be expected to occur and in such a manner that any local damage (including cracking) or deformation do not compromise it's functioning

b. permit safe movement of persons from floor to floor, and

c. have dimensions appropriate to its use.

M2 Fire Requirement

A stairway contemplated in regulation M1 shall comply with the relevant requirements in Part T of these regulations.

M3 Deemed-to-satisfy Rules

The requirements of regulations M1 and M2 shall be deemed to be satisfied where the design of any stairway complies with SANS 10400-M.

Balustrade + Handrail
SANS Codes Summary

SANS 10400-N: 2010 Edition 3
NBR - Glazing

This part of SANS 10400 provides deemed-to-satisfy requirements for compliance with Part N (glazing) of the NBR.

4.4 Safety Glazing

4.4.1. The panes of all safety glazing material shall be permanently marked by the installer in such a manner that the markings are visible in individual panes after installation.

4.4.2. Safety glazing material that complies with the requirements of SANS 1263-1 shall be used where

g. glazing is used in any wall or balustrade to a stairway, ramp, landing or balcony

k. glazing is used around areas such as swimming pools.

4.4.3. Glass in balustrades shall be toughened safety glass unless rigidly supported on all sides.

Balustrade + Handrail
SANS Codes Summary

SANS 10400-S: 2011 Edition 3
NBR-Facilities for persons with disabilities

This part of SANS 10400 provides deemed-to-satisfy requirements for compliance with Part S (Facilities for persons with disabilities) of the NBR.

4.7 Changes in level

4.7.1. in trafficable areas for public use, any changes in level shall comply with the requirements of SANS 10400-D, and with the requirements given in 4.7.3

4.7.3. where a change in level of more than 600mm occurs, a handrail shall be provided.

4.8 Ramps

4.8.2. Any ramp provided in terms of this part of SANS 10400 shall

b. have a clear trafficable surface not less than 1100mm wide

f. have a handrail on both sides of the ramp or, where the width is greater than 2.4 metres, a central handrail in accordance with the requirements of 4.10 where the gradient is steeper than 1:15.

4.9 Stairways

4.9.1. stairways shall comply with the requirements of SANS 10400-M, SANS 10400-T and the following requirements:

a. the width of the stairway, measured to an enclosing wall or balustrade, shall not be less than 900mm

b. a landing that serves two flights of stairs in the same straight line shall be of length at least 1100mm

e. a stairway shall be provided with handrails on both sides of the stairway in accordance with the requirements of 4.10

4.10 Handrails

The design and construction of handrails shall be in accordance with the following:

a. handrails shall have an elliptical gripping surface profile that is approximately 50mm wide and 40mm deep, or a circular profile of diameter not less than 35mm and not more than 50mm.

b. the height to the top of a handrail from the nosing of the tread of the stairs or from the surfaces of a ramp shall be in the range of 900mm to 1000mm and shall remain consistent along the length;

c. handrails shall be securely fixed and shall be rigid;

d. the surface of the handrail and wall, or any other surface adjacent to them,shall be free of any sharp or abrasive elements;

e. the clear width between a handrail and an adjacent wall shall be at least 60mm;

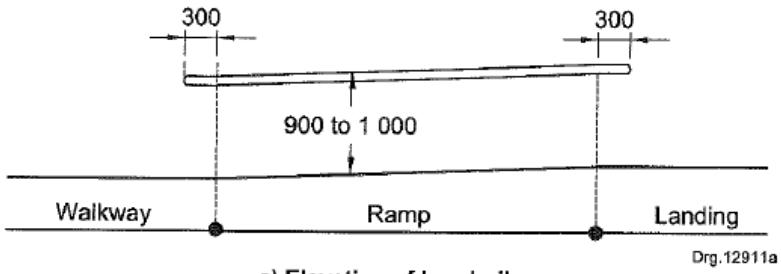
f. handrails shall extend 300mm horizontally beyond the top and bottom of the ramp or stairway and shall return to the supporting structure or shall finish with a positive return, and the minimum dimensions for landings on escape routes as required in SANS 10400-T shall be maintained;

g. handrails shall be continuous between landings where this does not create a hazard;

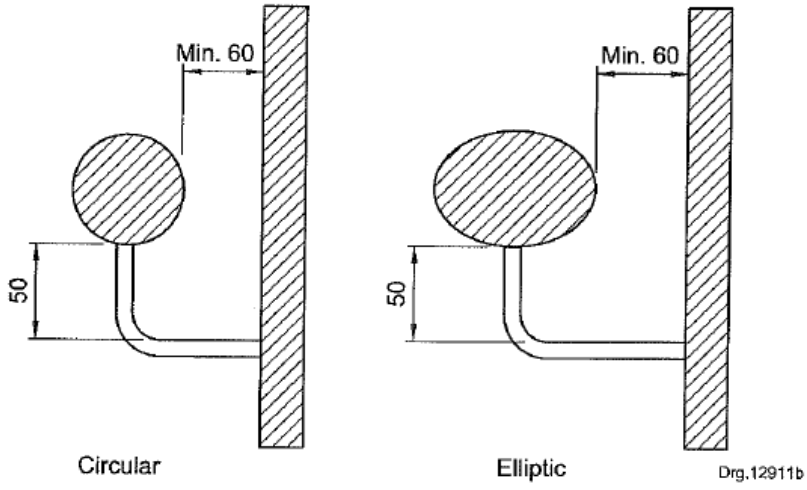
h. handrails shall be supported centrally from below with not less than 50mm between the underside of the handrail and the top of the support;

i. where the stairway is wider than 2.4 metres, a handrail shall be provided at no more than 2.4 metre intervals

Note: handrails that extend at the top and bottom of a stairway are a tactile aid for persons with visual impairments, and a balancing aid for ambulant persons with disabilities.



a) Elevation of handrails



b) Typical profiles of handrails

Figure 12 — Dimensions of typical handrails

Balustrade + Handrail
SANS Codes Summary

SANS 10400-T: 2011 Edition 3
NBR - Fire protection

This part of SANS 10400 provides deemed-to-satisfy requirements for compliance with Part T (Fire protection) of the NBR.

4.16 Provision of Escape Routes

4.16.1. one or more escape routes shall be provided in every building

4.16.5. all doorways and circulation spaces, obstructions in the path of travel, stairways, ramps, handrails and warning signals located along escape routes in buildings other than those occupancies classified as D4, H1, H3, H4, J1, or J2 (according to SANS 10400-A Table 1) in terms of regulation A20 (see SANS 10400-A) shall comply with the requirements of SANS 10400-S

4.23. Stairways and other changes of level along escape routes

4.23.5. no escalator shall form part of an escape route

4.23.6. where a stairway forms part of an emergency route, such stairway shall, throughout its length, be provided with a handrail on either side in accordance with the requirements of SANS 10400-S.

4.23.7. notwithstanding the requirements for minimum width given in SANS 10400-M, the width of a stairway that forms part of an emergency route shall not be less than that given in Table 10 for the population concerned and such width shall not be more than 1800mm, provided that any handrail may project into such width by an amount of not more than 100mm.

Table 10 — Width of escape routes

1	2	3
Maximum number of persons	**Building not required in terms of Part S of the National Building Regulations to provide facilities for persons with disabilities**	**Building required in terms of Part S of the National Building Regulations to provide facilities for persons with disabilities**
	Minimum width mm	
≤ 100	1 000	1 500
≤ 120	1 100	1 500
≤ 130	1 200	1 500
≤ 140	1 300	1 500
≤ 150	1 400	1 500
≤ 160	1 500	1 500
≤ 170	1 600	1 600
≤ 180	1 700	1 700
≤ 190	1 800	1 800
NOTE This table does not contemplate simultaneous evacuation from multi-storey buildings.		

Balustrade + Handrail
SANS Codes Summary

SANS 10160-2: 2011 Edition 1.1
Self -weight and imposed loads

The scope of application of this part of SANS 10160 falls within the general scope of application as given in SANS 10160-1. SANS 10160-1 is not included in this summary as no reference to balustrades is made.

9.3 Characteristic values of imposed loads

9.3.1. Residential, social, commercial and administration areas

9.3.1.1. Areas in residential, social, commercial and administration buildings shall be divided into categories according to their specific uses as shown in Table 1, 2, 3 and 7 which have been combined into one table for this document below. **Please note** these categories are NOT the same as stipulated in SANS10400 Table 1.

Balustrade + Handrail
SANS Codes Summary

SANS 10160-2:2011 (9.4) OCCUPANCY AND LOADING REQUIREMENTS

Category	Specific Use	Sub-category	Example	Line Load *(qk)* Kn/m	Concentrated load (*Qk*) Kn
Table 1	Table 1	Table 1	Table 1	Table 7	Table 7
A	Areas for domestic and residential activities	A1	All rooms in a dwelling unit and a dwelling house, including corridors and lobbies	0.5	1.0
		A2	Bedrooms, wards, dormitories, private bathrooms and toilets in hospitals, hotels, hostels and other institutional residential occupancies	0.5	1.0
		A3	**Stairs and escape routes** in residential occupancies for example serving hospitals, hotels, hostels and other institutional residential occupancies	0.5	1.0
		A4	Balconies accessable to domestic and residential occupancy areas	0.5	1.0
B	Public areas not susceptable to crowding	B1	Office areas for general use	0.5	1.0
		B2	Public libraries excluding stack areas	0.5	1.0
		B3	Kitchens, communal bathrooms and toilets in educational buildings hotels, office buildings and other institutional occupancies	0.5	1.0
		B4	Light laboratories, operating theatres, X-ray rooms	0.5	1.0
		B5	Filing and office storage areas and stack areas in libraries and archives	0.5	1.0
C	Public areas where people may congregate (with the exception of areas defined under category A,B and D	C1	Areas with movables such as furniture and tables for example, class rooms, areas in schools, cafes, restaurants, dining halls, reading rooms, reception areas, banking halls	0.5	1.0
		C2	Areas with fixed seats, for example, areas in churches, theatres or cinemas, conference rooms, lecture halls, assembly halls, waiting rooms, railway waiting rooms, grandstands and fixed individual seating	1.5	1.0
		C3	Areas without obstacles for moving people, all without fixed individual seating for example, assembly halls and areas, sport complexes, grandstands, areas in museums or exhibition rooms, and access in public and administration buildings, hotels, hospitals, airports, railway station forecourts and terminals; stairs, corridors, landings; cantilever balconies accessible to the public	1.5	1.0
		C4	Areas with possible physical activities, for example dance halls, gymnastic rooms, stages	1.5	1.0
		C5	Areas susceptible to large crowds for example, in buildings for public events like concert halls, exhibition halls, sports halls including stands, terraces, access areas, **escape routes** and railway platforms	3.0	1.0
D	Shopping areas	D	Areas in general retail, shops and department stores	1.5	1.0
	Table 2	Table 2	Table 2	Table 7	Table 7
E	Light industrial use	E1	Production rooms such as workshops with lightweight equipment	1.0	1.0
	Industrial use	E2	Production rooms such as workshops in works and factories	1.0	1.0
	Areas susceptible to accumulation of goods including access areas Access ladders and walkways	E3	Areas for storage use including storage of books and other documents	1.0	1.0
		E4	Maintenance walkways in buildings	1.0	1.0

NOTES

Note 1	Depending on their anticipated uses, areas likely to be categorised as C2, C3 or C4, **may** be categorised as C5, by decision of Client or the relevant authority.
Note 2	The concentrated load ***Qk*** is applied over an area of 0.1mX0.1m
Note 3	**Escape routes for category B and D shall be designed according to Category C5.**
Note 4	For areas of Category E, the horizontal load depends on the occupancy. Therefore the value of ***qk*** is defined as a minimum value and should be checked for the specific occupancy.
Note 5	A concentrated force, ***Qk*** should be applied acting in any direction between vertically downward and horizontally inward or outward, applied over a 100mm length for beam elements, and over 100mmX100mm area for plate elements and acting at the top or any other position of the guard for all categories.

Balustrade + Handrail
SANS Codes Summary

9.4 Horizontal loads on parapets, partition walls and guardrails acting as barriers.

9.4.1. The characteristic values of loads on parapets, railings, balustrades and walls acting as barriers, including partition walls, exterior walls, curtain walls and glazing units are specified in 9.4

9.4.2. The characteristic values of the line load, qk, acting at the height of the partition wall or parapets but not higher than 1.2 metres, shall be taken from Table 7.

9.4.3. The characteristic loads, qk and Qk, shall not be applied simultaneously

9.4.4. for guardrails in elevated or multi-storey parking garages for vehicles of a gross weight not exceeding 25kN: a horizontal load of 30kN; distributed over any 1.5 metre length of barrier, acting normal to the barrier and at a height of 550mm above floor level, shall be applied.

Note 1: design situations due to impact by vehicles for all categories of traffic areas, see Table 4, should be considered as an accidental design situation in accordance with SANS10160-1

Note 2: for procedures for accidental design situations involving impact by vehicles refer to EN 1991-1-7.

9.4.5. Boundary, yard and garden walls shall be designed in accordance with category A in Table 7.

9.4.6. ensure that all walls, curtain walls, partitions, balustrades and all large glazed areas within one metre of the floor that may be exposed to impact from a person falling against or bumping into them, have a level of impact resistance which will prevent undue risk of injury including the prevention of the person from falling through the balustrade, resulting from failure, fracture or penetration of the wall, partition, curtain wall, glazed panel or balustrade.

9.4.7. resistance to impact will be proven by testing using an impact of 400J, delivered by means of a 250mm diameter bag filled with dry sand to a mass of 30 kilograms, representative of the most severe conditions likely to occur. The impact test may be reduced to 200J for instances where the perpendicular approach distance is less than 1.5 metres.

Note 1: See SANS 1263-1 for an impactor capable of greater uniformity of impact and of delivering impacts up to and exceeding 400J.

Balustrade + Handrail
SANS Codes Summary

Note 2: for non-brittle materials and for masonry, the ability to withstand forces specified in 9.4 with the normal resistance factors for the materials concerned will generally ensure adequate resistance to human impact.

Note 3: The approach distance limits the velocity and therefore the impact energy of a person that is reduced where approach distances are small, such as on narrow staircases or corridors. If a door is positioned opposite such a barrier then the approach distance will increase, and if this exceeds 1.5 metres then the higher impact energy of 400J should be used. If non-load bearing systems such as dry wall partitions are installed and conceivably the position of doors or openings adjacent to the barrier change and affect the approach distance, then the higher impact energy of 400J should be used.

Balustrade + Handrail
SANS Codes Summary

SANS 10160-3: 2011 Edition 1.1
Wind actions

No specific reference is made to balustrade design in SANS 10160-3, reference is made to this SANS code in SANS 10137 below

SANS 10137: 2011 Edition 4
The installation of glazing in buildings

5.10 Resistance to wind loads
5.10.1. General (edited for information purposes)

Except for accidental loading, the most important force that glazing will be subjected to is wind load. The term "wind load" indicates the force generated by a gust of wind for a maximum of 3 s that the glazing will have to withstand.
It takes into account the fact that the glazing can be subjected to simultaneously to a positive load on one side and a negative load on the other.
It is the responsibility of the designer in conjunction with consultants to determine the expected wind load in terms of SANS 10160-3
The resistance of the glazing to wind load depends to a great extent on the surrounds and fixings and careful attention has to be given to the design and installation of the glazing.
A competent person (glazing) shall be required to design glass for installations using other support methods such as bolted, clamped, and cantilevered and any other method of transferring design loads from the glazing material to the superstructure.
A competent person (glazing) shall use good engineering practice or experience (or both) in the design of the glazing system to resist wind load (and any other loads such as impact) and shall document and maintain documentation of each project so designed.
The architect or structural engineer (or both) shall specify the design wind pressure for a particular building at time of tender. The specifier (i.e. architect, quantity surveyor, developer or owner) is to supply the manufacturer with the design wind pressure for a particular building as the manufacturer has no access to the owner's requirements in respect of the life expectancy of the building; this together with the engineer's interpretation of building configuration and location in terms of SANS 10160-3. The general procedures and loadings to be adopted in the design of buildings will determine the required design and wind pressure.

Balustrade + Handrail
SANS Codes Summary

The declaration of the design wind pressure at the time of tender also enables the specifier to compare like-for-like during adjudication and circumvents that (sub) contractors select unsuitable glazed architectural products for the project at hand. If a design wind pressure is not available, guidance for its determination shall be obtained from SANS 10160-3. This wind pressure shall be stated on all design documentation

6. Bolt fixed structural glazing

6.1. General

6.1.1. The use of bolts to fix through glass will inevitably result in stress concentrations around the boltholes. These are weak points in annealed glass, because drilling or notching almost inevitably leads to breakage of annealed glass when it is subject to applied loads. Toughened glass shall be specified where bolt fixings are to be used.

6.1.2. the frame or fixing (or both) shall always be designed so that they do not tend to distort the glass panel. This is more important with bolted connections, which can exert considerable force on the glass, where particular attention shall be paid to the alignment and position of the fixings in order to avoid unnecessary stress being developed.

6.1.3. A bolted fixing will generally consist of two metal spreader plates, one of which is attached to the structure, with one or more bolts passing through the glass and clamping it between the spreader plates. The spreader plates shall be separated from the glass by a gasket that shall be preferably not more than 1mm thick and incompressible (for example a vulcanized fibre gasket but not a chloroprene gasket). A nylon or similar, incompressible bush 2mm to 3mm thick shall be used to prevent the bolt from contacting the edge of the hole. The hole in the glass shall be at least 10mm larger in diameter than the bolt passing through it, to allow for tolerance adjustment and the presence of the bush. The spreader plate shall give a minimum of 15mm cover to the glass around the hole when the bolt is centrally positioned in the hole.

6.1.4. The bolt size, spreader plate diameter and spreader plate thickness shall be chosen to suit the specific design of the glazing. The design shall ensure that it can carry the anticipated loads without the glass fracturing and without excessive deflection.

6.1.5. The general relationship between the components of a bolted fixing can be determined after the appropriate size of the bolt has been chosen The thickness of the spreader plate shall be approximately three quarters of the bolt diameter, but not less than 6mm. The diameter of the spreader plate shall be approximately eight times its thickness. Table 10 shows this relationship.

Balustrade + Handrail
SANS Codes Summary

Table 10 — Relationship between bolt size, spreader plates and glass thickness

1	2	3	4	5
Loading	Bolt diameter mm	Spreader plate		Toughened glass thickness mm
		Diameter mm	Thickness mm	
Light	M6	50	6	8
Normal	M8, M10	50	6	8,10
Heavy	M10	60	8	10,12
	M12	75	10	12,15
	M16	100	12	15, 19, 25
NOTE For bolted fixings used simply to locate a pane in position, not intended to form a clamp and able to resist applied bending moments the fixing for normal loading should be appropriate for all thicknesses of toughened glass.				

6.2 Bolt fixing of glass in barriers

6.2.1. General

The barrier and glass panels shall be designed in accordance with BS 6180.

6.2.2. Bolt fixing of glass infill panels

At the bolted connections there shall be clamping plates and gaskets on both sides of the glass, a minimum of 50mm in diameter. These plates shall be not less than 6mm thick in steel or an equivalent stiffness in other materials. Figure 23 shows a typical fixing.

Where the length of a glass pane is much greater than the span between the bolted connectors, giving rise to a cantilevered portion of the pane, the cantilevered portion shall be less than one quarter of the span between the bolted connectors.

Under the design loads, the barriers shall be designed such that the relative in-plane movement of the bolted connections in the same panel is not greater than 2mm.

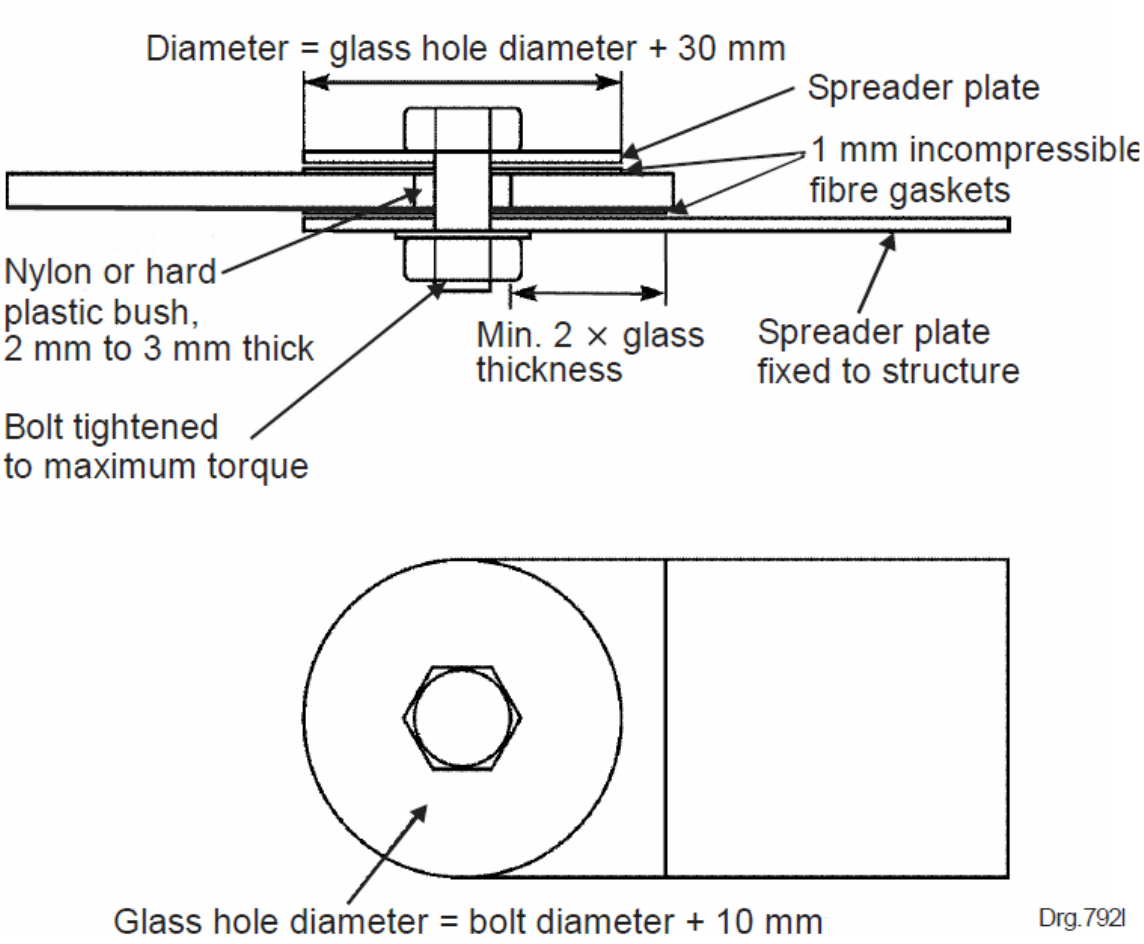


Figure 23 — Bolting of toughened glass

6.5 Balustrades

6.5.1. General

Balustrades are defined as being a device that guards and protect a drop of 750mm or more (see SANS 10160-2)

Refer to the relevant sections in SANS 10160-2 for the design loads on balustrading. Ensure that the impact load requirement as described in SANS 10160-1 for glazed panels within 500mm of the finished floor is applied.

Due to the various types of glazed panels, fixing methods, site conditions and workmanship of the installer all balustrades shall be tested to prove their design capability and shall also be tested on site to further ensure consistency of workmanship and installation detail. It is therefore not possible to describe "rule of thumb" glass thickness for generic installation methods.

Balustrade + Handrail
SANS Codes Summary

Note: The tests required by SANS 10160-2 can be exceeded in their magnitude to give some idea of the safety factor in these installations.

6.11.3.2. Safety glazing

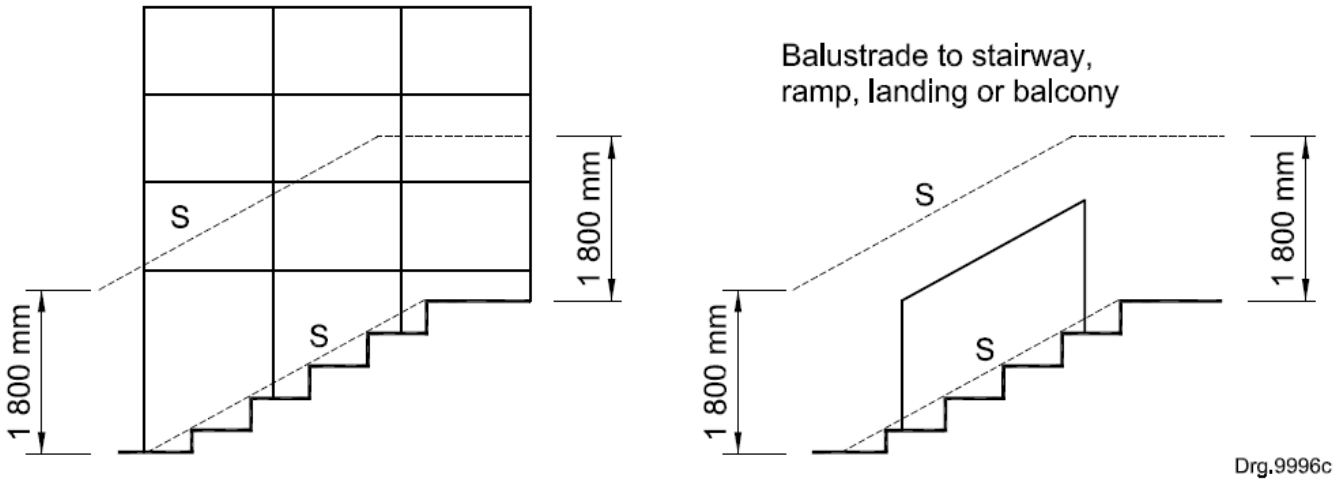
6.11.3.2.1. The panes of all safety glazing material shall be permanently marked by the installer in such a manner that the markings are visible in individual panes after installation.

6.11.3.2.2. Safety glazing material that complies with the requirements of SANS 1263 shall be used where

g. glazing is used in any wall or balustrade to a stairway, ramp, landing or balcony:

k. glazing is used around areas such as swimming pools

6.11.3.2.3. Glass in balustrades shall be toughened safety glass unless rigidly supported all round.



Key
S Safety glazing

Figure 36 — Examples of safety glazing requirements around staircases and landings

Balustrade + Handrail
SANS Codes Summary

SANS 1263-1:2006 Edition 3.1
Part 1: Safety performance of glazing materials under human impact

SANS 1263-1 provides requirements for the manufacture of safety and security glazing in buildings. This code is mandatory but not enforced. By February 2017, this code should be law and enforced by the NRCS. Every manufacturer of safety and security glazing will be required to permanently mark each panel of glass with a unique manufacturer's number for traceability.

The tests required in SANS 1263-1 are required to be undertaken by manufacturers of safety and security glazing, not by the installers of this glazing. Orders placed on manufacturers by installers of this glazing should be placed in accordance with SANS 1263-1:2006

Source: SANS Building Regulations South Africa

Subject to change according to original source. Information correct as of 9 February 2024