

An Industry Guide to Integrating Drainage into Pedestrian Friendly External Areas



Pitt Street Mall, Sydney

A custom designed iron ACO Heelsafe® Anti-Slip grate has been specified to great effect at Pitt Street Mall in Sydney. The architects wanted a grate that would integrate with the historic surrounds. The Heelsafe® Anti-Slip grate is able to manage the surface water demands of the space while remaining pedestrian friendly.

The importance of pedestrian friendly external areas

How to design pedestrian friendly external areas

Surface Water Management - Linear drainage





“ Surface water management is crucial to the safety of pedestrian walkways and shared areas. The risk of slips in poorly designed areas is high, and liability can extend to architects and designers. ”

The Importance of Pedestrian Safe External Areas

The importance of pedestrian and shared areas in our cities is being increasingly realised. In a recent report, consulting engineers Arup outlined 50 benefits associated with making cities more walkable, from improvements to mental health to supporting local business.¹ Jeff Speck, author of *Walkable City*, notes, “Get walkability right and so much of the rest will follow.”² As the youngest generation of Australians move away from driving,³ the importance of pedestrian areas in our cities will only increase.



The Rocks, Sydney

Pedestrian and shared areas must be designed with the pedestrian in mind, as the alternative can be hazardous. The risk of slips, trips and falls in poorly designed pedestrian areas is high, and the legal consequences of these accidents can be extreme. Bodily injury claims across Australia totalled over \$440 million in 2013.⁴ Liability for slips, trips and falls can extend from business and property owners to councils, architects and designers.⁵

Another central consideration is compliance with relevant legislation and building standards. The National Construction Code, including the Building Code of Australia, only applies to building works⁶ and is therefore inapplicable to most exterior areas. However, many councils have their own extensive planning regulations for external spaces, especially when it comes to streetscapes. Accessibility and disabled access requirements are also important. For example, the City of Sydney has a 550 page Streets Technical Specification.⁷ Under the *Disability (Access to Premises – Buildings) Standards 2010*, external pathways – which are required for access to buildings – must be accessible.⁸



Left: Compliance with accessibility standards in certain external areas is required under the law



“Overly wide slots in drainage grates pose risks to pedestrians. In particular, women wearing high-heels.”

How to design pedestrian friendly external areas

While designers must consider many different stakeholders when designing pedestrian and shared areas, the needs of pedestrians must come first. We will consider the design challenges of external areas in this section.

Slips, Trips & Falls

Pedestrians' greatest risk in external areas is slipping, tripping or falling. Designers can, and must, minimise these risks in their designs. Overly bumpy or steep pedestrian spaces will create trip hazards, particularly for the elderly, disabled and children. One consideration that often leads to steep or bumpy spaces is the need for surface water management. Grated pit and pipe systems, common in external areas such as car parks, require an undulating surface so that surface water will run off into the pits. Although managing surface water is a key consideration when it comes to designing pedestrian friendly external areas, this need not come at the expense of smooth, flat surfaces. Trench drains allow for external spaces to be designed with only a slight camber in a single direction. Furthermore, as shown in a report by independent quantity surveyor, Rider Levett Bucknall, precast modular trench drains are cheaper to install than pit and pipe systems.⁹

Slips, trips and falls can also occur on an even surface if the surface material has inadequate slip resistance. However, the correct amount of slip resistance is not always the greatest amount of slip resistance. Large, unexpected changes in slip resistance can themselves be trip hazards, so architects must take into account the compatibility of slip resistance between the walking surface and the different elements they specify, such as drainage grates. Standards Australia have provided guidance for specifying the slip resistance of pedestrian surface materials for typical locations inside and outside of buildings in its handbook HB 198 *Guide to the specification and testing of slip resistance of pedestrian surfaces*.¹⁰ This advice is based on the testing methods of AS 4586 *Slip resistance classification of new pedestrian surface materials*.¹¹ Note that, contrary to common belief, it is the P values of the Wet Pendulum Test, not the R values of the Oil-Wet Inclining Platform Test, that are relevant to most pedestrian spaces.

Without proper surface water management, water pooling will occur, which creates a risk of accidents. Global climate change has only increased the challenge of surface water management. As the City of Melbourne Climate Change Adaptation Strategy notes, “the potential for storm drain inundation and flash flooding will likely increase with more intense rainfall events accompanied by sea level rise.”¹² Surface water ponding, which was once seen as just being inconvenient, is now becoming a safety issue.

Finally, it is important that all elements specified in external pedestrian and shared areas can withstand the weather and wear they are exposed to. Even the most pedestrian friendly design can create slip hazards if it has been damaged. For shared spaces, wear caused by cars, trucks and trolleys must be considered, as well as wear caused by water ponding. This is why durable materials must be used.

Grate Slot Width

Overly wide slots in drainage grates pose risks to pedestrians. At best, they will require women (wearing small heels) to walk over the grate, which is not necessarily convenient or pedestrian friendly. At worst, the heel may fall or become trapped in the grate, which could cause the shoe to be broken, the woman to fall and to suffer serious injury.

Overly wide slots also pose risks to elderly people using walking canes or frames, as the end of the cane or frame may become stuck in the grate. This risk is severe, as people using walking canes or frames will already be having trouble walking. The wheels of wheelchairs can also be caught in overly large drain slots, thus creating accessibility issues. Bicycle riders are also at risk.

The current Australian Standard for drainage grate slot width is contained in AS 3996 *Access covers and grates*.¹³ However, this standard is quite out of date, and does not take into account all the risks of a modern urban environment. Section 3.3.5 of the standard states that slots should be no greater than 25mm wide, but a slot of that width could still easily trap heels, canes and wheelchair tyres. Australian Standard AS 1428.2 *Design for access and mobility*, which applies to some external areas, specifies that slots should be no greater than 13mm wide, which is still wide enough to catch some heels.¹⁴ The American Standard ASME A112.6.3 states that a grate designed to resist the entry of high-heel shoes should have slots no wider than 8mm.¹⁵

Ultimately, it is up to the judgement of the designer what size slot to use. However, there is a dilemma. The smaller the slots, the less likely it is that they will catch any heels or walking canes. But, narrower slots also collect less water, and clog up with debris (silt, cigarette butts, leaves, etc.), meaning that overly narrow slots can lead to water pooling or bypassing which, as was discussed above, is itself a hazard. Given this paradox, some compromise must be found. **Maria Rigoli** is a highly experienced landscape architect, having played a crucial role in the realisation of Barangaroo Reserve amongst other projects. She has suggested that having 10mm wide slots is a reasonable compromise between protecting heels and canes, and collecting surface water. This also accords with the finger entrapment clauses of AS 4685 *Playground Equipment and Surfacing*,¹⁶ meaning that it should be safe for little fingers. While some heels may be smaller than 10mm, 10mm should be safe for almost all heels, and any smaller width would start to provide problems when it came to collecting surface water. While it may not satisfy everyone, as Maria Rigoli notes, you can only ever design for 98% of the population.



“ 10mm wide drainage grate slots are a reasonable compromise between protecting heels and canes, and collecting surface water . . . you can only ever design for 98% of the population. ”





Heelsafe® Anti-Slip Grates from ACO

ACO's Heelsafe® Anti-Slip grates provide the ideal solution when it comes to surface water collection, level walking surfaces, slip resistance, durability, and heel safety. They have (maximum) 10mm wide slots, meaning that they embody the best balance between pedestrian safety and surface water collection, as suggested by landscape architect Maria Rigoli. For areas where surface water volumes are low (e.g. flat pavements with low water runoff speeds or undercover pavements) and specific protection is required for stiletto heels, ACO can also supply grates which conform to ASME A112.6.3, requiring slot sizes no greater than 8mm.¹⁵ If in doubt, ACO offers a free service where a grate's hydraulic intake capacity with blockage factors can be assessed against specific project requirements.

As part of a trench drain system, Heelsafe® Anti-Slip

grates do not require the undulating surfaces of pit and pipe systems. Furthermore, with precast modular channels, they are offered as part of a total surface water management system. Heelsafe® Anti-Slip grates are available in a variety of durable materials, including cast iron, composites and stainless and galvanised steel, which ensure that they can withstand cars, trucks, trolleys and the weather. They are also available in a variety of slip resistance ratings, tested in accordance with AS 4586,¹¹ making them appropriate for all external areas.

ACO provide a variety of services for designers. Their highly qualified engineering team offer a no obligation advice service. With offices around the country, ACO can provide a quick turnaround for all orders. ACO can also manufacture bespoke grates with custom designed patterns, to provide the perfect solution for any project.



ACO believe that pedestrian friendly grates and slip resistance must go hand in hand. This symbol represents Heelsafe® Anti-Slip grates' compliance with the slot width and bicycle tyre penetration resistance requirements of AS 3996,¹³ the wheelchair and walking cane safety requirements of AS 1428,¹⁴ and the slip resistance ratings of AS 4586¹¹ and HB 198.¹⁰

(1) Arup, *Cities Alive*, (2) Jeff Speck, *Walkable City* (3) Alexa Delbosc, "Why are young Australians turning their back on the car?", <http://theconversation.com/why-are-young-australians-turning-their-back-on-the-car-35468> (4) Kundan Misra, et. al., "Review of Claims Trends for Liability Insurance in Australia", (5) *Indigo Mist Pty Ltd v Palmer* [2012] NSWCA 239 (6) Australian Building Codes Board, "What is the NCC?" <http://www.abcb.gov.au/-/media/Files/Resources/Education-Training/whatistheNCC2016.pdf> (7) City of Sydney, *Sydney Streets Technical Specifications* (8) Australian Human Rights Commission, *Guideline on the Application of the Premises Standards* (9) ACO Technical Bulletin, *Drainage System Comparison*, <http://www.acodrain.com.au/pdf/drainage-system-comparison.pdf> (10) Standards Australia, *HB 198 Guide to the specification and testing of slip resistance of pedestrian surfaces*. (11) Standards Australia, *AS 4586 Slip resistance classification of new pedestrian surface materials* (12) City of Melbourne, *Climate Change Adaptation Strategy* (13) Standards Australia, *AS 3996 Access covers and grates* (14) Standards Australia, *AS 1428.2 Design for access and mobility* (15) American Society of Mechanical Engineers, *A112.6.3 Floor and Trench Drains* (16) Standards Australia, *AS 4685 Playground Equipment and Surfacing*

For more information about Heelsafe grates, please visit www.heelsafe.com.au

