



Access covers and grates



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 - Australian Chamber of Commerce and Industry
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 - Water Services Association of Australia
-

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Australian Standard®

Access covers and grates

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PREFACE

This Standard was prepared by the Standards Australia Committee CE-029, Access Covers and Grates, to supersede AS 3996—2006.

The objective of this Standard is to provide designers, manufacturers and purchasers of access covers and grates with a specification for design, supply and testing.

This revision has been made to improve performance of trafficable covers and grates, to provide a method of testing uplift and to include specific requirements for composite materials.

The terms ‘normative’ and ‘informative’ are used in Standards to define the application of the appendices to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard
Access covers and grates

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for access covers and grates for use in vehicular and pedestrian areas. It applies to single or multi-part access covers and grates, where any single cover does not exceed 1300 mm clear opening. This Standard covers products manufactured from grey and ductile iron, cast and manufactured steel, aluminium, concrete, and polymeric materials.

This Standard does not consider fire resistance.

The basis for the requirements specified in this Standard is a minimum service life of 25 years for covers and grates made from polymeric materials and 50 years for covers and grates made from all other materials.

This Standard does not apply to the following:

- (a) Covers and grates in Classes E, F and G made from polymeric materials.
- (b) Covers/grates with any wooden structural component.
- (c) Covers and grates of Class D, E, F and G made from grey cast iron.
- (d) In-situ structural infill covers.
- (e) The hydraulic design of access covers and grates.
- (f) Multi-part units that require fittings such as removable beams.
- (g) Applications with heavy point design loads greater than those specified are not covered in this Standard.

NOTE: Guidance on the information to be provided by the purchaser is provided in Appendix B.

1.2 PRODUCT CONFORMITY

Means for demonstrating conformance with this Standard shall be as specified in Appendix A.

1.3 NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE: Documents for informative purposes are listed in the Bibliography.

AS

1110 ISO metric hexagon bolts and screws—Product grades A and B

1110.1 Part 1: Bolts

1112 ISO metric hexagon nuts

1112.1 Part 1: Style 1—Product grades A and B

1379 Specification and supply of concrete

AS	
1428	Design for access and mobility
1428.2	Part 2: Enhanced and additional requirements—Buildings and facilities
1478	Chemical admixtures for concrete, mortar and grout
1478.1	Part 1: Admixtures for concrete
1580	Paints and related materials—Methods of test
1580.408.4	Part 408.4: Adhesion (crosscut)
1830	Grey cast iron
1831	Ductile cast iron
1874	Aluminium and aluminium alloys—Ingots and castings
2312	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
2312.1	Part 1: Paint coatings
2758	Aggregates and rock for engineering purposes
2758.1	Part 1: Concrete aggregates
3600	Concrete structures
3850	Prefabricated concrete elements (series)
3952	Water supply—Spring hydrant valve for waterworks purposes
4586	Slip resistance classification of new pedestrian surface materials
4506	Metal finishing—Thermoset powder coatings
AS/NZS	
1462	Methods of test for plastics pipes and fittings
1462.3	Method 3: Method for determining the impact characteristics of pipes
1554	Structural steel welding
1554.1	Part 1: Welding of steel structures
1554.6	Part 6: Welding stainless steels for structural purposes
1594	Hot-rolled steel flat products
2638	Gate valves for waterworks purposes
2638.2	Part 2: Resilient seated
2865	Confined space
3678	Structural steel—Hot-rolled plates, floorplates and slabs
3679	Structural steel
3679.1	Part 1: Hot-rolled bars and sections
3750	Paints for steel structures
3750.4	Part 4: Bitumen paint
4131	Polyethylene (PE) compounds for pressure pipes and fittings
4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
ISO	
527	Plastics — Determination of tensile properties
527-2	Part 2: Test conditions for moulding and extrusion plastics
1083	Spheroidal graphite cast irons—Classification
3127	Thermoplastics pipes—Determination of resistance to external blows—Round-the-clock method

ISO	
3506	Mechanical properties of corrosion-resistant stainless steel fasteners
3506-1	Part 1: Bolts, screws and studs
4014	Hexagonal head bolts—Product grades A and B
4032	Hexagon regular nuts (style 1)—Product grades A and B
4892	Plastics—Methods of exposure to laboratory light sources
4892-2	Part 2: Xenon-arc lamps
4892-3	Part 3: Fluorescent UV lamps
4995	Hot-rolled steel sheet of structural quality
5775	Bicycle tyres and rims
5775-1	Part 1: Tyre designations and dimensions
17804	Founding—Ausferritic spheroidal graphite cast irons—Classification
ASTM	
A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
A276	Standard Specification for Stainless Steel Bars and Shapes
A380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
A555	Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods
A580	Standard Specification for Stainless Steel Wire
EN	
14889	Fibres for concrete
14889-1	Part 1: Steel fibres—Definitions, specifications and conformity
14889-2	Part 2: Polymer fibres—Definitions, specifications and conformity

1.4 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.4.1 Access chamber (also known as maintenance hole)

A chamber that a person can enter to conduct inspections, testing, maintenance and the like.

1.4.2 Access cover

An openable cover for the purpose of gaining access to conduct inspections, testing or remove obstructions. Access covers may be placed over inspection chambers and access chambers.

1.4.3 Batch

A population of product, of known history, that enables verification that the product was made from known materials at essentially the same time by essentially the same processes and under essentially the same system of control.

1.4.4 Batch release test

A test performed on a batch of components to verify conformance to test criteria before the batch can be released.

1.4.5 Circular opening (CO)

The diameter of the largest circle (measured in millimetres) that can be inscribed in the unobstructed opening between any supporting frames with any removable supporting beams retained in place (see Figure 1.1).

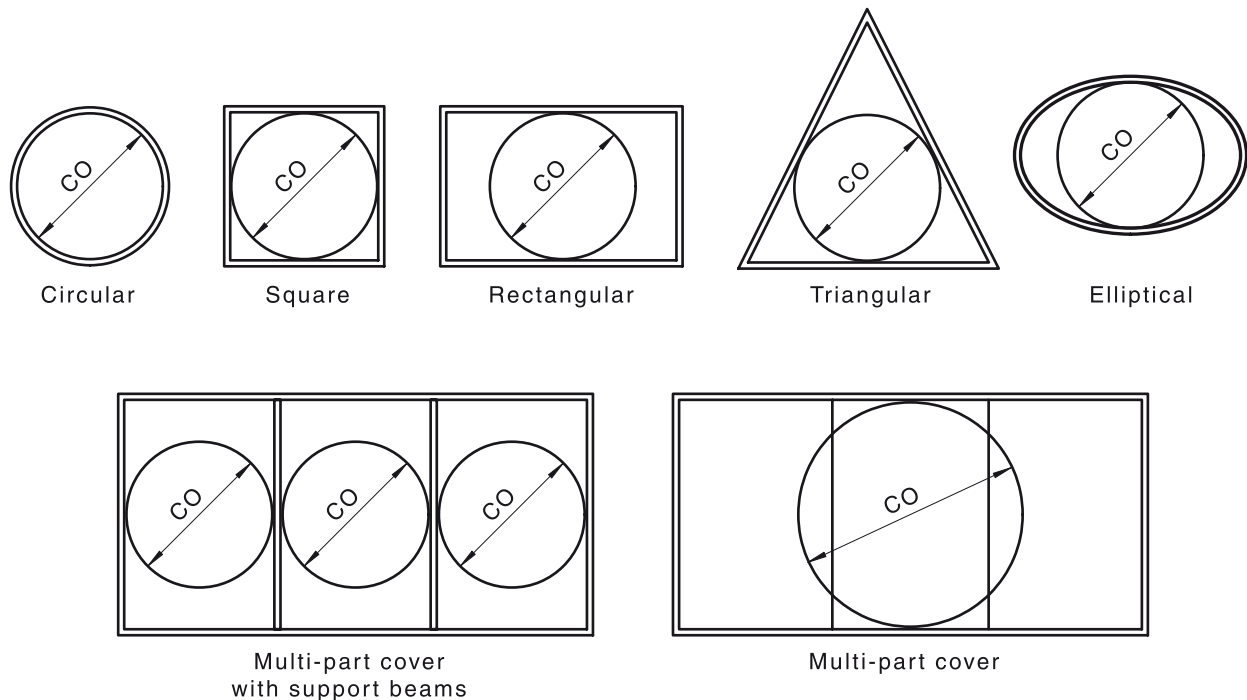


FIGURE 1.1 CIRCULAR OPENING (CO)

1.4.6 Clear opening

An unobstructed opening for access, in service, and without removable supporting beams in place.

1.4.7 Depth of insertion

The depth from the top of the frame to the horizontal seating.

1.4.8 Fastening device

A device that includes features to prevent or largely restrict one or more of the following:

- (a) Relative movement between a grate or cover and the frame.
- (b) The grate or cover being dislodged from the frame under traffic.
- (c) Opening of the grate or cover without the use of a tool.

1.4.9 Grate

A grid of metal or other suitable material placed over an opening, to allow the entry of water while providing protection and support for pedestrians or vehicles passing over it.

1.4.10 Hinge

A device with a means of pivoting that joins a cover or grate to the frame.

1.4.11 Inspection chamber

A chamber to provide access for equipment only, for inspection and testing, maintenance, clearing obstructions and removal of debris when operating from surface level. Inspection chambers do not require entry of a person; however, they may require entry of autonomous inspection equipment.

1.4.12 Lift-out

A cover or grate that can be removed by lifting the cover or grate out of the frame.

1.4.13 Pedestrian areas

Areas primarily accessible to pedestrians, such as footpaths, walkways, building entrances, pedestrian malls and shopping precincts, and includes shared zones that are open to slow moving vehicles.

1.4.14 Recessed cover

A cover requiring a non-structural infill.

1.4.15 Register

A slot and matching protuberance or other feature of a cover or grate and its frame which provides a permanent physical means of correctly orienting the cover or grate in its frame.

1.4.16 Sealed cover

A cover and frame that provide both a gas-tight and a watertight seal.

1.4.17 Sealed gas-tight

A cover and frame that provide a gas-tight seal.

1.4.18 Sealed watertight

A cover and frame that provide a watertight seal.

1.4.19 Seating

Surface on which the grate or cover rests in the frame.

1.4.20 Tilt-up mechanism

A device by which a cover or grate, unattached to the frame, is permitted to rotate into an open position.

1.4.21 Type test

Testing performed to prove that the material or product is capable of conforming to the requirements of the relevant Standard. Type tests are also carried out when a modification is made to some aspect of the product.

1.4.22 Unit

An access cover and its frame or a grate and its frame.

1.4.23 Vane

A part of a grate designed to impart a vertical deflection to inflow to the chamber.

1.5 CLASSIFICATION TERMINOLOGY

Covers and grates shall be classified as follows, as applicable:

- (a) *Load* Grates and covers shall be classified for load capacity, Classes A to G, in accordance with Table 3.1.
- (b) *Opening type* Grates and covers shall be classified as 'lift-out', 'tilt-up' or 'hinged'.

- (c) *Ventilation or sealing* Covers shall be classified as ‘ventilated’, ‘unsealed’, ‘sealed’, ‘sealed watertight’ or ‘sealed gas-tight’. Covers classified as ‘sealed’ shall be both watertight and gas-tight (see Clauses 1.4.16).
- (d) *Bicycle tyre penetration resistance* Grates shall be classified as ‘bicycle tyre penetration resistant’ in all directions.
- (e) *Internal pressure dislodgment resistance* Covers shall be classified to indicate they meet the dislodgement by internal pressure requirements, as specified by Clause 3.2.1.3.

1.6 PERMANENT MARKING

Unless otherwise specified, covers and grates shall bear the following permanent marks:

- (a) Manufacturer’s name or registered trademark.
- (b) Date of manufacture.
- (c) The number of this Standard, i.e. AS 3996.
- (d) For covers and grates with $CO > 300$, the year of issue of this Standard, i.e. AS 3996:2019.
- (e) Load classification in accordance with Table 3.1, e.g. ‘Class D’.
- (f) The approximate mass of the cover (including any infill) or grate, excluding the frame.
- (g) Covers that are sealed shall be marked as such in accordance with Clause 1.5(c).
- (h) Grates designed for a particular direction of inflow shall indicate the direction of inflow on their upper surface.
- (i) Covers that meet the dislodgement by internal pressure requirements, as stated in Clause 3.2.1.3, shall be marked ‘IPD’.

Markings specified in Items (e) to (i) shall be visible on the top of covers (including recessed covers after in-filling) and grates, as appropriate. Markings specified in Items (a) to (c) shall be visible on the top of covers (including recessed covers after in-filling) and grates, or, alternatively, they may be on the underside, such that they are visible when the cover is removed and overturned.

NOTES:

- 1 Additional marking to that specified above, its location and requirements for visibility should be as agreed between the purchaser and manufacturer.
- 2 Manufacturers making a statement of conformance to this Standard on a product, packaging, or promotional material related to that product are advised to ensure that such conformance is capable of being verified.

SECTION 2 MATERIAL REQUIREMENTS

2.1 GENERAL

The materials used in the manufacture and supply of access covers, inspection covers, road grates and frames shall conform to the applicable requirements of this Section. The effects of corrosion, fire durability, thermal expansion, degradation by ultraviolet radiation, serviceability, water absorption, creep, fatigue, impact skid resistance, abrasion and wear shall be taken into account.

2.2 CAST IRON

Cast metal grates and covers for water industry use (i.e. water supply and sewerage applications) shall be manufactured from spheroidal graphite cast iron (hereafter called ductile iron) conforming to the requirements specified in ISO 1083 or ISO 17804 for grades with a specified minimum tensile strength of 500 MPa–800 MPa as well as a specified minimum elongation of 10%.

Cast metal grates and covers for all other applications shall be either—

- (a) flake graphite cast iron (hereafter called grey iron) of a quality not less than that specified in AS 1830 for Grade T–220; or
- (b) ductile iron be in accordance with the requirements specified in AS 1831 for Grade 500/7, or Grade 600/3, as selected by the manufacturer to suit the design and dimensions of the unit.

2.3 FABRICATED MILD STEEL

Mild steel used in the manufacture of covers/grates shall meet the requirements of one of the following steels:

- (a) AS/NZS 3678 Grade 250.
- (b) AS/NZS 3679.1 Grade 300.
- (c) AS/NZS 1594 Grades HA250, HU250, HA300 or HU300.
- (d) ISO 4995 Grade HR235 or HR275.

Welding shall conform to AS/NZS 1554.1 Category GP except for Class D to G covers/grates, which shall conform to AS/NZS 1554.1 Category SP.

2.4 STAINLESS STEEL

Stainless steel used for the manufacture of grates and covers shall be either wrought or cast austenitic stainless steel.

Wrought fabrications shall be manufactured from material meeting the requirements of Grade 304, 304L, 316 or 316L to ASTM A240 (for sheet and plate) and ASTM A276, ASTM A555 and ASTM A580 (for bar and wire) or to the equivalent ISO or EN Standards. Cast grades shall be those with equivalent corrosion resistance.

Welding shall be in accordance with AS/NZS 1554.6 Category 2B except for Class D to G covers/grates which shall conform to AS/NZS 1554.6 Category 1B.

The finish of the grates and covers shall be either pickled, passivated or electropolished in accordance with AS/NZS 1554.6. Stainless steel components shall be passivated in accordance with ASTM A380.

2.5 ALUMINIUM

Aluminium alloys shall be in accordance with AS 1874 shall be selected to match the casting process. Aluminium alloys shall contain no more than 0.4% copper.

Aluminium alloys with as-cast temper designation F1 shall not be permitted.

2.6 CONCRETE FOR INFILLS

The methods and materials used for the manufacture of concrete for infilling of recessed access covers and inspection covers included in this Standard shall be in accordance with AS 1379.

Concrete shall have good abrasion resistance, and the minimum compressive strength shall be 32 MPa at 28 days, with a minimum cement content of 400 kg/m³. Concrete shall be appropriately wet-cured.

2.7 PRECAST CONCRETE

2.7.1 General

Precast concrete is a construction product produced by casting concrete at a place different from its final place of installation. Constituent materials of precast concrete are reinforcement, general purpose cement or blended cement, aggregates, water and admixtures. Concrete covers shall have a minimum compressive strength at 28 days of 32 MPa.

2.7.2 Reinforcement

Steel reinforcement materials shall be in accordance with AS/NZS 4671. At the time of placing concrete, the reinforcement shall be free of materials or coatings likely to impair its bond with the concrete.

Steel fibre reinforcement shall be in accordance with EN 14889-1.

Polymer fibre reinforcement shall be in accordance with EN 14889-2.

2.7.3 General purpose cement and blended cement

General purpose cement and blended cement shall be in accordance with AS 3972.

2.7.4 Aggregates

Aggregates shall be in accordance with AS 2758.1.

2.7.5 Water

Water shall be in accordance with the requirements of AS 1379.

2.7.6 Admixtures

Chemical admixtures shall be in accordance with AS 1478.1. Chemical admixtures shall not contain nitrates, calcium chloride, significant chlorides or other strongly ionized salts unless it can be shown that the admixtures do not adversely affect durability.

2.7.7 Reinforced concrete design

The design of serviceability and strength shall be determined in accordance with AS 3600.

2.7.8 Handling and lifting

Lifting anchors and design requirement shall be in accordance with AS 3850.

2.8 BOLTS

Supplied bolts and nuts shall be designed to withstand in-service loadings applicable to the load classifications in Table 3.1, and the place of the installation.

The length of fastener thread engagement in solid frame structural material shall not be less than the nominal fastener diameter. The thread form of fastener tappings in frames shall be in accordance with AS 1112.1 (ISO 4032) preferred threads. Fastener thread shall not protrude beyond the frame underside.

Where exposed to the environment, bolts and nuts for water industry use (i.e. water supply and sewerage applications) shall be made from stainless steel manufactured in accordance with AS 1110.1 (ISO 4014) and ISO 3506-1 Grade A4 or A5, or as specified by the purchaser.

NOTE: AS 1112.1 and AS 1110.1 are identical adoptions of ISO 4032 and ISO 4014 respectively. An identical adoption and its source document may be used interchangeably.

2.9 PROTECTIVE COATINGS

2.9.1 Cast iron

All surfaces to be coated shall be clean, dry and free from corrosion at the time of coating application.

Unless otherwise specified, covers and grates shall be supplied coated with a paint or bituminous compound. All surfaces to be coated shall be clean, dry and free from corrosion at the time of coating application. The coating shall be applied at a minimum average thickness of 50 µm and shall have an adhesion rating of not less than 2 when tested to AS 1580.408.4.

The coating provided is for short term protection only. If long term protection is required, or if the cover is subjected to a very corrosive environment, alternative corrosion protection should be specified. Where specified, coating shall be applied in accordance with AS 2312.1 as appropriate.

2.9.2 Steel

All fabricated steel covers/grates shall be hot-dip galvanized after fabrication in accordance with AS/NZS 4680.

2.10 POLYMERIC MATERIALS

Polymeric materials are materials that have a structural polymeric component. Such materials comprise both thermoplastic (e.g. polyethylene, polypropylene, polybutylene, nylon, polycarbonate, etc.) and thermosetting materials (e.g. epoxy, polyester, polyurethane, etc.), as well as composite materials that contain a polymeric component, such as fibre reinforced plastic (FRP), sheet moulding (SMC) and bulk moulding compounds (BMC) that can contain any reinforcing material (e.g. glass, cellulose, steel or plastic fibres).

SECTION 3 DESIGN REQUIREMENTS

3.1 LOAD CLASSIFICATION

Access covers and grates shall be designated by classes A, B, C, D, E, F and G according to load capacity as set out in Table 3.1. Testing of covers and grates shall be in accordance with Section 4. The design loads as specified in Table 3.1 shall be used for testing.

The appropriate class for a cover or grate depends on the place of installation. Some places of installation, relative to class, are outlined in Table 3.1. The selection of the appropriate class is part of the design process and where there is doubt the stronger class shall be selected. Figure 3.1 provides examples of the load classifications.

TABLE 3.1
LOAD CLASSIFICATIONS OF COVERS AND GRATES

Class	Typical use	Nominal wheel loading kg	Serviceability design load kN	Ultimate limit state design kN
A	Areas accessible strictly by pedestrians. Not suited to vehicles. Purpose—residential backyards. Walkways not accessible by vehicles.	330	6.7	10
B	Private and shared residential property. Suitable for vehicles accessing driveways and footways. Low speed only. Purpose—residential driveways. Unit sites. Parklands. Residential car parks.	2670	53	80
C	Residential roads and car parks trafficable to vehicles. Purpose—areas with slow moving traffic and minor roads.	5000	100	150
D	Major roads including freeway and motorway shoulders. Warehouses and loading docks. Purpose—major roads.	8000	160	240
E	Freeway and motorway carriageways. Suitable for all heavy vehicles. Purpose—freeways and motorways.	13 700	267	400
F	Docks, wharfs and airport service and taxiways. Purpose—heavy and high traffic volumes.	20 000	400	600
G	Docks, wharfs and airport runways. Purpose—heavy and high traffic volumes.	30 000	600	900

NOTES:

- 1 Nominal wheel loads are given for guidance only. Consideration should be given to the type, size and pneumatic pressure of the load applied.
- 2 Class B design loads exceed AS 5100.2 requirements for footway loading.
- 3 Class D design loads exceed AS 5100.2 requirements for a W80 wheel load.
- 4 Class C units are based on an intermediate load.
- 5 The ultimate limit state load is 3 times the nominal wheel load and 1.5 times the serviceability load.

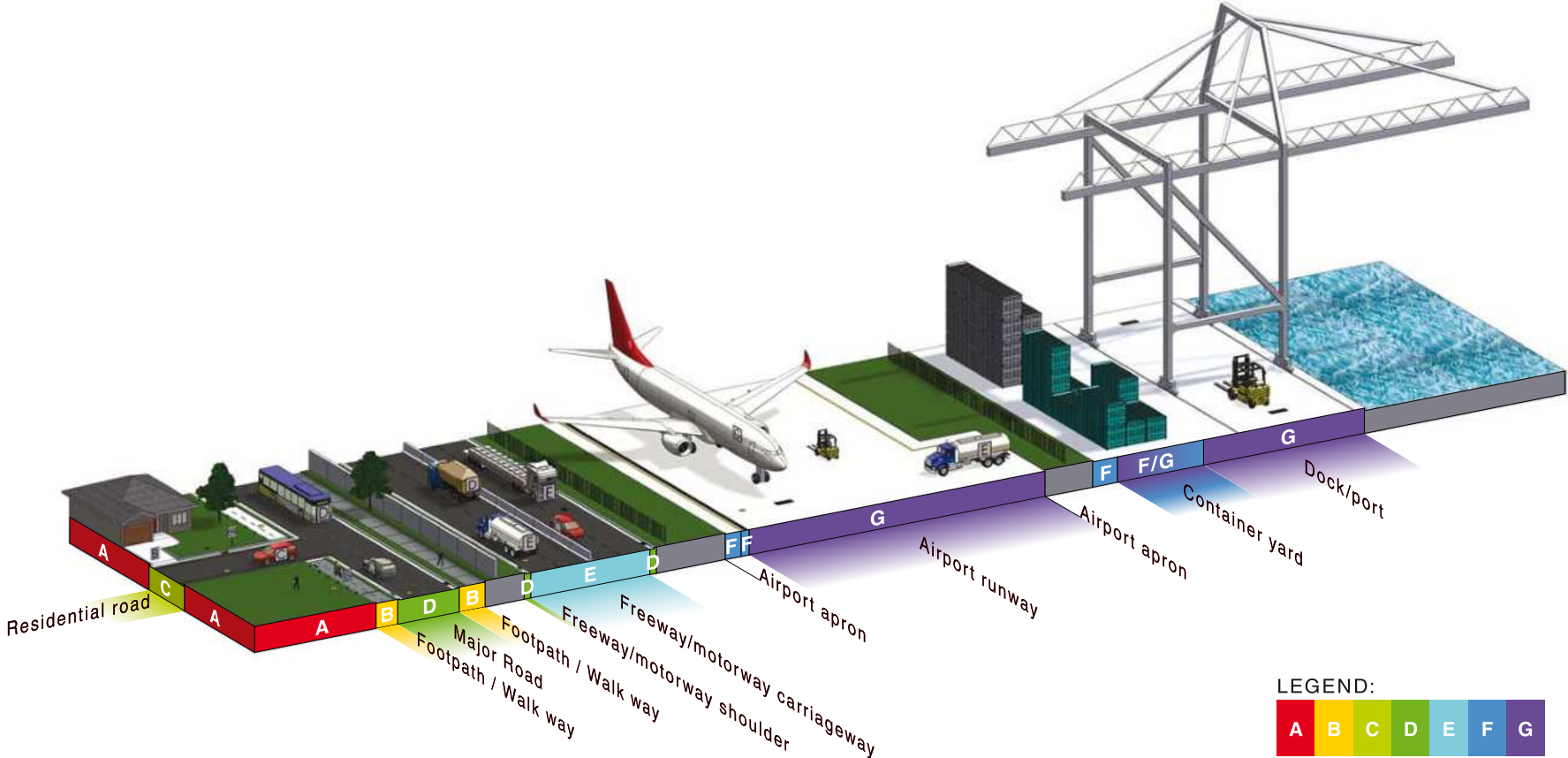


FIGURE 3.1 EXAMPLES OF LOAD CLASSIFICATIONS

3.2 DESIGN FEATURES

3.2.1 Covers and grates

3.2.1.1 Registers

Where directional orientation of cover or grate relative to frame is required, a register or a permanent marking shall be provided.

3.2.1.2 Dislodgment by traffic

To prevent dislodgement by vehicular traffic Class C–G covers and grates shall conform with one of the following:

- (a) A minimum 72 mm depth of insertion with a minimum mass of the cover (including any infill) or grate, excluding the frame of 200 kg per square metre of the cover surface area.
NOTE: For infill covers using this method to prevent dislodgement, the mass of infill may be included.
- (b) A minimum 50 mm depth of insertion with two or more M12 bolts of minimum strength grade 8.8, A4-70 or equivalent to prevent dislodgement. Fastening components for bolting shall have a minimum thickness of 12 mm.
- (c) A design feature to prevent dislodgement which shall satisfy the requirements of Clause 4.2.7.
- (d) All Class C-G covers and grates with a serviceability load maximum deflection of between CO/100 and CO/45 shall conform with Clause 3.2.1.2(c) and shall be tested for fatigue resistance in accordance with Clause 4.2.13 and load cycling in accordance with Table 3.2.

NOTES:

- 1 Vehicular traffic areas do not include areas that are primarily for pedestrians.
- 2 A design feature to prevent dislodgement is not required to be a bolt, other means of dislodgement prevention may be used.
- 3 For Item (d), during set up for the Appendix C fatigue test the design feature is to be installed according to manufacturer instructions, so as to avoid issues such as thread stripping from over tensioning or under tensioning affecting the fatigue performance of the design feature.

3.2.1.3 Dislodgement by internal pressure or flood

Designated sewer and stormwater covers that are installed in areas that are required not to dislodge when there is an internal pressure build-up or flood. Covers shall be deemed to conform if—

- (a) they are secured into the frame with two or more M12 bolts; or
- (b) they have a design feature to prevent dislodgement which shall satisfy the requirements of Clause 4.2.8; or
- (c) for a cover that is ventilated or is designed to open under pressure, the self-weight design feature shall prevent it from detaching from the frame during a surcharge event.

3.2.1.4 Security in open position

Hinged and tilt-up covers and grates shall be designed such that, in the installed position, they open to an angle at least 15° beyond the vertical, or they are secured by a positive mechanical retainer.

3.2.1.5 Rocking in the frame

Covers and grates intended for vehicular traffic areas shall not rock in their frame.