



**Monash Institute of
Railway Technology**

Report No: Monash/RT/2019/1439

**THE DISABILITY STANDARDS FOR ACCESSIBLE
PUBLIC TRANSPORT (2002) AND DISABILITY
(ACCESS TO PREMISES—BUILDINGS) STANDARDS
(2010) REVIEW**

SUMMARY REPORT

by

Monash Institute of Railway Technology

June 2019

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LIST OF ACRONYMS:

ABS	Australian Bureau of Statistics
ADA	Americans with Disabilities Act
AHRC	Australian Human Rights Commission
ARA	Australasian Railway Association
BLE	Bluetooth Low Energy
BMI	Body Mass Index
CBD	Central Business District
CMH	Ceramic Metal Halide
COAG	Council of Australian Governments
Cth	Commonwealth of Australia
DDA	Disability Discrimination Act 1992 (Cth)
DSAPT	Disability Standards for Accessible Public Transport 2002 (Cth)
ETA	Electronic Travelling Aid
EUROPA	Publications Office of the European Union
EU	European Union
GNSS	Global Navigation Satellite System
IRT	Institute of Railway Technology at Monash University
LED	Light Emitting Diode
MRT	Mass Rapid Transit
NTC	National Transport Commission
OECD	Organisation for Economic Co-operation and Development
ONRSR	Office of the National Rail Safety Regulator
PID	Passenger Information Display
Premises Standards	Disability (Access to Premises-Buildings) Standards 2010
PRM	Passengers with Reduced Mobility
RFID	Radio Frequency Identification
RSNL	Rail Safety National Law
SWL	Safe Working Load
TGSI	Tactile ground surface indicators
TSI	Technical Specification for Interoperability
TTY	Teletypewriter
UK	United Kingdom
USA	United States of America
WCAG	Web Content Accessibility Guidelines

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DISCLOSURE NOTICE

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PURPOSE:

This report is the deliverable for the independent review of two Australian standards:

- The DSAPT; and
- Premises Standards.

AUDIENCE:

The work described in this review was carried out for the ARA and the report is intended for general release.

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ASSUMPTIONS/QUALIFICATIONS:

All observations, results, conclusions and recommendations made in this report are based on a desktop engineering-based review of the two Australian standards indicated above. National and international data sets were also reviewed which included information from railway operators, organisations, governments and global agencies with relevance to standards and innovations aimed to improve accessibility for those with disabilities.

FURTHER INFORMATION:

Further information can be obtained from Mr. Ravi Ravitharan at the Institute of Railway Technology.

EXTERNAL SOURCE MATERIALS:

The Institute of Railway Technology (IRT) and/or Monash University do not accept responsibility for the validity, accuracy or quality of any source material or data used in this study that was not generated by IRT.

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Contents

LIST OF ACRONYMS:	iii
PREFACE	1
Background	1
Key demographic trends relevant to Future Proofing Australia’s Rail Infrastructure	1
Growth in Australia’s population	1
An aging population (aged 65+)	2
Changing physical nature of Australia’s population	2
Rail Industry Challenges	3
Legacy networks and heritage issues	4
Growth in patronage	4
Historic Underinvestment in Rail	4
New Investment in Rail	4
Accreditation and Safety Obligations	5
EXECUTIVE SUMMARY	6
Methodology	6
Terminology	6
Legislative Instruments	7
Exemptions	7
Identified issues in reviewing the DSAPT and Premises Standards	7
Timelines for implementation	8
Conflicts with other standards	11
Gaps in Standards	11
Difference between mobility and informational accessibility issues	11
Parallel-Services	12
Management of Heritage Requirements	13
Key Findings	14
Conclusions	14
Recommendations	15
REFERENCE LIST	24
APPENDIX 1: FUTURE OPPORTUNITIES	31

PREFACE

Background

Standards need to be flexible enough to be responsive to changing passenger needs and technological advancements, which can overcome obstacles, create greater efficiencies and improve safety. In 2010, in the USA, the analysis of space requirements for accommodating wheeled mobility devices in built environments highlighted that standards developed in 1970s, were still in use forty years on. They were out of date, failed to recognise advances in wheeled mobility technology, and did not reflect changes in population demographics. They also failed to address passenger needs relevant to current and future characteristics. The report emphasised the importance of integrating current research with standards development, organising international collaborations, and developing international standards that were relevant and responsive to changing population requirements [Steinfeld E., Maisel J., Feathers D., D'Souza C., 2010]. Similarly in Australia, research in 2018 indicated that standards developed for public accessibility to transport, and in premises access, were not only technically prescriptive, but like the example in the USA, fail to have the flexibility to keep pace with changes in user demographic needs. This in turn influences systems in infrastructure design, manufacturing, safety provision and the primary objective of capacity to provide equal access for all. Other standards, including the *Building Code of Australia*, provide “Performance Solutions” as a mechanism to satisfy the requirements via a route, which does not strictly meet the prescriptive provisions. In these standards, assessment methods are used to prove that the particular building solution can satisfactorily demonstrate compliance with performance requirements [Australian Government, National Construction Code]. This report will highlight the need for standards in Australia to be flexible and outcomes based to meet the objective of an inclusive and accessible public transport system for all in Australia in the future.

Key demographic trends relevant to Future Proofing Australia’s Rail Infrastructure

Rail is estimated to provide around 62% of urban public transport needs in the future [Australian Government, National Transport Commission, August 2016]. There are a number of key demographic trends, which are expected to have impacts on Australia’s public transport system in the future and some of these include:

Growth in Australia’s population

Since the year 2000, Australia’s population has grown by more than 25% and is forecast to double by 2070 reaching almost 45 million people [Deloitte Access Economics, 2017]. As the population grows, rail will be the backbone of commuter transport in both dense urban and regional areas. Rail will play a vital role through:

New or extended lines to facilitate land release and housing growth in areas of high demand. Rail corridors are well suited to apartment and townhouse living which

provide higher density living to cater for rapidly expanding population in both an urban and regional landscape.

An efficient way to move people quickly to and from the city CBDs and other employment clusters. An increasing population will generate more employment and even in a world of autonomous vehicles, the sheer volume of people that fit on a train means that rail will remain the most efficient way to move large volumes of people into and out of CBDs [Deloitte Access Economics, 2017]; and

Providing an efficient link to regional areas. The regional communities surrounding a city are closely integrated economically and socially with that city. For example, large sections of the population commute between Geelong and Melbourne, the Blue Mountains and Sydney, and the Sunshine Coast and Brisbane. Some commute five days a week, and others will do a mix of a couple of days in the city and the rest working from home. Better rail connections can help that integration, benefiting the city and its surrounding regional areas [Australian Government, The National Rail Program].

An aging population (aged 65+)

In 2017, there were 3.8 million Australians aged 65 and over (comprising 15% of the total population) -increasing from 319,000 (5%) in 1927 and 1.3 million (9%) in 1977. The number and proportion of older Australians is expected to continue to grow. By 2057, it is projected there will be 8.8 million older people in Australia (22% of the population) and by 2097, 12.8 million people (25%) will be aged 65 and over [ABS, 2014]. The implications for the rail network will be a larger portion of people utilising the network will require a greater focus on providing a seamless, safe and efficient access to public transport for a portion of the population that may have accessibility problems. Additionally:

It is likely, that with an aging population there will also be an increase in the number of people living with disability. The 2015 ABS *Survey of Disability, Ageing and Carers* reported that 50% of men and 52% of women aged 65 and over had some form of disability. This proportion was higher for those aged 85 and over, with 4 in 5 experiencing a disability (78% of men and 80% of women). In 2015, 15% of men and 22% of women aged 65 and over experienced disability as a severe or profound core activity limitation (that, sometimes or always needing help with self-care, mobility or communication). Again, this was higher for those aged 85 and over - 38% for men and 56% for women. The number of people with severe or profound disability is projected to increase over the next 40 years from 1.4 million to 2.9 million [Price Waterhouse Coopers, Disability Investment Group, 2009].

Changing physical nature of Australia's population

According to the World Health Organisation (WHO) in 2010, being overweight or obese is a major factor for a range of chronic diseases, including diabetes, cardiovascular diseases and cancer [WHO]. These diseases are likely to affect a person's mobility and increase the prevalence of disabilities in Australia. The implications for the rail industry include the requirement for innovative wayfinding

technologies, aids and strategies. Conveyance design will also need to be improved to help overcome changing passenger physical dimensions.

Obesity: Almost 2 in 3 Australian adults (63%) were overweight or obese in 2014–15, similar to 2011–12. Rates of obesity are continuing to rise in Australia. Collecting information on these trends is important for managing the associated health problems. The BMI is widely used to monitor body weight [Australian Government, Australian Institute of Health and Welfare].

Height: Australia's population has grown taller and taller over the past century, thanks to improved healthcare, nutrition and hygiene. A global height analysis of 200 countries measured the average growth of global populations from 1914 to 2014. Australian men are the only non-Europeans in the top 25, coming in at number 18, while Australian women jumped from 29th to 15th place [eLife 2016].

In addition to population changes, other impacts, which will affect the rail industry in the future, will include (but not limited to):

- Changes due to new technologies which will disrupt current thinking and ways of doing things;
- Challenges in shared infrastructure where freight and passenger services require access to the same infrastructure (track, signalling, stations etc.);
- Impacts of emerging environmental factors such as the need for more efficient fuels to minimise the effect on the environment as emissions targets receive greater attention;
- Changes to where and the ways employment is undertaken (at home, online and in shared offices);
- Housing location and affordability for those who are working, and those that have retired and make up the proportion of older Australians; and
- Changes due to the way we shop (impacts of the online environment) and emerging demands through greater globalisation and integration in economies.

Rail Industry Challenges

This report is an independent review of two Standards relevant to people with disability. They are the DSAPT and the Premises Standards. There are a number of issues noted by the rail industry to be affecting their ability to meet compliance to the Standards, which govern provision of accessible and inclusive transport to people with disability. A good proportion of the issues stem from the speed required for the DSAPT modernisation for the industry to meet the desired outcomes for access by people with disability. It is noted the prescriptive nature of the DSAPT may also stifle the ability for the rail industry to introduce innovation or technological alternatives that would provide 'best practice' to deliver the desired accessibility outcomes for people travelling with a disability. There are a number of specific industry concerns raised. These include:

Legacy networks and heritage issues

A number of DSAPT requirements conflict with statutory heritage specifications. These conflicts create significant challenges for the rail industry making some requirements under the DSAPT and Premises Standards expectations, impossible to meet in their current form, which may include as one example, significant changes to the existing heritage structures. Undertaking these changes would be cost prohibitive and would require support through a major works program.

Growth in patronage

As indicated in the key demographic trends above, Australia's population is expected to double by 2070. This population increase will also include a much greater proportion of people who will be travelling with a disability. With rail providing almost two-thirds of urban public transport, these trends will add significant pressure to the rail industry in how they will provide accessible transport to meet increased needs.

Historic Underinvestment in Rail

According to Deloitte Access Economics, there has been a prolonged period of underinvestment in rail infrastructure in Australia. [Deloitte Access Economics, 2017] This underinvestment is also illustrated by rankings in the "quality of railroad infrastructure"- produced by the World Economic Forum. Australia ranks 34th from 108 countries surveyed, well down the scale from its benchmarked peers in other developed nations [The Global Economy, Railroad Infrastructure Quality – Country Rankings, 2015]. Deloitte Access Economics also concluded that "sustained investment in transport infrastructure (and rail more specifically), will not only allow the country to manage the challenges posed by population and economic growth, but it will also allow the development of a better integrated and prosperous society", critical to ensure that the needs can be fulfilled of future national development [Deloitte Access Economics, 2017].

As noted earlier, a number of DSAPT requirements conflict with statutory heritage specifications. The historic underinvestment in rail has also meant that any permitted changes to heritage infrastructure has been limited (if any) because it has not been included in costing in major works program. This has become a significant issue for the industry to comply with the standards and will be discussed further in sections of this report.

New Investment in Rail

The historic underinvestment in rail has posed its own challenges but new investment in rail at levels unprecedented both in Australia and around the world, also present new challenges. Deloitte Access Economics (2017) estimated for Australia:

- The rail industry directly contributes \$13.3 billion in value add and employed 53,490 FTE workers in 2016;
- The total contribution of the rail industry to GDP (direct and indirect) was \$26 billion and 142,288 FTE workers – making up to 1.6% of the Australian economy; and

- Rail generates significant benefits for society in terms of reduced accidents, carbon emissions and congestion and improvements in health and social inclusion.

The Australasian Railway Association (ARA) noted in 2017, the investment in rail by the Australian Governments will be around AUD \$100 billion through to 2030. [ARA, 2017, National Industry Plan]. Whilst the new investment is long overdue and welcomed by industry, it also presents a number of challenges, including most importantly the issue in how to address the current workforce gaps both in numbers and in skills required to operate efficiently and effectively now and into the future.

The rapid development in new technologies has disrupted and changed the way railways operate especially in regards to the digitisation revolution. One of the greatest challenges for the railway industry is in how to build capacity in numbers and capabilities of a workforce that will enable industry to respond to changing market and environmental needs. This will be exacerbated in the future as the need to shift more passengers and freight from road to rail will prevail. In order to reduce road congestion and to have a greater focus on lessening the impact of transport on the environment, and to create greater efficiencies, transport solutions will need to have greater integration and use technology and innovation to provide an intelligent railway system ready for the future. The new investment in rail is ready to position the industry for an exciting future that can meet the requirements of all stakeholders, but the challenge will be in co-ordination, planning, governance, research, innovation and in education and training a workforce knowledgeable and enabled to respond to the continued rapid change that will prevail into the future.

Accreditation and Safety Obligations

Adherence to the Rail Safety National Law (RSNL) is recognised as essential by operators. It is however noted that there can in some instances be conflicts within the operator's safety management systems to meet accreditation needs under the RSNL that are contrary to the requirements of elements of the DSAPT and Premises Standards. This has been noted by industry as one of the challenges they are facing.

These concerns and others are detailed in each area of this report where there have been exemptions which were granted in some cases, and not granted in others to elements within the standards.

Executive Summary

Monash University's Institute of Railway Technology (IRT) was engaged by the ARA to conduct an independent review of the following two Standards:

- DSAPT; and the
- Premises Standards.

The content of this report identifies where elements were drawn from in the standards, why they may be or may not be practical for rail from a compliance perspective and proposes outcome based alternative solutions for rail passengers with disabilities. Primarily the research focuses on the areas within the standards that the industry has identified as both challenging to comply with and that may not necessarily provide the best outcome for passengers.

The Australian Government is currently leading the modernisation of the DSAPT. This report provides recommendations that Monash University believes will benefit people with disability and rail operators and providers alike.

Methodology

This project involved a desktop engineering-based review of the DSAPT and the Premises Standards, and a review of relevant global research to arrive at the recommendations. National and international data sets were also reviewed which included information from railway operators, organisations, governments and global agencies with relevance to standards and innovations aimed to improve accessibility for people with disability.

Of particular relevance to the study is the current Australian standards for design for access and mobility [AS 1428 Parts 1 to Parts 5], as per the following:

- AS 1428.1-2009-Design for access and mobility – General requirements for access – New building work;
- AS 1428.1-2009 Amendment 1 – 2010;
- AS 1428.2-1992-Design for access and mobility – Enhanced and additional requirements – Buildings and facilities;
- AS 1428.3-1992-Design for access and mobility – Requirements for children and adolescents with physical disabilities;
- AS/NZS 1428.4.1:2009-Design for access and mobility – Part 4.1: Means to assist the orientation of people with vision impairment: Tactile ground surface indicators; and
- AS 1428.5:2010-Communication for people who are deaf or hearing impaired.

Terminology

The following terminology is applied throughout this report to be consistent with the DSAPT and Premises Standards:

- “People with disability” represents the user group under each of the Standards;

- “Conveyance” is used in replacement of train, tram and coaches throughout this report; and
- “Premises” and “Infrastructure” refer to both train or tram premises and infrastructure.

Legislative Instruments

The following legislative instruments are relevant to people with disability to enable them to have seamless transition on rail conveyances and infrastructure.

- DDA;
- DSAPT; and
- Premises Standards.

This report acknowledges adherence to the Rail Safety National Law (RSNL) as fundamental in any of the recommendations put forward, identifying safety as paramount in each of the outcomes.¹ The recommendations provided also acknowledge the synergies, which exist between the DSAPT and the Premises Standards. There is also the need for a consistent approach across all states of Australia, duty holders and the Regulator, to future planning, highlighting the stipulated objective of the RSNL “is to develop a seamless and coordinated national approach to rail safety regulation.”²

Exemptions

The Commission may grant exemptions from compliance. The ARA has previously made application, on behalf of its members for temporary exemptions, which have been granted.

Identified issues in reviewing the DSAPT and Premises Standards

How standards interact with each other is one of a number of overarching issues that have emerged as findings of this report, also noting the fundamental principles of *Universal Design* and the potential conflicts that may exist in determining what may be best for one group, if too prescriptive, may not be the best option for all.

It is also important to note a significant issue this research highlights is the difficulty of compliance for industry when infrastructure and conveyances pre-date the DSAPT and Premises Standards. The conflict in some instances with heritage requirements and adjoining road and building infrastructure, makes compliance impractical. This is discussed further in this report in each of the areas of the standards where a request for exemption was made, and where compliance in the short term is not practical.

¹ In December 2009, the COAG agreed to implement a national single rail safety regulator and develop a rail safety national law, which the regulator would administer. The National Transport Commission (NTC) was tasked with developing RSNL, based on the National Transport Commission Model Rail Safety Bill (2007) and Model Regulations (Model Law). The RSNL would also address areas where states and territories had varied from the model bill and regulations. Following an extensive consultation period with industry, governments and unions, a final version of the National Law was submitted to and subsequently approved by the Transport Ministers in November 2011. The RSNL was first enacted in South Australia in 2012 with the other states and territories to either replicate that law or pass a law explaining that the RSNL (being the schedule to the South Australian law) is the rail safety law in that state or territory. Retrieved from the National Transport Commission, <https://www.ntc.gov.au/rail/safety/rail-safety-national-law/>

² Ibid

The following issues are identified as a result of the research, which require consideration:

Timelines for implementation

The DSAPT has 120 sections containing requirements for compliance and there are currently 21 temporary exemptions in place for ARA members. Under part 32.1 of DSAPT, the standards apply to all new premises or infrastructure and conveyances entering service after the date the standards come into effect. Under part 32.2, the Legislation allows for progressive compliance to pre-existing infrastructure and conveyances and outlines target dates. They do not however distinguish the different target dates for infrastructure and conveyances, and there is no national measure to determine compliance with the standards which compares state against state.

The percentage completion requirement is different for each type of service (e.g. coaches, trains etc.). Table 1 below relates to trains and trams. Whilst there has been significant progress in meeting compliance targets, the restructuring of the calculation may have better outcomes for people with disability.

For example, Schedule 1 of the DSAPT stipulates:

- Requirement: Compliance with the relevant Standards by the nominated *percentage of each type of service* in relation to: e.g. resting points; and
- Application: Conveyances, premises, infrastructure.

It is interpreted that *the percentage* uses the *quantity of train stations* rather than the *number of people with disability using those stations* to determine compliance. The daily patronage (all users) of Metro train stations in Melbourne, for example, varies from less than 200 to over 90,000. People with disability would also broadly reflect the variation in use. This raises the questions of “*Are all stations considered of equal significance in calculating compliance*” or “*Should there be a mechanism to enable priorities to be established for better overall outcomes?*”

DSAPT Part 32 on adoption requires that premises, infrastructure or conveyances that have undergone substantial refurbishment or alteration are to adhere to the standards. "Substantial" could provide large variations in interpretation. The ADA standard defines disproportionate costs as those that exceed 20% of the cost of the alteration. In this situation, standards only need to be complied with to the extent of 20%, an effective ceiling on costs. Prescriptive definitions, whilst providing certainty for rail operators, also influence outcomes, which may not be in the best interests of people with disability.

Whilst it is accepted that all new infrastructure and conveyances are expected to comply with the DSAPT, it is not practical to expect all legacy infrastructure to be upgraded to meet this requirement without a multi-billion dollar injection of funding per jurisdiction to support this. The upgrades, themselves, may require significant (temporary) network closures. Given these economic realities, the DSAPT should also include a timeline for implementation that is realistic and achievable with appropriate

operational and financial considerations that stipulate principles to assist providers in appropriately prioritising upgrades.

Table 1 – DSAPT Compliance Targets Requirements

DSAPT				Target Compliance level				
Part	Standard	No. of sections	No. of Temp Exempt.	2007	2012	2017	2022	2032
2	Access paths	9	3	25%	55%	90%		100%
3	Manoeuvring areas	3	0	25%	55%	90%		100%
4	Passing area	3	1	25%	55%	90%		100%
5	Resting points	1	1	25%	55%	90%		100%
6	Ramps	5	1	25%	55%	90%		100%
7	Waiting areas	2	0	100%	100%	100%	100%	100%
8	Boarding	8	2	25%	55%	90%		100%
9	Allocated space	11	0	25%	55%	90%		100%
10	Surfaces	1	0		100%	100%	100%	100%
11	Handrails and grabrails	7	1		100%	100%	100%	100%
12	Doorways and doors	6	2	25%	55%	90%		100%
13	Lifts	1	0	25%	55%	90%		100%
14	Stairs	4	1	25%	55%	90%		100%
15	Toilets	6	3	25%	55%	90%		100%
16	Symbols	5	0	100%	100%	100%	100%	100%
17	Signs	7	1	100%	100%	100%	100%	100%
18	Tactile indicators	5	1	25%	55%	90%		100%
19	Alarms	1	0	100%	100%	100%	100%	100%
20	Lighting	3	1	100%	100%	100%	100%	100%
21	Controls	4	1	25%	55%	90%		100%
22	Furniture and fitments	6	0	100%	100%	100%	100%	100%
23	Street furniture	1	0	25%	55%	90%		100%
24	Gateways	1	0		100%	100%	100%	100%
25	Payment of fares	4	0					100%
26	Hearing augmentation	2	0	100%	100%	100%	100%	100%
27	Information	4	1	100%	100%	100%	100%	100%
28	Booked services	4	1	100%	100%	100%	100%	100%
29	Food and drink services	3	0	100%	100%	100%	100%	100%
30	Belongings	1	0	100%	100%	100%	100%	100%
31	Priority	2	0	100%	100%	100%	100%	100%
		120	21					

Source - Target Compliance Level: DSAPT Schedule 1 (Parts 1-5)

Conflicts with other standards

It was apparent when considering the DSAPT in some situations, that the requirements were not compatible with other regulations or standards. The dimensions of land currently available to the rail provider, for example, does not allow the layout changes to the station required by the DSAPT, unless the operator was able to acquire neighbouring properties. Revisions to the DSAPT need to clearly articulate how operators and providers are to proceed when requirements are in conflict. It is an industry view that often the best accessibility outcomes will be achieved by considering such cases on a site-by-site basis, rather than a rigid principle. It is noted that this is a point requiring further research and consultation with stakeholder groups.

Gaps in Standards

Reading the DSAPT alongside the Americans with Disability Act (ADA) and UK/EU standards it is clear that DSAPT fails to consider – or gives scant attention to – a number of areas discussed in depth in these other documents. These are identified throughout this report. DSAPT requires a holistic, rather than a line-by-line review, as there is a danger that these gaps will not be spotted or dealt with adequately and the opportunity for better outcomes will be missed.

The international standards cited in this report provide useful comparisons with the current DSAPT and Premises Standards requirements, and the examples listed can guide best practice for how to address certain issues. Those included for comparisons are from Singapore, the US, the UK and Europe, as it has been deemed that these countries offer some good practices and may provide useful guidelines in how they are responding to changing demographic needs and managing this in the context of the age, design and heritage value of infrastructure, including how they handle upgrading or replacement, or construction of new infrastructure.

In some areas we also encourage the review of the Standards to consider deeply the role of online technology in the provision of information to people with disability, which is not considered at all in the Standards - but is becoming increasingly prominent in daily life.

Difference between mobility and informational accessibility issues

In reviewing the DSAPT, a loose distinction emerges between requirements that address accessibility issues that relate to mobility (e.g. can a wheelchair user board this conveyance) and those that relate to information (e.g. can a blind person find out what stop this is?). Mobility requirements are generally well suited to being addressed through the principles of *Universal Design* and the same accessible environment can be effectively utilised by people with various disabilities. However, information requirements can be diametrically opposed. People who are blind or have low vision can access an announcement but not a scrolling notice while the reverse is true of people who are deaf or have hearing impairment.

People with different disabilities will often have very different requirements for text to be accessible. The best solution is often to provide information electronically, so

that the individual with various devices including magnifiers, screen readers or Braille displays can modify it. By extension, it is also good practice to provide information in a range of formats including spoken announcements, passenger information displays, smart phone apps and real-time online updates on delays and conveyance location. These concerns also flow into the area of wayfinding, where the need for TGSI is in part a function of other environmental information that is also present - such as sonic beacons.

The DSAPT should acknowledge that providers deliver information across a range of formats, and that not all formats will be (or should be) accessible to all passengers. For each format (e.g. fixed signage), it is appropriate to provide guidance around maximising accessibility, but ultimately whether providers are meeting accessibility requirements in this area needs to be assessed as a totality across all information channels. The DSAPT should provide guidelines around the accessible provision of information online.

Providers should also be required to express their spoken and written information in ways that are simple, clear and easy to follow for people with intellectual disabilities or from non-English speaking backgrounds. The *UK Code of Practice for Operators* provides general tips around writing in plain English, which could serve as a model. While it is not possible to write prescriptive standards on what is or is not 'plain English' operators should remove jargon from their communications with passengers, to ensure that messages such as "this train is late or cancelled" can be understood by as many passengers as possible.

Parallel-Services

Parallel-transit³ solutions are not widespread (particularly in some regional areas), but play an important role in improving accessibility in situations where legacy infrastructure is yet to receive capital upgrades. An obligation to provide parallel-services where accessibility requirements are not met underpins the American ADA and could serve as a model for implementation in Australia. This is another area where DSAPT would be better served with performance-based outcomes – on a site-by-site basis.

A major advantage of a parallel-service obligation is that they provide immediate options to customers with a disability, rather than having to (potentially) wait years for upgrades to infrastructure or conveyances. It also means that providers have a clear understanding of demand and cost implications of inaccessible environments and may provide an incentive for upgrading legacy infrastructure in high use areas. A downside is naturally the increased cost that parallel-services would incur as well as the need to carefully stipulate the conditions under which such services are available. Care also needs to be taken to ensure that the day-to-day cost of parallel-services does not take away from money allocated to capital upgrades of inaccessible infrastructure.

³ Paratransit is alternative transport services provided at no extra cost to consumers when mainstream public transport is inaccessible - e.g. taxi service; dedicated wheelchair mini-buses.

This report should not be read as advocating the widespread adoption of parallel-service solutions to accessibility issues, but invites the review of the DSAPT to consider the role that they might play, especially in situations like train and tram replacement coaches, tram stops in narrow environments or certain heritage-listed stations where it is extremely difficult to overcome accessibility challenges.

Management of Heritage Requirements

A number of DSAPT requirements conflict with statutory heritage requirements. These conflicts create significant challenges making some requirements impossible in their current form or requiring significant changes to the existing structures. Conducting these changes are cost prohibitive outside of a major works program. The methodologies utilised by the USA and UK in working with this constraint can provide guidance on ways to manage these restrictions.

The ADA standard [USA 2010, ADA, Standards for Accessible Design] has allowances for disproportional costs, which includes:

- Alterations made to provide an accessible path of travel to an altered area will be *deemed disproportionate* to the overall alteration when the *cost exceeds 20% of the cost of the alteration* to the primary function area.
- When the cost of alterations necessary to make the path of travel to the altered area fully accessible is disproportionate to the cost of the overall alteration, the path of travel shall be made accessible to the extent that it can be made accessible without incurring disproportionate costs as outlined above.

The UK Code of Practice (2015), *DoT, Design Standards for Accessible Railway Stations, Version 04* looks to focus on only bringing stations and other rail buildings up to the standard if they are undergoing major works, renewals, or replacements. The Code identifies European and national standards relevant for all passenger train and station operators in Great Britain. Licensed operators, including Network Rail, must follow the Code, a condition of their licence, whenever they install, renew or replace infrastructure or facilities. This includes the requirement to establish and comply with a *Disabled People's Protection Policy (DPPP)*, paying due regard to this Code. The Code contains mandatory European Standards (from the Persons with Reduced Mobility Technical Specification for Interoperability) which must be applied when any "major work" is being undertaken; mandatory national standards, which must be applied to all other installations, renewals or replacements; and best practice guidance which should be applied wherever possible.

It can be interpreted that these documents intend to apply the standard in full as part of a general works program, to within a reasonable cost expectation. Neither document states a deadline for completion of these works, however it is well understood that whilst full compliance to the standard is the objective, alternative access options are suitable until upgrade programs are conducted. This looks to try and achieve a balance between providing accessibility and understanding practical and financial limitations on upgrading a major part of national infrastructure.

The issues associated with retrofitting are widespread. This is illustrated in the following case study:

The London Underground opened in 1863 and now carries around 5 million passenger per day. Access for people with a disability was not considered when most of the system was built. The stations on the Jubilee line extension opened in 1999, were designed for accessibility, but retrofitting accessibility features to the older stations is a major investment that is planned to take over twenty years. In 2016, an extra £200m (AUD\$366m) was committed to help “fast-track” a step-free access on the Tube. This is envisaged to take the total number of step-free Tube stations to over 100 – By 2024, 38% of the Tube network will be step-free - compared to 28% in 2018 – an increase of only 10%. Even with a considerable budget and modern engineering techniques, retrofitting takes time. [Transport for London, 2019]

Key Findings

The research has identified there are two key approaches to standards development:

- Prescriptive; and
- Outcomes or functional based.

The former may allow greater mitigation of risk, but arguably will not deliver solutions relative to needs. The latter, an outcomes-based approach, will enable greater capacity for ongoing consultation and offers a much more inclusive, collaborative approach with user groups and key stakeholders such as the AHRC.

Where there are concerns about the extent of latitude on specifics, benchmarks could be built into standards that allow some flexibility in approach through indicative acceptable specification ranges. An expert panel could review functional solutions in a similar way to which surveyors assess performance-based solutions under building codes. Outcomes based standards can also be solutions-based which allow then for adaptation as new technologies become available such as Smart Phone Apps. In comparison prescriptive based standards reduce the capacity for innovation, and consideration of best practice solutions which become available in real-time, potentially providing a declining benefit over time.

Conclusions

This report provides an independent analysis of the DSAPT and the Premises Standards relevant to people with disability. It considers the industry challenges as presented to the Consultants in what they have determined are some of the issues they are experiencing in their capacity to meet the compliance requirements outlined for the future to provide accessible and inclusive transport to Australia’s changing population needs. Compliance is a problem for the industry as both standards were reviewed or written quite some time ago, and the biggest concern is the way and rate in which the Standards are expected to be applied given the challenges which have been outlined in this section of the paper and which are detailed in the full report.

There have been significant changes in the way people move around, and how they manage and access facilities and information. This is likely to continue to change at a rapid rate due to technology and new innovative practices and having standards that are too prescriptive in nature will limit the industry's capacity to respond quickly taking consideration of the most easily and relevant 'best practice' mechanisms that support inclusive and accessibility to public transport to meet changing demographic needs. A significant issue for industry is also in how to manage standards that are prescriptive in infrastructure that has in most instances competing requirement in addressing heritage needs in protecting the history within the infrastructure.

This study was conducted through a review of literature without any specific research. The information provides some options that are practical for consideration, and some will require further research. The recommendations are provided in good faith using the available information that has been sourced from the public domain. It is the intention that the recommendations will be explored further with a range of stakeholder groups, to determine outcomes-based approaches which will best meet the expectations of a range of users in the future who identify as having some form of disability or who are aging and require special considerations in how they access and use public transport.

Appendix 1 of this report provides a table of future opportunities that can be considered for further research.

Recommendations

This review suggests an outcomes-based approach in its recommendations. Table 2 following provides a summary of general outcomes-based recommendations. Table 3 provides the recommendations put forward as a result of the research findings.

The recommendations provided take account of the application made by the ARA on behalf of its members for a number of temporary exemptions from the DDA, the DSAPT and the Premises Standards to the Australian Human Rights Commission.

TABLE 2: GENERAL RECOMMENDATIONS

R. NO.	RECOMMENDATION
GR1	An outcomes-based approach to Standards is developed and adopted, in consultation with experts and disability support groups (with suitable benchmarking used, and/or a specified range determined and agreed where prescription is required).
GR2	Where prescription is required in the Standards compliance measures should be clear and structured in a way that will improve outcomes for people with disability.
GR3	Language used in the Standards should provide clear distinction on expectations and definition on terminology.
GR4	Flexibility should be allowed within the Standards for different types of structures, including some discretion for heritage sites, where on a case by case basis, a clear definition is offered.
GR5	Clear distinction on requirements between different modes of transport is provided in the revisions to the Standards.
GR6	Rail sector representation in any committees/working groups for revisions to Standards should be considered (subject to Standards Australia procedure for revising standards).
GR7	The latest revision of any Standards should always be the most applicable (unless by specification of exception).

TABLE 3: SUMMARY STANDARDS RECOMMENDATIONS

No.	REFERENCE	R. NO.	RECOMMENDATION
A1	(2.1) ACCESS PATHS – UNHINDERED PASSAGE	R1.1	Provide a clear definition on the extent of the accessible path and/or what constitutes an accessible path in terms of what operators need to provide at different premises.
		R1.2	Future revisions to the Standards to adopt a provision for flange gaps that is in line with EU Standards.
		R1.3	Focusing on a 'primary' access path should only apply to existing infrastructure/premises or sites that have restraints to allow full access. New infrastructure/premises should have compliant accessible access paths as required.
		R1.4	Provide detailed information about available access paths as part of the standard pre-planning/journey-planning tools.
A2	(2.4) ACCESS PATHS-MINIMUM UNOBSTRUCTED WIDTH	R2.1	Accessibility requirements for people with disability should provide an updated analysis and data for the built environment in 2019.
		R2.2	Incorporate the inclusion or exclusion of TGSI (where sufficient space is available) into the definition of an access path.

No.	REFERENCE	R. NO.	RECOMMENDATION
		R2.3	The provision of a clause in DSAPT that identifies and caters for different types of structures, that offers varying requirements for the minimum obstructed width of access paths suitable for each of these. Additionally, offer a case-by-case basis definition for heritage buildings.
		R2.4	Where it is not feasible to provide equal access for all passengers, priority is given to achieving required widths on a primary path of travel through premises where possible.
		R2.5	The inclusion of a clause that outlines the frequency and requirements of passing locations along a primary accessible path as set out in equivalent international standards.
A3	(2.6) ACCESS PATHS - CONVEYANCES	R3.1	Clarify the context of when an accessible access path is required.
		R3.2	Identify establishing 'primary path/s of travel' from a whole of journey approach.
A4	(4.2) PASSING AREAS – TWO-WAY ACCESS PATHS AND AEROBRIDGES	R4.1	Include in the Standards provisions for upgrade of existing infrastructure (or new infrastructure in developed areas) to maximise access to a reasonable scope and cost for development works.
		R4.2	Outcomes-based standards be developed in consultation with disability support groups (and potentially with suitable benchmarking), taking into consideration the constraints associated with existing infrastructure and opportunities that arise with new infrastructure (where prescriptive standard may apply).
		R4.3	Railways to provide improved access information on pathing for passengers with limited mobility.
A5	(5.1) RESTING POINTS – WHEN RESTING POINTS MUST BE PROVIDED	R5.1	Determine the appropriate distance required between resting points through further research.
		R5.2	Further consultation undertaken to determine the best functional outcomes for all passengers when identifying locations for resting points.
A6	(6.4) SLOPE OF EXTERNAL	R6.1	Industry upgrades infrastructure/conveyances to limit the occurrence of external ramp deployment

No.	REFERENCE	R. NO.	RECOMMENDATION
	BOARDING RAMPS		and/or reduce the slope of external boarding ramps.
		R6.2	Review of industry performance penalties to acknowledge impact of extended dwell times to safely assist people with disabilities.
A7	(8.2) BOARDING – WHEN BOARDING DEVICES MUST BE PROVIDED	R7.1	Undertake progressive upgrades to infrastructure through platform renewals to set a consistent platform coping height within each network limiting vertical step height variability. Predominant rolling stock to inform coping height and include this as a critical design specification for vestibule floor height of future rolling stock tenders.
		R7.2	Continue to investigate dynamic boarding/alighting systems.
		R7.3	Review and provide further clarity, identify implications for industry/people with disabilities and those who represent them, on the phrase ‘any accessible entrance’ within clause 8.2.
A8	(8.7) BOARDING – SIGNALS REQUESTING USE OF BOARDING DEVICE	R8.1	Standard to remain unchanged.
A9	(11.2) HANDRAILS AND GRABRAILS – HANDRAILS TO BE PROVIDED ON ACCESS PATHS	R9.1	Provide handrails on graded walkways and ramps where people with disabilities may require additional support.
		R9.2	Consult with disability access groups regarding handrail needs on graded walkways and ramps.
		R9.3	Provide alternate passive guidance using wayfinding, signage and directional TGSI.
A10	(12.2) DOORWAYS AND DOORS – COMPLIANCE WITH AUSTRALIAN STANDARD – PREMISES AND INFRASTRUCTURE	R10.1	Update references to the latest AS 1428.1 within the DSAPT.
A11	(12.4) DOORWAYS AND DOORS – CLEAR	R11.1	Standard to remain unchanged.
		R11.2	Update AS references to more recent and accessible anthropometric data sources.

No.	REFERENCE	R. NO.	RECOMMENDATION
	OPENING OF DOORWAYS	R11.3	A <u>retrospective consideration</u> clause (particularly relevant for narrow gauge operators and existing operational conveyance designs) accommodated in DSAPT modernisation.
A12	(14.3) STAIRS – COMPLIANCE WITH AUSTRALIAN STANDARDS – CONVEYANCES	R12.1	Provide priority seating for less mobile passengers.
		R12.2	Consult with disability access groups to identify improved seating options for multi-level conveyances.
A13	15.2) TOILETS – LOCATION OF ACCESSIBLE TOILETS	R13.1	When undertaking an access upgrade, the scope of work should focus on providing the best possible outcomes for passengers, which includes providing adequate numbers and accessible toilets in each station precinct.
		R13.2	Utilise current technology, localization, and mapping services to map accessible toilets as part of standard journey planning.
A14	(15.3) TOILETS – UNISEX ACCESSIBLE TOILET – FERRIES AND ACCESSIBLE RAIL CARS	R14.1	Develop an assessment method between industry/key stakeholders to determine hierarchy of needs in relation to new conveyances and retrospectively (if applicable).
		R14.2	A comprehensive stakeholder engagement (people with disability) undertaken to evaluate AS 1428.1, both 2001 & 2009.
		R14.3	With acknowledged constraints on the dimension of conveyances, a rail-based standard drawing upon the previous study developed as an industry benchmark. Stakeholder agreed design amendments for existing conveyances appended to the rail-based standard.
A15	(15.4) TOILETS – REQUIREMENTS FOR ACCESSIBLE TOILETS – FERRIES AND ACCESSIBLE RAIL CARS	A15.1	Adopt Recommendation 14.2 and 14.3.
A16	(17.5) SIGNS –	R16.1	Minimum display times be allowed to vary depending on the number of words being

No.	REFERENCE	R. NO.	RECOMMENDATION
	ELECTRONIC NOTICES		displayed (as per UK standards) – allowing a minimum of 2 seconds display time per word.
		R16.2	Changes to this standard be made in conjunction with more general revisions to A20 (27.3) Information – size and format of printing.
A17	(18.1) TACTILE GROUND SURFACE INDICATORS – LOCATION	R17.1	The DSAPT must clearly distinguish between hazard and directional TGSi and provide different requirements for each.
		R17.2	Hazard TGSi requirements taken from AS 1428.4 (2009).
		R17.3	In addition to AS 1428.4 (2009), there should be a note that Hazard TGSi are not required where physical barriers make the edge of the platform not directly accessible to passengers.
		R17.4	Further research is required on if/ how directional TGSIs should interact with passive wayfinding cues to guide blind/ low vision consumers through complex rail environments to inform the practice in the installation of directional TGSIs.
A18	(20.1) LIGHTING – ILLUMINATION LEVELS – PREMISES AND INFRASTRUCTURE	R18.1	Revised standards should include a rider clause that allows for the use of motion-activated lighting.
		R18.2	Providers should consider ambient lighting in determining overall lighting levels.
		R18.3	UK Standards and Code of Practice serve as a model for revising the DSAPT treatment of lighting, but there is a need to consider different types of rail environments encountered in Australia.
		R18.4	Clear guidance on specific lighting requirements is required on how to manage any conflicts between lighting standards and applicable technical standards around signalling.
A19	(21.1) CONTROLS – COMPLIANCE WITH AUSTRALIAN STANDARD – PREMISES AND INFRASTRUCTURE	R19.1	Align DSAPT with current Australian Standard (AS 1428-1 – 2009).

No.	REFERENCE	R. NO.	RECOMMENDATION
A20	(27.3) INFORMATION – SIZE AND FORMAT OF PRINTING	R20.1	Revised standards must distinguish between fixed signage and other text types.
		R20.2	Standards for printed signage need to give much more information about graphic design details – including size relative to reading distance; colour/ luminance contrast and glare. The US, Singaporean and UK standards all provide potential model texts that could be used to this end.
		R20.3	Develop separate standards for electronic signs/ notices and touch-screens. This is an emerging area internationally – the UK standards cited above provide some guidance, but will need further development.
		R20.4	Develop minimum requirements for the presentation of information online in consultation with consumer groups. At a minimum this should require online information to be provided through at least one channel that meets at least level A Web Content Accessibility Guidelines (WCAG) 2.1 standards; or through a range of complementary channels that collectively offer an equivalently accessible experience.
		R20.5	A means of initiating contact with a member of railway staff (for example help button, station staff, contact phone number, twitter handle) at all stations must be provided.
A21	(28.2) BOOKED SERVICES – PERIOD OF NOTICE OF REQUIREMENT FOR ACCESSIBLE TRAVEL	R21.1	Develop guidelines on what obligations providers have to offer assistance to passengers with disabilities, and how these interface with other operational requirements and conditions (e.g. unmanned stations). EU regulations cited above provide a potential model text for this area, but need to be adapted to Australian operating conditions in consultation with consumer groups.
		R21.2	Passengers who require complex assistance be encouraged, but not required, to pre-book their assistance requests in order to ensure someone is available to help them. Leave the length of notice periods for pre-booking to providers to determine, with a 48 hour maximum.

No.	REFERENCE	R. NO.	RECOMMENDATION
		R21.3	The review should consult widely with consumer groups around if, when and how parallel-services might be used to provide alternative transport when legacy or replacement infrastructure is inaccessible.
		R21.4	Accessible seating be fully integrated into the dynamic ticketing marketplace negating the need for a different notice period for the sale of accessible seating.

EXEMPTIONS NOT GRANTED

No.	REFERENCE	R. NO.	RECOMMENDATION
A22	(3.1) CIRCULATION SPACE FOR WHEELCHAIRS TO TURN IN	R22.1	Standard to remain unchanged.
		R22.2	Industry to quantify within rail networks instances where limited circulation space impacts on meeting compliance and/or operational performance and address through DSAPT provided discretionary clauses.
A23	(11.2) HANDRAILS AND GRABRAILS	R23.1	Provide handrails where passengers may require additional support.
		R23.2	Consult with users regarding handrail needs.
A24	(21.2) PASSENGER OPERATED DEVICES FOR OPENING AND CLOSING DOORS	R24.1	Standard to remain unchanged.
A25	(21.3) LOCATION OF PASSENGER OPERATED CONTROLS FOR OPENING AND LOCKING DOORS	R25.1	Standard to remain unchanged.
A26	(26.2) HEARING AUGMENTATION – LISTENING SYSTEMS – PUBLIC ADDRESS SYSTEMS – CONVEYANCES	R26.1	Remove reference to AS 1428.2 (1992) and replace with the current standard (AS 1428.5, 2010).
		R26.2	Allow where it proves impractical to install assisted listening devices on conveyances to the standards outlined in AS 1428.5 (2010), providers to provide equivalent access to real-time information via non-aural channels (e.g. PIDs).
		R26.3	Clarify when hearing augmentation is provided operators still have an obligation to

No.	REFERENCE	R. NO.	RECOMMENDATION
			provide access to real-time information via non-aural channels (e.g. PIDs).

REFERENCE LIST

[Access Economics \(2006\), Listen hear! The economic impact and cost of hearing loss in Australia website https://apo.org.au/node/2755](https://apo.org.au/node/2755)

[A Web Content Accessibility Guidelines \(WCAG\) 2.1 standards, W3C Recommendation 05 June 2018 website https://www.w3.org/TR/WCAG21/](https://www.w3.org/TR/WCAG21/)

[Australian Bureau of Statistics \(ABS\) 2014. Australian historical population statistics, 2014. ABS cat. no. 3105.0.65.001. Canberra: ABS website https://www.aihw.gov.au/reports/older-people/older-australia-at-a-glance/contents/demographics-of-older-australians/australia-s-changing-age-and-gender-profile](https://www.aihw.gov.au/reports/older-people/older-australia-at-a-glance/contents/demographics-of-older-australians/australia-s-changing-age-and-gender-profile)

[Australian Government, Australian Institute of Family Studies website https://aifs.gov.au/](https://aifs.gov.au/)

[Australian Government, Australian Institute of Health and Welfare website https://www.aihw.gov.au/reports/biomedical-risk-factors/risk-factors-to-health/contents/overweight-and-obesity,](https://www.aihw.gov.au/reports/biomedical-risk-factors/risk-factors-to-health/contents/overweight-and-obesity)

[Australian Government, Department of Infrastructure, Regional Development and Cities, The National Rail Program: Investing in Rail Networks for our Cities and Regions website https://investment.infrastructure.gov.au/files/national_rail_program/national_rail_program_booklet.pdf](https://investment.infrastructure.gov.au/files/national_rail_program/national_rail_program_booklet.pdf)

[Australian Government, Department of Social Services, National Disability Strategy 2010-2020 website https://www.dss.gov.au/our-responsibilities/disability-and-carers/publications-articles/policy-research/national-disability-strategy-2010-2020,](https://www.dss.gov.au/our-responsibilities/disability-and-carers/publications-articles/policy-research/national-disability-strategy-2010-2020)

[Australian Government, Federal Register of Legislation, DDA website https://www.legislation.gov.au/Series/C2004A04426](https://www.legislation.gov.au/Series/C2004A04426)

[Australian Government, Federal Register of Legislation, DSAPT as amended made under subsection 31 \(1\) of the DDA. Compilation was prepared on 1 May 2011. website https://www.legislation.gov.au/Details/F2011C00213](https://www.legislation.gov.au/Details/F2011C00213)

[Australian Government, Federal Register of Legislation, Disability \(Access to Premises – Buildings\) Standards 2010 DDA website https://www.legislation.gov.au/Details/F2010L00668](https://www.legislation.gov.au/Details/F2010L00668)

[Australian Government, Federal Register of Legislation, DSAPT website https://www.legislation.gov.au/Details/F2011C00213](https://www.legislation.gov.au/Details/F2011C00213)

[Australian Government, Future Cities Planning for our growing population, February 2018 website https://infrastructureaustralia.gov.au/policy-publications/publications/future-cities.aspx](https://infrastructureaustralia.gov.au/policy-publications/publications/future-cities.aspx)

[Australian Government, National Construction Code, Australian Building Codes Board, "How it works" website https://ncc.abcb.gov.au/ncc-online/How-it-works](https://ncc.abcb.gov.au/ncc-online/How-it-works)

[Australian Government, National Transport Commission, \(August 2016\), Who Moves What Where, Freight and Passenger Transport in Australia website https://www.ntc.gov.au/Media/Reports/\(D62E6EFC-36C7-48B1-66A7-DDEF3B04CCAE\).pdf](https://www.ntc.gov.au/Media/Reports/(D62E6EFC-36C7-48B1-66A7-DDEF3B04CCAE).pdf)

[Australasian Railway Association \(2017\), A National Rail Industry Plan For the Benefit of Australia website https://ara.net.au/sites/default/files/National%20Rail%20Industry%20Plan_full%20report.pdf](https://ara.net.au/sites/default/files/National%20Rail%20Industry%20Plan_full%20report.pdf)

[Australasian Railway Association \(Nov. 2018\), Skills Capability Study Skills Crisis: A Call to Action website https://ara.net.au/sites/default/files/18-11-26%20BOE%20Report%20Final.pdf](https://ara.net.au/sites/default/files/18-11-26%20BOE%20Report%20Final.pdf)

[Australian Human Rights Commission website with ARA Submission website https://www.humanrights.gov.au/australasian-railway-association-ara](https://www.humanrights.gov.au/australasian-railway-association-ara)

Bails J. H. (1983). Field testing of Commonwealth standard furniture by disabled persons: A research project undertaken by the Public Buildings Department of South Australia for the Commonwealth Department of Transport and Construction, Public Buildings Department South Australia.

[Brizs, S., Carpenter, S., Davey, A., Davies, L., Eickhoff, B., Flint, T. Pullinger, J. \(2015\). Platform train interface strategy website https://www.rssb.co.uk/Library/improving-industry-performance/2015-01-platform-train-interface-strategy.pdf](https://www.rssb.co.uk/Library/improving-industry-performance/2015-01-platform-train-interface-strategy.pdf)

[Deloitte Mobile Consumer Survey 2018, Behaviour Unlimited website https://www2.deloitte.com/au/mobile-consumer-survey](https://www2.deloitte.com/au/mobile-consumer-survey)

[Deloitte Access Economics \(2017\), Value of Rail -The Contribution of Rail in Australia, commissioned by the ARA released 2017 website https://www2.deloitte.com/au/en/pages/economics/articles/value-rail.html](https://www2.deloitte.com/au/en/pages/economics/articles/value-rail.html)

[Department of Transport \(UK\) Guidance on the use of Tactile Paving Surfaces \(2007\) website https://www.gov.uk/government/publications/guidance-on-the-use-of-tactile-paving-surfaces](https://www.gov.uk/government/publications/guidance-on-the-use-of-tactile-paving-surfaces)

Devadoss, R., Ahmad, S., & Dhamodharan, D. R. (2012). *Station Platform -Train Interface for Rail passengers - A Technology review*. CRC for Rail Innovation.

[Disability Horizons, The London Underground – An accessible future? \(2011\) website](http://disabilityhorizons.com/2011/07/the-london-underground-an-accessible-future/)
<http://disabilityhorizons.com/2011/07/the-london-underground-an-accessible-future/>

Eizmendi, G. (2007). Measurement of luminance contrast sensitivity of persons with low visual capability in order to secure the visibility of tactile walking surface indicators. *Challenges for Assistive Technology: AAATE 07*, 20, 326.

[eLife, quoted by Sydney Morning Herald, Global study of tallest people shows Australians are going up in the world website](https://www.smh.com.au/national/global-study-of-tallest-people-shows-australians-are-going-up-in-the-world-20160729-ggg8v4.html)
<https://www.smh.com.au/national/global-study-of-tallest-people-shows-australians-are-going-up-in-the-world-20160729-ggg8v4.html>

[EUROPA Commission Regulation \(EU\) No 1300/2014 of 18 November 2014 on the technical specifications for interoperability relating to accessibility of the Union's rail system for persons with disabilities and persons with reduced mobility website](https://publications.europa.eu/en/publication-detail/-/publication/2a0f1ad4-81c9-11e4-89f7-01aa75ed71a1)
<https://publications.europa.eu/en/publication-detail/-/publication/2a0f1ad4-81c9-11e4-89f7-01aa75ed71a1>

[EU Agency for Railways, Persons with Reduced Mobility Technical Specification for Interoperability website, https://www.era.europa.eu/activities/technical-specifications-interoperability_en](https://www.era.europa.eu/activities/technical-specifications-interoperability_en)

[EUR-EX, Access to European Law, Regulation \(EC\) No 1371/2007 of the European Parliament and of the Council of 23 October 2007 on rail passengers' rights and obligations website, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32007R1371](https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32007R1371)

[Casey C. Grant, P.E., National Fire Protection Association, "A Look from Yesterday to Tomorrow on the Building of Our Safety Infrastructure," Presented at NIST Centennial Standards Symposium, March 7, 2001 website](https://www.ansi.org/consumer_affairs/history_standards)
https://www.ansi.org/consumer_affairs/history_standards

Grönvik, L. (2009). Defining disability: Effects of disability concepts on research outcomes. *International Journal of Social Research Methodology*, 12(1), 1–18.
doi:10.1080/13645570701621977

Hashizume, T., Yoneda, I., Kitagawa, H., Fujisawa, S., & Sueda, O. (2009). Accessibilities of wheelchair users to cross the gaps and steps between platforms and trains. *SICE Journal of Control, Measurement, and System Integration*, 2(4), 199–205

Hughes, B., & Paterson, K. (1997). The social model of disability and the disappearing body: Towards a sociology of impairment. *Disability & Society*, 12(3), 325–340.

Kiuru, T., Metso, M., Utriainen, M., Metsävainio, K., Jauhonen, H.-M., Rajala, R. Juntunen, R. (2018). Assistive device for orientation and mobility of the visually impaired based on millimeter wave radar technology—Clinical investigation results. *Cogent Engineering*, 5(1), 1450322.

Morlok, E. (2002). Need for a new commuter car entranceway design for mixed high- and low-level platforms. *Transportation Research Record: Journal of the Transportation Research Board* (1793), 40–46.

[National Standards Authority of Ireland \(2017\). IS EN 16585-1:2017 Railway Applications Design for PRM Use, Equipment and components on board rolling stock. Toilets website <http://www.standards.ie/>](#)

[National Standards Authority of Ireland \(2011\) IS EN 12464-1:2011: Light and Lighting - Lighting of Work Places - Part 1: Indoor Work Places website <http://www.standards.ie/>](#)

[National Standards Authority of Ireland \(2011\) IS EN12464-2:2014 Light and Lighting – Lighting of work places – Part 2: Outdoor Work Places website <http://www.standards.ie/>](#)

[National Transport Commission, Rail Safety National Law website <https://www.ntc.gov.au/rail/safety/rail-safety-national-law/>](#)

[Office of the National Rail Safety Regulator website <https://www.onrsr.com.au/about-onrsr/legislation>](#)

Ohno, H., Suzuki, A., & Akiu, N. (2017). Measuring Methods of Luminance Contrast between Tactile Walking Surface Indicators and Their Surrounding or Adjacent Surfaces at Railway Stations. *Quarterly Report of RTRI*, 58(2), 145–152.

[Padzi, F. A., Ibrahim, F., & Karim, N. A. \(2013\). Incongruent Installation of Tactile Ground Surface Indicator Toward Visual Impaired People’s Need: Masjid Jamek Station. *Procedia - Social and Behavioural Sciences*, 101, 130–139. website <https://doi.org/10.1016/j.sbspro.2013.07.186>](#)

Palmer-Cannon, L. P., & Gloster, J. L. (2016). Providing unassisted access at train platforms for passengers with mobility restrictions. *CORE 2016: Maintaining the Momentum*, 550.

[People with Disability Australia, History of Disability Rights Movement in Australia website <https://pwd.org.au/about-us/our-history/history-of-disability-rights-movement-in-australia/>](#)

[Price Waterhouse Coopers, Disability Investment Group: National Disability Insurance Scheme Final Report, Commonwealth of Australia, 2009 website](#)

<https://www.dss.gov.au/our-responsibilities/disability-and-carers/program-services/for-people-with-disability/disability-investment-group/pricewaterhousecoopers-national-disability-insurance-scheme-final-report>

[ReWalk exoskeleton website https://rewalk.com/rewalk-exoskeleton-puts-disabled-back-on-their-feet/](https://rewalk.com/rewalk-exoskeleton-puts-disabled-back-on-their-feet/)

Rueger, B. (2011b). *Platform-based devices for accessible railway boarding*. Paper presented at Railway Terminal World – Design and Technology Conference 2011, Bella Center, Copenhagen, Denmark.

Shakespeare, T. (2013). *Disability rights and wrongs revisited*. Abingdon, Oxon: Routledge.

[Singapore Building and Construction Authority, Code of Accessibility in the Built Environment, 2013 pp.1-254 website https://www.bca.gov.sg/BarrierFree/others/ACCESSIBILITY_CODE_2013.pdf](https://www.bca.gov.sg/BarrierFree/others/ACCESSIBILITY_CODE_2013.pdf)

[Singapore Government, Land Transport Authority, Architectural Standards website https://www.lta.gov.sg/content/ltaweb/en/industry-matters/development-and-building-and-construction-and-utility-works/architectural-standards.html](https://www.lta.gov.sg/content/ltaweb/en/industry-matters/development-and-building-and-construction-and-utility-works/architectural-standards.html)

[Steinfeld E, Maisel J, Feathers D, D'Souza C. \(2010\), Anthropometry and standards for wheeled mobility: an international comparison, Center for Inclusive Design and Environmental Analysis, School of Architecture and Planning, State University of New York at Buffalo, New York 14214-3087, USA website https://www.ncbi.nlm.nih.gov/pubmed/20402047](https://www.ncbi.nlm.nih.gov/pubmed/20402047)

Steinfeld E., et al. (1979). *Accessible Buildings for People with Walking and Reaching Limitations*

[Standards Australia \(2009\), Design for access and mobility – General requirements for access – New building work, AS 14281-2009 website https://www.disabilityaccessconsultants.com.au/australian-standards-as1428-suite/](https://www.disabilityaccessconsultants.com.au/australian-standards-as1428-suite/)

[The Global Economy, Railroad Infrastructure Quality – Country Rankings, 2015 website https://www.theglobaleconomy.com/rankings/railroad_quality/](https://www.theglobaleconomy.com/rankings/railroad_quality/)

[The Rail Vehicle Accessibility Regulations 1998 website http://www.legislation.gov.uk/uksi/1998/2456/contents/made](http://www.legislation.gov.uk/uksi/1998/2456/contents/made)

Thomas, C. (2004). How is disability understood? An examination of sociological approaches. *Disability & Society*, 19(6), 569–583.

[Transport for London, London Underground website https://tfl.gov.uk/corporate/about-tfl/what-we-do/london-underground](https://tfl.gov.uk/corporate/about-tfl/what-we-do/london-underground)

[Transport for London, London for Transport, Step-free access website
https://tfl.gov.uk/travel-information/improvements-and-projects/step-free-access?intcmp=1954](https://tfl.gov.uk/travel-information/improvements-and-projects/step-free-access?intcmp=1954)

[Transport Scotland, Department of Transport, Design Standards for Accessible Railway Stations website
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/425977/design-standards-accessible-stations.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/425977/design-standards-accessible-stations.pdf)

[UK Government, Department of Environment, Transport and Regions \(DETR\) Guidance on the use of Tactile Paving Surfaces \(2007\) website
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/289245/tactile-paving-surfaces.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/289245/tactile-paving-surfaces.pdf)

[UK Government, Design Standards for Accessible Railway Stations website
https://www.gov.uk/government/publications/accessible-railway-stations-design-standards](https://www.gov.uk/government/publications/accessible-railway-stations-design-standards)

[United States Access Board, Advancing Full Access and Inclusion for All, Chapter 5 Toilet and Bathing website
https://www.access-board.gov/guidelines-and-standards/transportation/passenger-vessels/background/recommendations-for-accessibility-guidelines-for-passenger-vessels-final-report/chapter-5-toilet-and-bathing](https://www.access-board.gov/guidelines-and-standards/transportation/passenger-vessels/background/recommendations-for-accessibility-guidelines-for-passenger-vessels-final-report/chapter-5-toilet-and-bathing)

[United States Access Board - Chapter R3: Technical Requirements website
https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines/chapter-r3-technical-requirements](https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines/chapter-r3-technical-requirements)

[United States Department of Justice, Civil Rights Division, Disability Rights Section, ADA, updated, requirements, including the 2010 Standards for Accessible Design \(2010 Standards\) website
https://www.ada.gov/ticketing_2010.htm](https://www.ada.gov/ticketing_2010.htm)

[United States Department of Transportation, Federal Transit Administration, ADA Regulations website
https://www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/ada-regulations](https://www.transit.dot.gov/regulations-and-guidance/civil-rights-ada/ada-regulations)

[United States Access Board, Guides on ADAAG for Transportation Vehicles: Subpart C - Rapid Rail Vehicles and Systems website
https://www.access-board.gov/guidelines-and-standards/transportation/vehicles/adaag-for-transportation-vehicles](https://www.access-board.gov/guidelines-and-standards/transportation/vehicles/adaag-for-transportation-vehicles)

United States Access Board, US Access Board, Rail Vehicles Access Advisory Committee July 29, 2015,

[United States Access Board, US Access Board, Rail Vehicles Access Advisory Committee July 29, 2015 website
https://www.access-board.gov/guidelines-and-standards/transportation/vehicles/adaag-for-transportation-vehicles](https://www.access-board.gov/guidelines-and-standards/transportation/vehicles/adaag-for-transportation-vehicles)

[standards/transportation/vehicles/rail-vehicles-access-advisory-committee/final-report](#)

[Veeck, Gregory. Pannell, Clifton W. \(2007\). China's Geography: Globalization and the Dynamics of Political, Economic, and Social Change website](#)
https://www.researchgate.net/publication/298793564_China's_Geography_Globalization_and_the_Dynamics_of_Political_Economic_and_Social_Change

Webb, Queensland (2004) Lighting of Station Environment to Comply With Disability Standards for Accessible Public Transport. Report prepared for the Australasian Rail Association

Wiggenraad, P., Lee, Y.-C., & Daamen, W. (2008). Boarding and alighting experiments: overview of setup and performance and some preliminary results. *Transportation Research Record: Journal of the Transportation Research Board*, 2042(-1), 71–81. doi:10.3141/2042-08

William of Malmesbury's and John A. Giles, (2004) *Chronicle of the Kings of England 12th Century*

Wood, Frances. (2008). *China's First Emperor and His Terracotta Warriors*, Macmillan Publishing, 2008

[World Health Organization, Health Topics, Obesity website](#)
<https://www.who.int/topics/obesity/en/>

[World Health Organization. World report on disability website](#)
http://www.who.int/disabilities/world_report/2011/en/

APPENDIX 1: FUTURE OPPORTUNITIES

DSAPT AND PREMISES STANDARDS		
A1	(2.1) Access paths – Unhindered Passage	<ul style="list-style-type: none"> In order to keep pace with technological progress, innovative solutions for enhanced accessibility may be required, which do not comply with current standards. In that case, new specifications and/or new assessment methods associated with these innovative solutions will need be developed. New methods of assessment may include creating virtual experiences for people to assess, test and validate a proposed access path or unobstructed route. Virtual and augmented reality tools and capabilities to create a virtual environment to undertake such assessments are potentially already in existence. This technology may be extended further than as an assessment tool, and could provide all public transport users with a means by which to familiarize themselves with various public transport locations, conveyances and environments prior to travel (see spatial computing part of MIVP Showreel 2018 https://vimeo.com/298508915) which would enable users to quickly and more confidently traverse accessible paths and routes at locations they intend to visit.
A2	(2.4) Access paths- Minimum Unobstructed width	<ul style="list-style-type: none"> It is highly likely that advances in restorative and therapeutic treatments together with technological advances in robotics and complex motion systems have the potential to revolutionize the way in which people with disabilities interact with the world around them. At the same time, it is likely that transportation facilities will also become “smarter” and more interactive. An example of an enhanced mobility aid, that already exists, is a modified exoskeleton. The ReWalk exoskeleton (ReWalk exoskeleton https://rewalk.com/rewalk-exoskeleton-puts-disabled-back-on-their-feet/) has already enabled a number of people who cannot use their legs to walk with the aid of a robotic machine that uses computers and electric motors to power their paralysed limbs. Such technologies are likely to become more prevalent as advanced artificially intelligence systems allow these systems to rapidly learn what users are capable of and compensate and adapt accordingly. The use of such devices in the public transport environment will introduce other challenges, but it is expected that standards based on outcomes and service delivery are likely to be best placed to deal with these, as opposed to prescriptive standards that lock in constraints for mobility aids that may themselves soon be considered redundant.

DSAPT AND PREMISES STANDARDS		
		<ul style="list-style-type: none"> In addition, such systems can be configured to interoperate with smart systems that are being developed for people with visual impairments that use an array of sensors, including cameras, LiDAR and navigation sensors, together with artificial intelligence systems to alert the user of obstacles that may exist in front of them and report this back as either audio descriptions and/or vibrations on either a belt or wrist band. The ability to signal intention, provide updates on status and order/request services will also help streamline services for all passengers and in particular for those with increased accessibility requirements.
A3	(2.6) Access paths- conveyances	<ul style="list-style-type: none"> Undertake virtual modelling of existing/potential conveyance layouts against DSAPT requirements and stakeholder requirements to determine optimal design arrangements of seating vs access paths vs allocated spaces vs accessible facilities to inform industry.
A4	(4.2) Passing areas – Two-way access paths and aerobridges	<ul style="list-style-type: none"> It is highly likely that advances in restorative and therapeutic treatments together with technological advances in robotics and complex motion systems have the potential to improve the way in which people with disabilities access services. As such it is quite likely that the functional anthropometry of disabled people will change. At the same time, it is likely that transportation facilities will also become “smarter” and more interactive. As the world becomes more connected, it is likely that transport facilities will increasingly interact with the public and such advancements are likely to facilitate significant opportunities for enhanced accessibility. The rail industry should work to provide design standards relevant for use of the conveyance to accessibility equipment designers and manufactures to ensure the equipment available to people with disabilities is suitably designed.
A5	(5.1) Resting points – When resting points must be provided	<ul style="list-style-type: none"> The original research used to determine the distance for resting points predates the original DDA by some years – the data could be over 40 years old. Given the advances in both medicine, technology and mobility aids over the last few decades, additional research to assess the distances that can be covered by people with a disability could be undertaken.

DSAPT AND PREMISES STANDARDS		
A6	(6.4) Slope of external boarding ramps	<ul style="list-style-type: none"> • A review of network conditions to identify and build a database of (a) problematic platforms and (b) location of remediated platforms, could be undertaken and made available to develop pre-journey planning applications taking advantage of digital technologies/ distribution and as general public information.
A7	(8.2) Boarding – When boarding devices must be provided	<ul style="list-style-type: none"> • Investigate innovative, adaptive gap fillers – within the field of architecture this could include digitally informed responsive surfaces, within automation design self-identifying and self-aligning components. • A complete survey of Australia’s rail networks is recommended to provide baseline data from which to measure and benchmark the efforts towards compliancy. It would also highlight the extent of remediation that may/may not be required. There seems to be insufficient data from which to draw conclusions or understand the full extent of the issue currently. • Develop a standard to include the use of a gap-mitigating device to be included in product design specifications for future rolling stock tenders – while maintaining design continuity as close as possible with existing stock.
A8	(8.7) Boarding – Signals requesting use of boarding device	<ul style="list-style-type: none"> • A review of applied digital technology integration in order to identify other passive methods of pre-empting passengers signalling the request of a boarding device.
A9	(11.2) Handrails and grabrails – Handrails to be provided on access paths	<ul style="list-style-type: none"> • Equivalent access may also be sufficiently provided with other solutions such as lower ticket counter. A review of alternate measures to handrails along access paths may be appropriate •
A10	(12.2) Doorways and doors – Compliance with Australian Standard – premises and infrastructure	<ul style="list-style-type: none"> • None identified.

DSAPT AND PREMISES STANDARDS		
A11	(12.4) Doorways and doors – Clear opening of doorways	<ul style="list-style-type: none"> Update of Anthropometric resources seems appropriate with any modernisation of the DSAPT.
A12	(14.3) Stairs – Compliance with Australian Standards – conveyances	<ul style="list-style-type: none"> Several options have been identified for innovative new wheelchairs that may be capable of negotiating stairs within conveyances. It is however noted that large-scale adoption of the technologies seem unlikely in the short term.
A13	(15.2) Toilets – Location of accessible toilets	<ul style="list-style-type: none"> As the world becomes more connected it is likely that transport facilities will increasingly interact with the public and such advancements are likely to facilitate significant opportunities for enhanced accessibility to toilets through the use of technology mapping and a consistent approach to building and construction of toilets in the future.
A14	(15.3) Toilets – Unisex accessible toilet – ferries and accessible rail cars	<ul style="list-style-type: none"> A broad scoping report on dual purpose architectural spaces may provide insight in resolve of spatial restrictions imposed by the network.
A15	(15.4) Toilets – Requirements for accessible toilets – ferries and accessible rail cars	<ul style="list-style-type: none"> A collaborative design study undertaken at an industry level with key stakeholders to determine the baseline spatial requirements or whether AS 1428.1 recommendations are appropriate for rail is suggested. This will provide a clear benchmark for design and procurement of rollingstock for standard and narrow gauge operators.
A16	(17.5) Signs – Electronic notices	<ul style="list-style-type: none"> As technologies for presenting information change there is a need for applied research that explores how rail users (with and without disabilities) are accessing real-time information about services and the accessibility implications of various design decisions. This could feed into the development of more comprehensive and nuanced recommendations around the presentation of information in a rail environment.

DSAPT AND PREMISES STANDARDS		
A17	(18.1) Tactile ground surface indicators – Location	<ul style="list-style-type: none"> • There is a genuine lack of research internationally on the efficacy of TGSIs as wayfinding tools in real-world environments; as well as the cost-benefit trade-off of allowing TGSIs to be collocated on accessible paths. Before operators are asked to invest heavily in directional TGSIs installation, consideration should be given to undertaking research to assess the value of this wayfinding tool.
A18	(20.1) Lighting – Illumination levels – premises and infrastructure	<ul style="list-style-type: none"> • While our recommendation is for a functional standard, if prescriptive standards are to be employed there is arguably a need to conduct research to verify or update the lighting levels recommended in the Webb report given recent developments in CEH/ LED lighting technologies and attendant changes in lighting technology. An update could also consider whether different approaches to lighting are required for outdoor elevated stations as distinct to those at ground level.
A19	(21.1) Controls – Compliance with Australian Standard – premises and infrastructure	<ul style="list-style-type: none"> • It has been noted by suppliers that the ability to produce doors capable of achieving the 2001 standards has proven difficult. In the future, technology has the ability to assist in many aspects relating to control (and in fact in many cases already does). Examples may include: <ul style="list-style-type: none"> ➤ Proximity sensors for door opening; ➤ Auto-locking doors; ➤ Bluetooth operation through registered devices; ➤ RFID tags to detect proximity; and ➤ Voice activated control (may include smart phone activation via Siri, Google etc.).
A20	(27.3) Information – Size and format of printing	<ul style="list-style-type: none"> • As technologies for presenting information change there is a need for applied research that explores how rail users (with and without disabilities) are accessing static and real-time information about services and the accessibility implications of various design decisions. This could feed into the development of more comprehensive and nuanced recommendations around the presentation of information in a rail environment.
A21	(28.2) Booked services – Period of notice of requirement for accessible travel	<ul style="list-style-type: none"> • If operators are to offer parallel-service services as a potential resolution to inaccessible rail environments/ conveyances extensive consultation with affected patrons and rail providers should take place to ensure all parties have input into how the policy is implemented in practice and the circumstances under which it is appropriate to be used.

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