

**FLOOR COVERINGS IN  
HEALTHCARE BUILDINGS**

Technical Series TS-7

**Version 1.1**

PREPARED FOR:

NSW Health  
Strategic Business and Development Branch

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## **SUMMARY**

This revision addresses the many changes that have occurred in healthcare flooring since publication of the previous edition in 1988. These changes have occurred in the area of products, sustainability and legislation. Particularly, the Building Code of Australia (BCA) and Disability Discrimination Act (DDA), Occupational Health and Safety (OHS) and floor safety; and in the awareness of the interaction between indoor environment and occupant wellbeing. Choice has become increasingly difficult due to the expanding range of available products, the complexity of factors to be considered, and the variation between different products within any one flooring type.

Section 1 provides an introduction that covers the increasing importance of some issues, new topics, materials and the significant increase in regulations and standards relating to flooring.

Section 2 provides a classification of flooring and examines selection on the basis of performance, covering whole of life costing, sustainability, risk management, OHS, slip resistance, infection control, interior environment, Standards and Regulations. Comment on maintenance, construction and warranties are included.

Sections 3 to 14 cover each floor finish material by type, e.g. carpet, vinyl, rubber, linoleum, ceramic tiling, seamless coatings and includes products made for specific purposes. Also covered are matting, accessories, outdoor flooring, and other commercial floor materials less often used in healthcare.

Section 15 provides schedules of recommended floor finishes including tables of standard and typical rooms with recommended floor finishes for each.

Sections 16 to 22 contain common used terminology and abbreviations; relevant references including legislations, standards, guidelines and directives, suggestions for further reading and lists of organisations / trade associations and technical appendices.

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## 1 INTRODUCTION

### 1.1 Background

This document is one in the series of *Technical Guides* issued by NSW Health. This edition of TS-7 has been revised and updated by the Centre for Health Assets Australasia (CHAA) Built Environment, UNSW, in 2008 to keep pace with the developments and changes in technologies, products and regulations that have occurred since the publication of the previous edition in 1988.

### 1.2 Scope

The purpose of this document is to provide information and recommendations for flooring that meet the special conditions encountered in the healthcare environment.

The content is intentionally generic with individual product information, product and brand names excluded.

In providing guidance the content does not diminish the responsibilities of the design team to meet all professional and regulatory obligations.

Facility management procedures such as cleaning and risk reduction are generally outside the scope, except where these have a direct influence on the design or selection of finishes.

Floor finishes for a limited group of external and covered areas directly related to internal spaces are briefly covered, but external surfaces and paving in general are outside the scope of this document.

'Wet areas' have specific issues and performance requirements, and are covered in more detail in *NSW Health Report 2007, Wall and floor finishes for wet areas*.

[www.fbe.unsw.edu.au/cha/4.2\\_linksandreferences.asp#TECHREPORTS](http://www.fbe.unsw.edu.au/cha/4.2_linksandreferences.asp#TECHREPORTS) (report located under section 3 *CHAA Technical Reports*).

### 1.3 Application

This document is intended for facility planners, members of the design team, those engaged in the construction, commissioning or management of healthcare facilities, and students studying Healthcare Facility Planning.

To mitigate risk the selection and specification of floor finishes should be achieved using appropriate professional or industry based expertise, with comprehensive construction documentation (including detailed drawings and a technical specification) where appropriate.

### 1.4 Associated literature

The contents cover key issues and make recommendations for floor finishes, with extracts from Regulations, Standards and Industry Associations included for comprehension.

Finishes are dealt with under their generic types. Links to individual manufacturers, trade and technical information can be found through the various trade organisations and associations provided. It is assumed that professional users have access to current Regulations, Standards, product literature, samples and technical support.

The process of selecting a floor finish is subject to regulations, policies and guidelines, Standards and a range of functional and other performance criteria, including cleaning requirements, aesthetic and psychological considerations. Refer: *Australasian Health Facility Guidelines - Part B*, and *Standard Components* for specific departmental, unit and room requirements.

Information contained or referenced in this document may be subject to change without notice and should therefore be checked for currency before use.

## 1.5 Terminology

A variety of different terms are used within the flooring industry, this document uses those adopted by Standards Australia, and additionally by Industry Organisations. See *Appendix A*.

'Patient care' is used to distinguish those areas intended for patient use or treatment, including circulation routes. 'Inpatient' refers to patient accommodation areas. For additional terminology refer to AusHFG.



## **2 SELECTION FACTORS**

### **2.1 General**

The primary requirement governing the selection of flooring for healthcare is that it should be 'fit for purpose', i.e. that the functional performance of the flooring should match the users' requirements. This definition covers not only the physical or functional performance (see 2.3 below), but also the many factors that impact users and occupants, and are a recognised part of the healing or working environment, e.g. acoustic control, colour, texture, and comfort.

### **2.2 Materials, Properties**

Flooring materials can be most simply classified as hard, resilient or soft. Hard and soft materials are easily distinguished and are represented by ceramic tiles at one end of the scale and textile finishes at the other. Resilient finishes by contrast include vinyl sheet, rubber and linoleum, ranging from semi rigid (vinyl composition tiles) to semi soft (acoustic backed vinyl and rubber).

Within each category a further level of properties includes imperviousness, smoothness, slip-resistance, fire hazard properties, dirt retention/control, component size and method of joining, all of which affect suitability for use.

### **2.3 Performance**

'Fit for purpose' implies that floor finishes achieve the performance required for the intended use, such as:

- safety and OHS
- infection control, hygiene and odour control
- fire safety
- interior environment quality (IEQ), including acoustic control and indoor air quality (IAQ)
- being reassuring and comfortable, including underfoot comfort
- sustainable or low environmental impact
- ease of cleaning and low maintenance
- Whole of Life Costing (WLC) and Life Cycle Assessment (LCA) efficiency
- accessibility, wheelchair and wheeled equipment use.

Many of these properties are governed by regulation, e.g. accessibility, safety, acoustic, fire safety and OHS.

Australian or other Standards define a minimum performance and quality level; this minimum may need to be improved upon when an open or non-proprietary specification is called for. NSW Government procurement policy where required, should be followed.

Above all it is essential that the designer consult with the client representative and product manufacturer to ensure that the end product can be signed off as suitable and 'fit for purpose'.

### **2.4 Safety**

#### **2.4.1 Slips, trips and falls (STF)**

Floor safety is now a principal consideration in the selection of floor finishes. The following conditions directly influence safety in relation to preventing 'slips, trips and falls' (STF):

- frictional properties of the floor surface material
- surface contamination (including water)
- environment

- cleaning regime
- footwear
- human (pedestrian) factors
- lighting levels and reflectivity of the floor surface.

Many of the conditions above are measurable and can therefore be controlled, others are not.

The risk of STF is influenced by users' cognitive senses, motor skills, carrying of objects, unnoticed sources of contamination, and unfamiliarity with the environment and distractions.

Age is a factor in trips and slips with the aged, children (and the disabled) among the most vulnerable groups. The elderly are more likely to fall and suffer consequent injury with the risk of further serious complications - any change in surface should be clearly identified to reduce the risk of tripping.

The published data for wood and concrete floors - with and without a carpeted surface, indicates a relationship between injury reduction and impact absorption. Refer: *Age and Ageing Vol 33 No 3 - British Geriatrics Society 2004*.

In acute mental health facilities and high security areas, damage, removal and misuse of finishes and accessories by patients constitutes a risk.

#### 2.4.2 Risk management

Floor safety may be compromised by a number of factors not directly attributable to the floor finish itself, these include:

- incorrect design
- inappropriate materials
- poor workmanship during installation
- poor maintenance.

All of which are controllable through appropriate risk management practices.

The recognition of the obligations for those who specify and manage floor surfaces - combined with the implementation of quality assurance procedures from design to maintenance, can greatly reduce potential hazards.

Consultation between designers, facility managers, cleaning managers and suppliers should occur at an early stage in the design process. 'Duty of care' responsibilities are shared between the specifier/designer, manufacturer, installer and client (maintenance practices).

Organisational practices including inspections, staff safety training, cleaning practices, reporting and corrective action within a given facility can significantly reduce potential injuries from falls.

Note: Safety performance standards that relate to fire hazard properties and egress are requirements of the Building Code of Australia (BCA) - compliance is mandatory.

## 2.5 Occupational Health and Safety (OHS)

The focus of Occupational Health and Safety (OHS) legislation is employee safety in the workplace. Various parts of OHS legislation apply to building processes, aspects of the design, and the use of Healthcare Facilities. Floor coverings can impact on staff work practices in a number of ways:

- fatigue on feet and legs from standing and walking (footwear can be a factor)
- manual handling risks, e.g. manoeuvrability of wheeled equipment
- risk of slips, trips and falls (STF)

- risk of injuries sustained in cleaning (rough) surfaces.

OHS is covered by regulation within NSW. The legal obligations for employers, building owners (controllers) and employees are defined, including their duties towards 'third parties'. It is required that floors are designed and constructed to be safe, and maintained to minimise the risk of slips, trips and falls (STF), with procedures to identify and rectify hazards.

The NSW *Occupational Health and Safety Act*, Clause 13, covers the subject of employees' contribution to the decision making process that may affect their health, safety and welfare at work. Appropriate staff consultation should therefore occur at all stages of the planning process.

In selecting a finishing system, care should be taken to ensure that installation materials and processes comply with OHS requirements. Although OHS provisions covering building processes have traditionally not been the designers' responsibility, the selection of a particular finishing system may now breach these provisions at any stage in the life cycle of the system from installation to eventual removal and disposal. OHS applies equally to work occurring within or adjacent to an occupied area.

In selecting finishes any relevant non-statutory guidelines or policies should be followed, including those issued by an area health authority or individual healthcare facility.

Included in the designer's responsibilities under State OHS preventative legislation is the obligation to extend the design decision-making process, ensuring that:

- The conditions of warranty protect the facility administration and occupants from risk, or alternatively, advising and obtaining acceptance from the responsible party for the risk.
- The manufacturer's warranty conditions are complied with.

A risk assessment methodology is recommended using AS 4360: *Risk management* as an appropriate tool.

## 2.6 Manual Handling

The ease with which wheeled equipment can be moved manually is affected by the resistance (rolling friction) of the floor surface, other factors such as the 'tracking' of wheels caused by surface profiles, e.g. raised tactile pattern, grooves or textile weave, are less common. A manual handling risk assessment should form the basis of the floor finish selection, e.g. within an Acute Rehabilitation Unit, the movement of bariatric patients and areas with frequent wheeled traffic. 'Wheeled equipment' includes wheelchairs (independent or assisted), beds, trolleys and hoists.

Equipment made with larger wheels provide less rolling resistance on resilient surfaces, however it is usual for the wheels of most equipment to be supplied with a 'standard' diameter and tread material. A choice of material usually exists, ranging from hard (polyurethane) for resilient surfaces, to soft (rubber) for harder surfaces, but a change of wheel diameter is generally no longer an option.

The relationship between floor finishes and rolling friction is summarised below:

- standard sheet vinyl, rubber or linoleum provide the least rolling friction
- foam backed products provide more rolling friction and may deform under frequent heavy loads
- dense, short tufted loop pile, direct stick carpet (less rolling friction) may be unsuitable in some situations, e.g. frequent heavy wheeled equipment.

For detailed information covering individual flooring materials see *Sections 3 - 14*.

## 2.7 Slip Resistance

### 2.7.1 General

Slip resistance is represented by the tested slip resistance of the material, usually provided by the initial

properties of the floor surface material. The slip resistant 'non-slip' potential of any installed floor surface in use may be considerably less than the initial tested value; this can be due to a variety of factors including wear, contamination or lack of appropriate cleaning.

Surface slip resistance is a function of one or a number of the following factors:

- surface (macro) roughness comprising an aggregate
- surface (micro) roughness relying on irregularities in the surface of the material
- a profiled surface providing volumetric displacement, or structured surface
- the properties of the materials in contact, e.g. footwear - attraction/repulsion or visco-elastic.

Each of these properties operates differently and products intended for specific uses, e.g. showers, commercial kitchens, ramps, use a combination of these properties.

Note: The 'R' value most commonly given in product information relates to the 'Oil-wet' ramp test, and is unrepresentative for other conditions - see Appendix D.

### 2.7.2 Application

AS/NZS 4586 *Slip resistance classification of new pedestrian surface materials*, and SA HB 197 *An introductory guide to the slip resistance of pedestrian surface materials*, deal with the slip resistance of new floor surfaces and provide a ratings guide for different areas. In addition to those requirements and recommendations, the following factors should be considered:

- The dry tested rating of surface (micro) roughness can be significantly affected by water on the surface, or by contamination filling of surface pores, e.g. incorrect cleaning or sealing.
- In areas where water (not running) could be present on the surface of the flooring during normal operational functions, and where standard footwear is being used - a friction filled non-profiled material with macro-roughness is recommended.
- The slip resistance rating for materials used on slopes and ramps may vary from those used on horizontal surfaces, and slip resistance rating should match the degree of incline and specific conditions of use, e.g. exposure to weather.
- To prevent tripping, any changes in floor surface and slip resistance should be indicated by a visual cue such as a change of colour.
- The required slip resistance must not be compromised by a reduction for any real or perceived ease of cleaning.

At present there are no Australian Standards covering safe footwear, and with the exception of food preparation areas, the control of the type of footwear worn by staff is uncommon in the Australian healthcare environment. Flooring should be selected on the basis of high risk, e.g. worn soles, poor adhesion dry/wet.

See *Appendix 4 - Slip Resistance* for additional information on the Australian Standards covering the slip resistance of floor surfaces.

Note: The BCA (referencing AS 1428.1) has a requirement for slip resistance in relation to continuous paths of travel, including ramps and stair treads.

## 2.8 Building Regulations

The BCA (Building Code of Australia) regulates certain aspects of buildings, and is mandated in NSW with state variations. The provisions affecting finishes can be found under the 'general provisions', 'health and amenity', and under 'fire resistance'. The BCA contains performance requirements or 'deemed to satisfy' provisions, and the Australian Standards referenced by the BCA provide the basis for minimum performance. The BCA requirements are limited in scope and should be regarded as a minimum requirement.

Note: The BCA currently does not call up or reference either AS/NZS 4586 or SA HB 197 in the context of floor safety.

## **2.9 Fire Safety**

The fire performance of floor and wall lining materials are mandated by the BCA. The fire performance of these products in Class 9a are 'health care building' and Class 9c 'aged care buildings', must comply with the minimum requirements set out in BCA Specification C1.10a, Table 1 for 'flooring materials' and Table 2 for 'wall linings', for buildings with and without a sprinkler system. The current fire tests nominated in the BCA Specification C1.10a are the AS/ISO 9239-1 'Critical Radiant Flux test for flooring materials' and AS/NZS 3837 'Cone Calorimeter Test for wall linings'. The smoke development rate requirement in both floor (and wall) applications is only applicable in areas without a complying sprinkler system. Refer: *Appendix C – Fire Hazard Properties*.

Note: Floors and floor-coverings in lift cars are also covered although there is no smoke requirement for lift cars.

## **2.10 Standards**

Most floor finishes and coverings are a manufactured product conforming to either Australian or overseas standards. These standards define properties, installation methods, testing and special conditions relating to use.

Many products manufactured outside Australia and New Zealand carry test certificates to European or US norms. These qualifications may not be accepted in Australia, and certification in the form of NATA testing, CSIRO appraisals or testing by a similar recognised body may be required.

There is an increasing adoption of ISO, BS and EN standards by Australia, and acceptance of 'external' international accredited testing between standards organisations.

### **2.11 Australasian Health Facility Guidelines (HFG)**

The following parts of the HFG have a direct or indirect relevance when selecting floor finishes:

- Part A - Introduction and Instructions for Use
- Part B - Health Facility Briefing and Planning
- Part C - Design for Access, Mobility, OHS and Security
- Part D - Infection Prevention and Control
- Standard components - Room data sheets (RDS)
- Standard Facility Cost Planning Guidelines.

### **2.12 Sustainability**

Sustainability requires consideration of the complete life cycle of a product including extraction, manufacture, installation, use, maintenance and eventual removal and disposal. The environmental performance of a flooring material or system should conform to the relevant Commonwealth, State and NSW Health requirements.

The selection of flooring materials should follow NSW Government Procurement Policy relating to Ecological Sustainable Development (ESD) in Procurement. One objective in the NSW Health *Process of Facility Planning (POFP)* document is the efficient use of resources. The selection of finishes should be included in the *Environment Performance Report (EPR)* system. This system applies to all new NSW government buildings with a construction value of greater than \$5M.

The *Environment Performance Report (EPR)* system is used for the performance reporting of new NSW government buildings. This process is managed by the Government Asset Management Committee (GAMC). It

asks questions regarding building data and performance in a number of environmental performance areas such as energy, water, materials, indoor environment, biodiversity and transport. Materials are assessed within the terms of 'Life cycle analysis' (LCA) and 'Whole of life costing' (WLC).

Refer: *The Environmental Performance Guide for Building (EPGB)*  
<http://www.asset.gov.com.au/EnvironmentGuide/>

Environmental information can be obtained from the manufacturer's data sheets, labelling and marking. These will usually conform to ISO standards or may cite local/regional industry reporting standards. Generalised marketing terms such as 'sustainable', 'halogen free', 'green' should be verified for relevance and substance against reliable scientific fact.

ISO 14000 is frequently cited and refers to a series of voluntary standards in the environmental field under development by ISO. Included in the ISO 14000 series are the ISO 14001 EMS Standard and other standards in fields such as environmental auditing, environmental performance evaluation, environmental labelling, and life-cycle assessment.

The Building Research Establishment (BRE), UK publishes *Environmental Profiles*. These use a Life Cycle Analysis (LCA) standardised method of identifying and assessing the environmental impacts of building materials over their life cycle, and provide comparable environmental information about individual building materials many of which are imported into Australia.

The Green Building Council of Australia (GBCAUS) publishes the 'Green Star - Health as built' a tool for analysis and rating of healthcare facilities. Rating is achieved through 'credit points' based on carbon credits. Categories include: 'MAT (Materials) - Walls and Floors - Indoor Air Pollutants Criteria and Compliance Document - VOCs (volatile organic compounds), mould prevention and internal noise levels. Materials and IEQ (indoor environment quality) account for approximately 40% of the available credits. Some parts of this rating tool are the subject of public discussion and as the tool 'in whole' is not universally accepted, the status of endorsement by NSW State Agencies and NSW Health should be verified before using any part of the tool.

### **2.13 Acoustics**

Noise can be generated by foot traffic, fixed and mobile equipment, communication devices, staff activities, speech and a wide variety of other internal and external sources. Many studies have shown that hospital background noise levels fall in far higher ranges than those recommended for Hospitals by the World Health Organisation.

Hospitals are usually excessively noisy for two general reasons. Firstly, noise sources are numerous, often unnecessarily so, and many are loud for example paging systems, alarms, bedrails being moved up/down, telephones, staff voices, ice machines, pneumatic tubes, trolleys and roommates. Secondly, building finishes and surfaces such as floors, walls, ceilings usually are hard and sound-reflecting, not sound absorbing, thus creating poor acoustic conditions.

In patient accommodation areas, it is generally accepted that noise can adversely affect the healing process, while in residential aged care noise can adversely impact on a home-like environment. In many treatment and consultation areas privacy is an important requirement. In staff areas sound control will contribute to a good working environment. Some activities/areas may be subject to OHS requirements relating to noise.

A considerable body of research has documented negative effects of noise on patient outcomes. A range of environmental interventions is recommended as being effective for reducing noise in hospital settings including the use of sound-absorbent flooring. Where carpet is not appropriate, soft linoleum may be another effective option particularly when used in combination with sound-absorbing ceiling tiles

Floor surfaces, by reducing airborne and impact generated sound, play an important part in controlling noise. The selection of any floor finish on the basis of acoustic performance should be based on test data from an accredited source.

Note: The acoustic requirements in the BCA (part FO5) only apply to Class 2, 3 or 9c (aged care) building.

All finishes (floor, walls and ceiling) within an area should be selected on the advice of an Acoustic Consultant, or comply at least with AS/NZS 2107: *Recommended Design Sound Levels and Reverberation Times for Building Interiors*.

Refer: AusHFG, *Part C, Section 790, Safety – Noise reduction*, for OHS issues.

#### 2.14 Indoor Air Quality (IAQ)

Indoor air quality will be affected by the following factors:

- chemical contaminants from inside and outside the building - these include volatile organic compounds (VOCs)
- biological contaminants, e.g. bacteria, moulds, pollen.
- inadequate ventilation due to ineffective heating, ventilating and air-conditioning systems.

VOC emissions consist of a range of volatile organic compounds which at room temperature may be released from materials or products in the form of gases. Some of the common sources of VOCs are from furnishings, flooring coverings/finishes, underlays, skirtings, adhesives, sealants, cleaning agents and surface treatments. The health effects depend on the specific composition of the VOCs present and the length of human exposure. Floor products should be low-VOC emitting, non-toxic, and chemically inert, (i.e., contain concentrations of VOCs to prescribed limits).

Note:

- *Green Star - Health as built* tool uses the *US Carpet and Rug Institute Green Label for carpet* awarding and EN ISO 16000-9:2006: *Indoor Air* for other floor finishes, or "where it is demonstrated that the flooring used in the project has a reduced environmental impact as determined by the Flooring Calculator".
- Products manufactured in the USA and imported into Australia may carry certification from the GREENGUARD Environmental Institute (GEI).
- A new European draft indoor air quality standard Pr En 15052 based on the German AgBB/DIBT test chamber method is in preparation.

For other prescribing organisations including Sustainable Buildings Canada (SBC), refer to *Appendix B*.

#### 2.15 Infection Control

Infection control objectives and practices are a key element in the operation and design of healthcare facilities. Floor finishes and environmental cleaning protocols are a part of the overall facility infection control risk management strategy, and associated legislative and accreditation obligations.

NSW Health *Infection Control Policy - PD2007\_036* deals primarily with infection control management practices; it lists areas within a healthcare facility in four groups ranging from 'very high' to 'low/minimal' according to the risks associated with inadequate cleaning in that area (see *Appendix E*). Although materials and construction are not covered specifically, these four groups should be used to guide the selection of appropriate floor finishes, i.e. to facilitate the level of cleaning required. For low/minimal risk areas it advises that "In the event of an outbreak of a transmissible disease or infection...the affected ward should be re-categorised to 'very high risk' for the period of the outbreak". Cleaning standards for 'very high risk' are defined as 'the highest level of intensity and frequency of cleaning'. This is particularly relevant when designing wards and flooring for multi-purpose use and for outbreaks.

Note: PD2007\_036 states that Section 5 Environmental Cleaning is based on DHS Victoria 2000, Cleaning standards for Victorian public hospitals, it also advises that it be read in conjunction with NSW Health, 1996, Policy Manual, Cleaning Service Standards, Guidelines and Policy for NSW Health Facilities, however both documents are restricted to cleaning protocols.

Although *PD2007\_036* is used for infection control policy in NSW, recommendations relating to floor finishes can be found in Standards Australia *HB 260: Hospital acquired infections - Engineering down the risk*, these are limited to rooms used for infection control purposes. Section 3 has a general recommendation under *Surface materials* advising:

- smooth, impervious, seamless surfaces where there is a likelihood of patient contact, or blood or body fluid spills
- these surfaces should also be used in treatment rooms
- materials should be resistant to corrosion – from disinfectants.

Section 5 has recommendations for floors and skirtings however these are for rooms 'for the containment of infection', and are 'preferred' features, i.e. 'Welded vinyl floors covered up the walls and wall finishes that are easy to clean'.

Note: 'Vinyl' should be expanded to include other appropriate resilient sheet finishes.

Collaboration with the Facility Infection Control representative and compliance with current NSW Health policy is a required part of the risk management process.

Refer: Australasian HFG, *Part D, Infection Control*, for general coverage under *Surfaces and Finishes*, and for a comparison between NSW/Vic categories for 'isolation rooms' and those in *SAA HB 260*.

## **2.16 Colour and Pattern**

The use of colour, pattern and texture for practical purposes is particularly relevant in flooring, and is used for the following outcomes:

- maintain appearance and improve service life by reducing the unwanted effects of staining and marking
- provide an interior environment that assists the intended outcomes, e.g. healing, 'home like', stress reduction.
- create designs that identify, unify or separate spaces, and add aesthetic and functional value
- serve as a wayfinding device for general use or for specific user profiles, e.g. patients with dementia.

Although the successful use of colour, pattern and lighting often requires expert advice, there are some principles that have a general application:

- light colours reflect more light but will deteriorate in appearance more rapidly requiring replacement
- dark colours can absorb downward lighting and can alter the colour spectrum
- pure or bright colours will show staining more than dull colours.

A colour and pattern selection appropriate for a patient bedroom area or a corridor would be unsuitable for an operating room where sharp visual contrast is required for the rapid identification and recovery of small dropped items, such as micro surgical needles.

Inappropriate patterning and floor patterns can create a risk for some users by causing disorientation, dizziness or impeding movement and can adversely affect intended outcomes or the tolerance of occupants, to the point of requiring early replacement. The successful use of colour and pattern is a design skill requiring the services of professionals with healthcare experience in collaboration with appropriate healthcare staff. An unsuccessful design or selection can result in costly and disruptive replacement.



## 2.17 Skirtings

As discussed in 2.15 *Infection Control* there is a direct relationship between the design of skirtings, ease of cleaning and infection control. The functional areas categorised in NSW Health PD2007\_036 from very high risk to low/minimal risk provide a basis for the selection of appropriate floor finishes and skirtings.

Skirtings can be site formed, custom made or manufactured and available in a variety of profiles and sizes. Materials include vinyl, rigid plastic, metal including ducted skirtings, timber or composites, and terrazzo. In healthcare and other functional areas, skirtings should match the floor finish in supporting and facilitating the intended function, performance and maintenance regime for that area.

Skirtings in clinical areas should be a minimum of 150mm high to reduce damage and marking from cleaning and wheeled equipment. In areas where damage to the wall finish from mobile equipment may compromise infection control, the use of a higher skirting or wall protection strips is recommended, e.g. operating suites. In non-clinical areas (offices, etc) a minimum of 100mm is visually less institutional and should be suitable for most cleaning equipment.

Integral or self-coved skirtings are recommended for all areas where hygiene and ease of cleaning are required. These skirtings are formed by turning the floor sheet up the wall over a 20mm radius cove fillet at the base of the wall, providing a smooth and continuous transition between the horizontal and vertical surfaces.

Sheet vinyl and rubber skirtings can be continuously welded to the matching floor material, while linoleum and ceramics require special preformed skirtings. Vinyl wall finishes can be adhesive fixed over a vinyl up-stand using an overlap, or preferably a more durable welded joint can be used - providing the wall material has adequate thickness and welding is a recommended option.

For textile floor coverings a 'flat skirting' is usual and fixed before the floor covering, this prevents damage to the wall during installation if using gripper strip and stretching. 'Feather edged skirtings' are generally used for resilient finishes where a coved skirting is not required, and for fit-out partitioning over existing floor coverings. Removable skirtings (ducted metal, aluminium, etc.) provide an advantage over glued on PVC skirtings for removal and replacement without excessive damage i.e. to plasterboard surfaces.

Healthcare facilities support a variety of processes, activities and uses, many of which are regulated. These regulations may include the design and selection of floors and skirtings, e.g. in term of hygiene, safety. Areas other than 'patient care' areas include:

- food premises including storage, production, servery and waste management areas
- handling and storage of hazardous chemicals including the containment of spills and cleanup
- pharmaceutical manufacturing, storage and dispensing
- mortuary
- engineering services, back of house, etc.

Skirtings for dock and back of house areas, general stores and plant rooms should meet any other special functional requirements such as wheeled traffic, industrial conditions, bunding for liquid spills and high pressure water or steam cleaning.

## 2.18 Maintenance

Floor maintenance (environmental cleaning) practices are part of facility management and constitute a highly technical and specialized service; these are covered in general by *NSW Health PD2007\_036* which adopts *DHS Victoria, 2000, Cleaning Standards for Victorian public hospitals*. Maintenance is also covered by various Australian Standards, e.g. *AS/NZS 3733*, and by the flooring manufacturers' recommendations.

The specific maintenance regime required for each flooring material can be an important factor in the selection of floor finishes, with the following issues to be considered:

- maintenance - frequency, techniques and equipment to be used
- cost - maintenance as a part of 'Whole of Life costing (WLC)', see following clause
- risk - hard and resilient finishes with a smooth surface require constant monitoring for safety with the immediate removal of contamination by standard cleaning procedures, textile finishes neutralise contaminants and delay removal
- disruption and disturbance caused to occupants and activities
- infection control - inappropriate cleaning techniques or devices may constitute an infection control risk, i.e., vacuuming.
- Patient population to be accommodated or purpose of area may also direct the maintenance requirements and regime.

The maintenance regime for a specific material while acceptable in an area with normal working hours may be unacceptable for an area in use 24/7.

While textile finishes can provide a non-institutional indoor environment for inpatient and patient care areas, they may be unsuitable in areas where there is a high soiling rate or a requirement for infection control. In some cases modular carpet will overcome the maintenance limitations of a broadloom installation. See Section 3 *Textile Floor Finishes*.

Most soiling occurs from foot traffic, and unless removed will lead to accelerated wear. Some products such as textile finishes and heterogeneous resilient materials with a thin wear layer will deteriorate faster. The maintenance of external surfaces and the provision of high performance entry mats (see *Mats and Matting*) will help to maintain appearance reduce risk and eliminate premature replacement.

In areas where a mixture of room types exists, consideration should be given to selecting finishes to facilitate a more efficient maintenance program. This may require that an equivalent alternative finish is substituted to avoid a patchwork of floor finishes and maintenance regimes.

Damage (and soiling) can be caused to floor surfaces from equipment movement, i.e. heavy (high friction) equipment (mobile x-ray unit) and certain wheels types. This should be taken into account when choosing floor coverings as maintenance/rectification in these instances can be difficult,

A floor covering should not be rejected out of hand because it means introducing an apparently new maintenance procedure into the organisation. In most healthcare buildings at least two major forms of cleaning and maintenance for floor coverings already exist and the 'new' procedure is sometimes only a variation of one of these. The compatibility of different cleaning methods needs to be considered especially if an area will require more than one method to be used.

### **2.19 Whole of Life Costing (WLC)**

'Whole of life costing' (WLC) includes materials and installation, level of usage, cleaning and maintenance, disposal and replacement, and warranty conditions. Accurate comparisons between different finishes and finishing systems should be sought at the time of selection. In refurbishment the removal of the original finish and rectification of the substrate to the standard required for the new finish will form part of the overall cost.

In many instances accurate WLC costs may be unavailable for established products or for a new product or re-formulation. An analysis based on a minimum 10 to 20 year life span is desirable for an accurate comparison between short and long term products, e.g. between carpet and sheet vinyl.

In comparison to WLC data, 'Life-Cycle Assessment' (LCA) data will often only cover the product cost and maintenance, and is used for establishing Environmental Profiles. WLC and LCA data should come from a reliable source such as a government or an accredited independent authority.

Indirect costs associated with incorrect or poor selection can significantly add to the cost of a particular finish. These may entail compensation, the result of civil actions, and costs associated with organisational disruption due to the replacement, repair or treatment to a faulty finish.

Some materials may require early replacement due to deterioration in appearance (ugly out) before the end of their functional life. For these materials particularly textile finishes, entry matting and good floor maintenance are essential in extending their acceptable life.

Note: 'Whole Life Value' (WLV) is a concept predicting sustainable outcomes.

## **2.20 Construction Issues**

In some cases selection will be influenced by factors such as the suitability of the existing floor as a sub-base, or by the lack of availability of particular materials or trades in remote locations.

Some floor materials will require floor set-downs and falls, and these should be resolved early in the project. The decision to use ceramic tile flooring will require designed slab set downs to accommodate the combined thicknesses of screeds to falls, tiles and bedding, whereas the use of an alternative material such as a seamless finish may only require a surface profile in the slab, leaving top reinforcement unaffected.

If textile finishes are proposed for patient care and other areas with regular spills, the concrete slab should be sealed to assist cleaning and prevent absorption and odour from liquid spills and wet cleaning processes.

Since many flooring products are manufactured overseas and imported, selection will be made from a sample. The period of time from selection to final delivery can include both manufacture and shipping. If the landed product fails to meet the standard of the sample and is rejected, this will impact the construction program. Effective specifying, quality compliance and monitoring are essential for managing risk in project delivery.

## **2.21 Warranty and Certification**

Warranties are an important consideration when proprietary products, they provide assurance that the product or system selected will perform functionally and that the financial investment is safeguarded. To fulfil the conditions of warranty the manufacturer's written instructions should be followed, these may cover the condition of the sub-base, the use of approved applicators, installation, the conditions of use, and maintenance.

Comply with any conditions applying under State purchasing contracts such as *NSW Contract 295 - Floor Coverings and Window Furnishings*.

### **3 TEXTILE FLOOR COVERINGS**

#### **3.1 General**

Textile floor coverings (carpet) form the largest and most diverse group of floor products available. The introduction of carpet into the Australian healthcare environment in the 1960s was made possible by the introduction of economic tufted broadloom carpet and synthetic fibres. Similarly the recent change in the BCA fire test requirements now permits the use of previously excluded products. Some of these products are designed specifically for healthcare use, and when assisted by improved maintenance techniques overcome many of the previous objections to using carpet.

#### **3.2 Application**

The success or failure of textile floor coverings in the healthcare environment depends largely on selecting a product with properties that match the individual performance and maintenance requirements for each area type, e.g. administration, technical, public, and patient care areas.

The principal advantage cited for using carpet in healthcare is the creation of a non-institutional, hotel or home-like environment, with good sound reduction and underfoot comfort. While patient care and public areas present the most challenge and are subject to most debate, commercial and retail standards can be applied to other carpeted areas such as administration.

A major concern of using carpet in public areas is the anticipated level of mistreatment by visitors, causing rapid loss of appearance and short life, and requiring high maintenance. In patient care areas this is less of a problem, but there are additional clinical and functional requirements. The use of modular carpet overcomes many of the limitations previously experienced with broadloom installations, e.g. cleaning, associated hygiene issues and replacement.

Patient care wards and bedrooms present a range of often opposing requirements. One goal is to achieve a quiet, home like environment that will reduce stress for patients, staff and assist the healing process. This has to be equated with a range of clinical and practical issues including infection control, with other variables such as single, or multi-bed rooms, length of stay, flexible or multi-use rooms and effects of using vacuum cleaning equipment (central or mobile). Central vacuum systems (e.g. noise) provide fewer disturbances to patients and reduced aerosol risk; however the installation cost and absence from many existing facilities will be a factor when considering the use of carpet.

Patient bedrooms are assumed to be continually occupied and require an appropriate hygienic cleaning program. Floors are subject to severe staining, bacteria from spills, aggressive cleaning and a high volume of wheeled traffic. Although contaminated floors do not represent a high infection risk, microbial survival and count is higher in carpet (untreated with an antimicrobial) compared to smooth impervious surfaces (vinyl etc.). Cleaning processes may also aerosolize fungal spores –for these reasons carpet should be avoided in acute care (high-risk) areas, clinical and in most patient care areas.

If carpet is considered at all for patient areas then it should be borne in mind that the ability to clean promptly, appropriately and effectively is essential to avoid adding to the overall microbial load within an environment (which in turn can increase the risk of cross-contamination between environments). The frequency of spillage and unforeseen contamination can impede any maintenance schedule for a carpet installation.

In view of the many concerns outlined above, the issue of using carpet in patient care areas should be resolved on a case by case basis by all responsible parties with risk management a central consideration.

#### **3.3 Performance**

In addition to the general issues covered above and in *Section 2*, the following factors are particularly relevant to the use of textile floor coverings in patient care areas:

- fibre types and materials used for pile and backings
- wear resistance

- soil and stain resistance and release
- ease of cleaning, bleach resistance, and ability to withstand steam
- anti-microbial and anti-static properties
- colour and light fastness
- low rolling friction
- low potential to cause tripping
- moisture barrier requirements
- resistance to rot and shrinkage, de-lamination and edge-unravel (fraying).

### 3.4 Carpet Types

Tufted carpet is now the predominant carpet type for commercial use in Australia. It is made in broadloom or modular tile in 100% nylon, wool/nylon blends or 100% wool, with various backing materials and treatments. There are a range of underlay's, adhesives and sealers for different applications. A level loop or cut pile tufted carpet laid by direct stick is recommended for most healthcare applications.

The other carpet types such as Bonded (flocked and needle punched) in the lower price range, with Woven (Axminster and Wilton) in the higher price range. Both of these groups are rarely used in healthcare on the basis of cost or functional performance. They may be appropriate in areas other than patient or public use where a higher or lower quality is acceptable - woven for boardrooms, bonded for utility/back of house, or for special applications such as matting and outdoor carpet.

Until the recent change in the BCA fire test criteria, wool and wool/nylon blend carpet were used extensively in Australian healthcare with 100% nylon excluded. If carpet is selected in preference to resilient finishes for patient care areas then carpet using 100% nylon pile (BCA compliant) is recommended.

See *Appendix D - Textile floor coverings* and *AS 2454: Textile floor coverings-Terminology* for a full description of carpet types.

### 3.5 Modular Carpet (Tiles)

Both modular and broadloom tufted carpets have similar physical and performance characteristics. A thicker reinforced vinyl or dense polyurethane backing in modular carpet provides additional rigidity stability and less rolling resistance.

The primary differences of modular carpet in comparison to broadloom for healthcare use are:

- the ability to remove tiles for cleaning, to avoid in-situ cleaning and drying
- replacement of individual tiles when worn or damaged
- rotation of tiles to improve the life span of the installation
- impervious backing.

This flexibility provides improved infection control with the immediate removal of odour, while causing minimum disruption to the use of the area. Carpet however is still unsuitable for patient care areas or patient traffic areas where there is the potential for contamination and inability to clean appropriately.

Modular carpet should be laid by direct stick using a pressure sensitive adhesive or high friction coating to facilitate tile replacement. In patient care and high traffic areas full-stick (full surface coverage) is recommended, for other areas grid-stick (partial coverage) is adequate.

The ability to place removable tiles of the same thickness but with a dirt removal function within the overall layout is an advantage in some locations.

Modular carpet returns a better environmental profile than broadloom due to improved life span, reduced wastage and the ease of recycling. However products used in healthcare may be excluded from recycling.

Note: An adequate quantity of spare tiles should be stored conveniently on site with 24/7 access.

### 3.6 Carpet Classification

Classification of Carpet in Australia is covered by the Australian Carpet Classification Scheme (ACCS), see Appendix D. Pure wool and wool blend carpets can also be classified under the Woolmark / Woolblendmark Scheme, and may additionally carry an ACCS classification.

*AS 2914: Textile floor coverings - informative labelling* now in revision provides a set of minimum disclosure requirements to be provided at the point of sale.

### 3.7 Environmental Classification Scheme (ECS)

The Environmental Classification Scheme (ECS) for carpet is an extension of the Australian Carpet Classification Scheme (ACCS). The ECS introduces three new technical criteria covering Volatile Organic Compound (VOC) emissions, noise reduction and thermal insulation properties that relate to environmental performance. The ECS criteria are more stringent than Standards set for environmental certification in the Australasian marketplace, and those of the US Carpet and Rug Institute's synthetic carpet based 'Green Label Plus' Scheme. An important feature of the ECS is that carpet manufacturers must comply with an Environmental Code of Practice.

Refer: Carpet Institute of Australia Limited, *Environmental Classification Scheme (ECS)*.

Note: The Carpet Industry of Australia Limited (CIAL) issue the *Code of Practice for Environmental Management* as part of ACCS provisions.

All warranties should recognise relevant environmental legislation and policy.

### 3.8 Indoor Environment

#### 3.8.1 Acoustic Comfort

As described previously carpet performs significantly better than smooth resilient or hard finishes in noise reduction.

Refer: *CIAL, Fact Sheet, Acoustic Comfort*, Carpet Institute of Australia Limited.

#### 3.8.2 Indoor Air Quality (IAQ)

At the end of the manufacturing process carpet is a product with a low residual VOC content. Installed carpet is a minor contributor to VOC emissions with approximately 90% of all VOCs discharged from carpet dissipating within 2 days of installation. With good ventilation, VOC emissions from new carpet will drop below most minimum requirements for indoor air quality within a few days. Sealers and adhesives should have a VOC emissions rating complying with NSW Health policy.

Carpet made in Australia and New Zealand generally meets Australian requirements for indoor air quality including the National Occupational Health and Safety Commission occupational limits and the National Health & Medical Research Council Interim National Indoor Air Quality Goals.

Refer: *Appendix E Textile Floor Coverings*.

Carpet has the ability to trap small particles in pile (particles may be airborne or from direct soiling). This property can reduce airborne dust to half of that found with smooth surfaced floor finishes, but larger numbers of organisms survive in standard carpet (if untreated with an anti-microbial), and the need to vacuum clean carpet can aerosolize and disperse fungal spores.

### 3.8.3 Hygiene and Infection Control

For general use in low risk patient care areas, carpet with a good maintenance regime will meet general hygiene standards and match resilient flooring. Carpet is less easily cleaned than resilient finishes and should not be used in acute (high risk) areas, or where there is a high rate of spills or soiling.

Note: Effective cleaning is required to prevent and remove bacterial growth; materials treated with anti bacterial agents should be considered as a supplementary measure only.

## 3.9 SAFETY

### 3.9.1 Slip, trips and falls (STF)

The published data for carpeted and uncarpeted wood and concrete floors indicates a correlation between injury reduction and impact absorption. Thick pile or high resilience however is not recommended as this may cause the elderly and persons with disabilities or under medication to trip.

Refer: *Age and Ageing Vol.33, No.3* - British Geriatrics Society 2004.

### 3.9.2 Occupational Health and Safety (OHS)

Thin, dense and level pile, direct stick carpet is recommended as this will provide less rolling resistance for the movement of equipment, less effort in walking (staff), and less potential for tripping. Fibres from carpet can collect however in wheel mechanisms and increase maintenance and manual handling risks.

### 3.9.3 Fire Safety

Carpet for healthcare use should comply with the requirements of the BCA for class 9a buildings. See Specification C.1.10a.

Refer: *Appendix C - Fire Hazard Properties*, and CIAL, 2006, *Frequently Asked Questions on Testing to AS ISO 9239-1 for the Building Code of Australia*, The Carpet Institute of Australia Limited.

## 3.10 Maintenance

Textile floor finishes should not be considered unless there is a comprehensive maintenance and replacement program in place complying with AS/NZS 3733 *Textile floor coverings - Cleaning maintenance of Residential and Commercial Carpeting* as a minimum standard.

The cleaning and maintenance program should comply with the carpet manufacturers' conditions and recommendations. Departure from these may nullify the warranty and detrimentally affect the floor covering system. NSW Health cleaning policies and recommendations also apply.

Refer: Australian Wool Testing Authority (AWTA), <[www.awta.com.au](http://www.awta.com.au)>, and National Upholstery and Carpet Cleaning Association (NUCCA), <[www.nucca.asn.au](http://www.nucca.asn.au)>

## 3.11 Warranties

Warranties are covered briefly in *Section 2 - Warranty and Certification*.

Carpet organisations and manufacturers provide warranties, which should be checked and amended if necessary before acceptance.

It is usual for tufted modular nylon carpet to be covered by a 15 year wear and dimensional stability warranty, and a lifetime antistatic warranty. In addition these products are warranted against fading, fraying, backing separation, shrinking and warping.

Under the ACCS warranty system the licensee warrants that the carpet will perform in accordance with the grading awarded, subject to the proper installation and correct care of the carpet (in accordance with the manufacturer's recommendations). The warranty is publicised generally by the Scheme's administration. The

warranty is provided by the Licensee, and applies for a minimum of two (2) years.

## 4 VINYL SHEET

### 4.1 General

Since its introduction polyvinylchloride (PVC) or 'Vinyl' sheet has been one of the principal flooring materials used in healthcare facilities. It is a durable, resilient and impervious sheet material providing an economic 'polish free' low maintenance and hygienic solution, previously only achieved by using hard surfaces such as terrazzo and tiling.

### 4.2 Properties

PVC is a polymeric thermoplastic material with vinyl chloride polymers/copolymers acting as a binder with plasticizers, stabilizers, fillers and pigments to form a stable compound. Vinyl sheet is generally available in 2 mm thick, 2000 mm wide rolls. Other specialised products with thicknesses up to 4 mm are available.

The two main generic types of vinyl sheet flooring are:

- 'Homogeneous' - A single ply sheet with the wear layer extending throughout the full sheet thickness, (e.g. 2mm).
- 'Heterogeneous' - A multiple ply sheet consisting of separate layers of different materials bonded/laminated together. The sheet usually consists of a *wear* layer, (e.g. 0.7mm) bonded to a *backing* layer. There can be considerable variation in the composition and thickness of layers between products.

Note: Ensure the selected product type is 'fit for purpose'. Heterogeneous sheet may wear unevenly in high traffic areas and have a shorter life in areas such as main entry and high circulation corridors.

### 4.3 Performance

The widespread and accepted use of vinyl sheet flooring in the healthcare environment is due to the following properties:

- long usable life with maintained appearance
- resistance to damage, with ease of repair
- impervious to water, oil and grease
- ease of cleaning and maintenance
- assists infection control
- slip resistance
- cost efficiency.

The uses of vinyl sheet are extended further by the availability of specialist products designed for specific applications:

- electrostatic control
- acoustic control
- underfoot comfort
- enhanced slip resistance.

A more balanced view of the environmental performance of vinyl is now possible - supported by information, and structured comparisons with other materials, achieved through independent testing. See [4.7 Sustainability](#)



and the relevant clauses in Section 2.

The arguments that resilient sheet flooring produces an institutional atmosphere, and that carpet is preferable in non-acute patient care areas are valid only if the intended use and demonstrable performance including WLC are first satisfied. See *Section 3 Textile Floor Finishes, Application*.

#### 4.4 Product types

Vinyl sheet flooring is manufactured in a variety of product types for different applications:

- General purpose: Products have a smooth or slightly textured surface and are intended for general areas and ease of cleaning. Either homogeneous or heterogeneous.
- Acoustic backed: Usually a heterogeneous sheet consisting of a PVC wear layer bonded to a glass fibre reinforced closed cell foam backing. Alternatively a 'general purpose' sheet can be laid over a cork or closed cell acoustic underlay.
- Anti-static (conductive): A homogeneous sheet with carbon particles throughout the thickness of the material providing static dissipative properties. A range of products are available with varying grades of surface resistance, specific earthing and laying techniques are required for higher conductivity installations, see *AS 2834*.
- Slip-resistant: Products with varying macro-rough and/or profiled surfaces providing a range of slip-resistance ratings for specific uses. Particles of quartz, silicon carbide and aluminium oxide embedded in the sheet provide surface macro-roughness. Some slip resistant flooring will provide a performance layer of non-slip additives on the surface of the wear layer only; others will have the additives mixed throughout the wear layer ensuring that the slip resistance classification is retained for the warranted life of the product.
- Low-maintenance: A range of surface enhanced products are available, these include polyurethane (PU) treatments, polyurethane reinforced (PUR) 'polish free' surfaces and modified polymer products to reduce wear and marking, these surfaces can be restored during the life of the product.
- Anti-bacterial: An antimicrobial agent to inhibit bacterial growth is added to some products.
- Sports: Special resilient flooring is produced for indoor sports and gym applications.

The previous Australian Standards covering resilient flooring are now superseded pending a new series of Standards. Since most vinyl sheet flooring is imported the product information may cite overseas Standards, e.g. *BS EN 649, 650 and 651* covering different vinyl floor coverings. *BS EN 685* provides the following 'Use Area Classification' system for resilient floor coverings:

- Class 23 - Domestic
- Class 34 - Commercial
- Class 43 - Industrial.

#### 4.5 Application

Where slip resistance is required in patient care areas then the floor finish should be appropriate for the particular 'patient group'. Raised profiles, and excessive or severe changes in slip resistance may contribute to trips and falls for elderly patients. A resilient surface in general use areas will decrease the risk of injury from a fall.

Foam-backed products with a light gauge wear layer may be unsuitable for areas subject to heavy wheeled traffic or with heavy stationary objects, the resilience can provide resistance to movement and the sheet may indent, deform or de-laminate. Acoustic products with a heavier gauge wear layer (or a less resilient backing) will provide improved life and easier manual handling.

Surfaces with a raised profile or heavy texturing should not be used in areas where wheeled traffic is expected,

these profiles may adversely affect the movement of patients through vibration, and may 'track' the wheels on mobile equipment. Where a raised tactile profile is required under the BCA for accessibility, a dispensation should be sought.

Raised surface profiles are however required for floor safety in some areas such as, central kitchens, and wet areas (barefoot or footwear). With profiled surfaces, contamination will build up more readily and a special cleaning program is required to maintain both hygiene and slip resistance.

If products containing an anti-microbial or 'bacteriostat' agent are used, it is recommended that the material has test certification obtained by independent assessment, confirming that the material inhibits the growth of specific organisms such as MRSA.

Integral coved skirtings are recommended for all areas where hygiene and ease of cleaning are a required.

Wet area applications are covered in NSW Health, *Report - Wall and floor finishes for wet areas*, 2007.

#### **4.6 Installation**

Sub-bases should have a smooth flat surface free from imperfections that will show through the floor covering as raised surfaces will wear rapidly, damage the installation and constitute a safety hazard. Sub-bases should be free from moisture and hydrostatic pressure. Requirements are clearly defined in *AS 1884* and in most manufacturers' instructions.

Joints in vinyl sheet are formed by:

- heat welding, using a vinyl welding rod - recommended for most situations
- chemical (cold) welding - for special use and repair
- butted joint using 'epoxy' adhesive - not a manufacturer's recommended option.
- sealant - used at edges, and with accessories.

Note: Heat welding (strong bond) provides an impervious, hygienic and durable solution.

Control joints are generally recommended to absorb movement in the sub-base; however the flexibility of sheet vinyl will generally accommodate minor differential movement without fracture if this occurs.

As stated previously the materials and methods used in the installation of vinyl sheet should comply with all OHS requirements, *AS 1884* and the manufacturer's instructions.

#### **4.7 Sustainability**

Materials should comply with the recommendations in Section 2 - *Ecologically Sustainable Development*.

Selection should ensure that suppliers of all floor covering structures are ISO 14001 Environmental Systems Accreditation compliant, and have independent international third party LCA environmental profiling certification. This should show a low environmental impact (environmental profile), and indoor air quality certification showing low or ultra low emissions.

#### **4.8 Cleaning and Maintenance**

Vinyl sheet floors should be cleaned by damp mop with neutral detergent and dry burnishing. Some heavily soiled areas may benefit from periodic use of an alkaline detergent. A soft cloth is used for general cleaning. Sterilisation solutions and pressure cleaning with hot water equipment can be used, but abrasive cleaning methods should not be used. Special cleaning solutions are used for heavy staining. Cleaning regimes and products as recommended by the flooring manufacturer should be adopted to comply with warranty conditions.

#### **4.9 Vinyl Tile**

Vinyl tiles under Australian Standards are classed as 'Semi Rigid' (*AS 1889.1*) and 'Flexible' (*AS 1889.2*).

Vinyl Composition Tile (VCT) - in comparison with vinyl sheet, is a harder less flexible material with a higher proportion of fillers. It is widely used retail and commercial installations because of durability, ease of cleaning, low installed and life cycle cost, and design flexibility (tile patterning). It is also more friable and subject to impact damage. Sub-bases can be sealed and water resistant adhesives used where regular spills are expected. Since the flooring material cannot be covered up as a skirting it is not recommended for areas where hygiene is a requirement. The multiplicity of joints is a further limitation to use.

Note: *AS 1889 Parts 1 and 2* are now superseded but available for reference.

## 5 RUBBER

### 5.1 General

Before the advent of PVC, the available alternatives in resilient flooring were rubber, linoleum and cork. The introduction of PVC led to a gradual reduction in the use of rubber and linoleum for general domestic and commercial flooring, although rubber continued to be used for many heavy duty applications.

Rubber has recently re-emerged as a viable alternative to PVC, and is promoted for (some) healthcare flooring applications. This can be attributed to the development of new rubber compounds, a wider choice of products, improved colour range and performance - including the claim of good sustainable performance.

### 5.2 Properties

Rubber flooring can be manufactured using natural, synthetic, or recycled rubber, and is available in sheet or tile form. The properties of rubber flooring products can vary significantly with manufacturer and product. Product types suitable for healthcare are covered below with products made from reconstituted recycled rubber for special applications covered at the end of this section.

Most rubber flooring is made from synthetic rubbers such as SBRs (synthetic butyl rubber), EPDM (ethylene propylene diene), and new synthetic compounds. Products made from natural rubber are usually a more expensive alternative. The composition of floor sheet can include inert fillers such as kaolin (clay), chalk and non-volatile plasticizers.

Construction can be homogeneous, or consist of bonded (vulcanised) layers that can include a top homogeneous wear layer, a soft rubber cushion layer and a synthetic backing/reinforcement, e.g. polyester or silica.

Electrostatic dissipative (anti-static), acoustic, anti microbial and sports flooring products are available.

Low maintenance products can have either a wax in a slow release matrix (releasing the wax over a number of years), or an integral or applied surface treatment.

Sheet rubber flooring is available in roll form nominally 2.7 to 6 mm thick and 1400 to 1900 mm wide. The surface can be smooth, textured or have a raised stud or similar profile. Tiles from cut sheet material are available in a variety of sizes for general use or to match panel sizes in raised access flooring systems.

Joints can be hot or cold (chemically) welded, or butt-jointed. Rubber is a product with virtually no shrinkage, and the need to weld is usually influenced by the intended use, e.g. hygiene.

Installation is similar to sheet vinyl in respect of jointing, seaming and coving techniques. However some products with smaller roll widths such as 1400 mm may generate more joints than other resilient materials, and require borders when used in a corridor wider than the roll width.

Floor sheet can be covered up the wall surface to form an integral skirting. Alternatively matching preformed skirting systems are available from some manufacturers with a 100 x 50 mm L section complete with corner angles. Welding is usual with these systems. Special stair profiles incorporating tread, nosing (non-slip, contrast colour) and riser are also made.

Rubber flooring is covered by BS 1711 *Specification for solid rubber flooring*.

### 5.3 Performance

Rubber sheet (and tile) flooring has the following general characteristics:

- durability and wear resistance
- underfoot comfort
- reduction of impact noise

- slip resistance
- impervious and hygienic in welded sheet form
- BCA fire test compliance for class 9a buildings (check individual products)
- resistance to chemicals and contaminants
- resistance to staining and oils.

There are variations between the different materials, compositions and product types, with a wide variation in performance, the following issues should be confirmed:

- appearance in use (wear and scuffing)
- LCA and WLC
- maintenance
- ability to be recycled - check for restrictions if used in healthcare areas
- stability under heavy rolling loads - if applicable
- environmental profile
- off-gassing and odour.

Since some manufacturers produce or market both rubber and vinyl flooring, unbiased advice on the suitability and performance of each material for different applications should be available - commercial interests notwithstanding.

#### **5.4 Applications**

The properties of durability, resilience and dry slip resistance (utilised in rubber tyres) have been traditionally utilised for high traffic flooring in stadiums, station concourses, trains and buses.

Products development including an increased product range means that an alternative to vinyl sheet is now available for some healthcare applications

The degree of off-gassing is variable between products and if this does occur it usually relates to non toxic odour.

At present the use of rubber sheet is not recommended for showers and wet areas. If intended for general use where accidental spillages can occur, e.g. for areas where food is consumed, then a suitable slip resistance rating is essential.

Some sheet rubber products are suitable for heavy fork-lift traffic areas such as loading docks, back of house and stores areas. Epoxy adhesives will resist 'adhesive shear' from rolling items, and when used in seams provide a more durable installation than water based adhesives.

For use in gym, sports, pool and external areas see *Rubber Paving* below.

#### **5.5 Maintenance**

Maintenance for rubber flooring is similar to vinyl, with a minimum of washing and buffing for 'low maintenance' products.

#### **5.6 Rubber Paving**

This group of materials are made from recycled rubber in granulated form to produce a range of flooring products in sheet or tile (including interlocking tiles) with thickness varying from 5 to 90 mm. Surfaces are generally porous with an open texture, and laying with butt joints is usual.

Suitable for interior and exterior use, applications include sports/play areas (see AS 3541.1), hydrotherapy and swimming pool surrounds, back of house areas and exterior paths. Products should be resistant to chemicals and contaminants where these are present, e.g. chlorine, oils/fats, cleaning agents. It is recommended that an existing installation (5 years minimum) is visited to verify durability and cleaning requirements before final selection is made. See also *Outdoor Flooring*.

## **6 LINOLEUM**

### **6.1 General**

Linoleum has a long history of general use in Australia although excluded from use in class 9a buildings until fairly recently. Linoleum may now be considered for use in class 9a buildings subject to compliance with the new BCA fire test requirements.

As a resilient finish it provides an alternative to vinyl and rubber for some healthcare flooring applications.

### **6.2 Properties**

Linoleum flooring is manufactured from naturally occurring materials that include linseed oil, wood flour, rosin, limestone, natural pigments and jute (backing). The final compound is more porous and less flexible than equivalent rubber or vinyl sheet products.

Linoleum is available as a backed or unbacked product in sheet or tile form. Thicknesses range from 2 to 4mm. Sheet width is generally 2000 mm and specialised anti-static products are available.

Note: To achieve the equivalent *EN 685* Use Area Categorisation '34 commercial', and '43 Industrial', 2.5mm thick linoleum will be required (2mm for sheet vinyl).

Most products have a factory applied low maintenance surface finish which can be refurbished during the life of the product using sealers and polishes.

Linoleum is covered by Standards *BS EN 548, 686, 687, and 688*. See *Appendix B, References*.

### **6.3 Performance**

The materials used in the manufacture of linoleum provide anti-bacterial properties without the addition of a separate 'bacteriostat'.

Acoustic performance is achieved by products having an integral cork or synthetic backing; alternatively a standard sheet is used with a separate cork underlay. Similar floor products are used for sports, gym and play areas.

Linoleum flooring provides a good environmental profile, however a WLC comparison with other alternative materials should be made, with particular attention paid to the 'in use phase' of the products life cycle.

Linoleum products may have a characteristic low odour (linseed oil), which is non-toxic. However, independent international VOC emission test results should be requested for comparison with vinyl and rubber.

### **6.4 Applications**

Suitable for many patient care areas it is not recommended for areas with intensive cleaning and disinfecting regimes such as operating theatres and procedure rooms.

Linoleum is also not recommended in wet area applications where enhanced slip resistances qualities are required. Vinyl sheet (or ceramic tile) with the appropriate wet slip resistance classification should be used in these applications, see Section 15 *Schedule of Recommended Floor Finishes*. Linoleum is suitable for dry areas subject to occasional (accidental) wetting, see Section 2 *Safety*.

Sheets can be cut using high-pressure water jet equipment for inlay patterns. Installation is covered under BS 8203.

### **6.5 Maintenance**

Linoleum floor products with a low maintenance surface finish are recommended to reduce service costs. Maintenance methods and protocols are similar to those for smooth surface vinyl or rubber flooring.

## **7 CERAMIC TILING**

### **7.1 General**

Ceramic tiling provides a durable, moisture resistant and decorative floor finish. It is relatively easy to clean and broadly used in residential, commercial and industrial applications. A wide variety of tiles and installation methods exist with considerable differences in quality, performance and cost.

In healthcare facilities many of the traditional applications for ceramic tiling as a functional floor finish for utility and wet areas, have been replaced by alternative seamless or sheet materials to meet the changing requirements of performance, cost and risk.

### **7.2 Properties**

Ceramic tile is a clay product fired to a desired degree of hardness and porosity. Tiles can be glazed, unglazed or fully vitrified. Different products will have some or all of the following properties in varying degrees:

- hardness
- impermeable surface
- durability - resistance to scratching, staining and acids
- low porosity if required
- stability
- ease of cleaning.

AS 4662 (reproducing ISO 13006) covers properties including method of manufacture, water absorption, extruded and dry pressed tiles, properties covering dimensions, surface quality, physical and chemical properties.

Refer to *Appendix F - Ceramic Tiling*.

Other Australian Standards cover the selection and installation of tiling systems, adhesives, grouts, waterproofing and testing.

### **7.3 Performance**

While the hardness and imperviousness of ceramic tiles provide durability and hygiene, in patient care areas these properties can result in:

- high levels for impact noise and reverberation
- increased risk of injury as a result of falling on a hard, non resilient surface
- increased risk of STF from worn surfaces.

Hard surfaces (including ceramic tiling) are generally not recommended in patient care areas on the basis of risk of injury from falls. In some conditions however this may not apply, e.g. in patient ensuites, where there is a reduced severity of falls and a reduced risk of falling due to the confined spaces, and the availability of grab rails and other surfaces for support. See *NSW Health, 2007, Report 'Wall and floor finishes for wet areas'*.

Hardness (rigidity) absorbs impact or flexure from loading less easily, resulting in tile fracture or a damaged tile surface.

Tiles are tested as individual units whereas a finished tiling system includes joints, grouting, bedding and waterproofing. The combination of multiple tiles, other less durable products, and variable on-site conditions and methods, can often result in an installation that performs well below that expected from the individual tile. Any unevenness in the tiled surface due to tile shape, laying inaccuracies or poorly grouted joints can cause trips and impede wheeled equipment.



The overall performance of any tiled surface is ultimately dependent on the grouting or joint component.

- grouting (non epoxy) in general is porous, will deteriorate and require replacing or re-pointing.
- grouting is less resistant than the surrounding tile to mechanical cleaning, and can provide an infection source.
- joints provide a point of entry for moisture, and the build up of contamination (fats, oils) on joints will contribute to STF.

Movement joints (at junctions) using a flexible sealant become the least durable part of the system. The expected service life of the joint will be further reduced by exposure to chemicals, cleaning products, cleaning methods and mechanical damage.

The following issues should be considered when comparing ceramic tiling to other floor finishes:

- cleaning and maintenance (joints)
- infection control (joints and cracked tiles)
- LCA and WLC
- additional slip sheet and reinforced screed (for some applications).

#### **7.4 Application**

Ceramic tile flooring is extensively used in the residential, retail and public building sectors, where it is chosen for appearance, durability and ease of cleaning. In healthcare facilities tiled floors have a more limited application and are generally restricted to areas such as Mortuary, Central Kitchen, Laundry, Trolley wash, Boiler/calorifier plant, and external areas.

For large areas such as central kitchens, where movement caused by tile (clay product) growth can occur, then specialist advice from the tile manufacturer, with design to the appropriate standard, e.g. *BS 5385*, is recommended. Any shrinkage in a concrete sub-base will compound the problem.

Tiling is a traditional trade found in most locations whereas the use of other materials can require more specialist skills. This factor alone may favour the use of tiling in more remote locations.

#### **7.5 Sustainability**

Environmental profiles for tiling systems should include for all materials and processes used. Verify that environmental information and labelling (if available) conforms to acceptable overseas or Australian standards.

While neither ceramic tile nor cementitious grout generate VOC emissions, tile production has traditionally had a high embodied energy component. Energy efficiency is now a priority within the tile industry in an effort to reduce production costs and emissions.

Adhesives, sealants, waterproofing and special grouts can generate VOCs either in the long or short term, all products selected should satisfy OHS and occupant safety requirements during and after installation.

#### **7.6 Tiling System Selection**

Tiling systems should be selected to meet the individual performance requirements for each area. Tiles selected for interior floors will generally be a dry pressed ceramic tile with a low to medium water absorption rating. Other properties such as slip resistance, low reflectivity, etc. may be required.

Grouts and sealants: Grouts are dealt with by AS 4992.3 which covers admixes, cementitious and reaction resin grouts. Application methods are also covered. Grout types will vary for general or specialist applications such as showers, hygiene, food preparation and harsh environments. Sealants should be selected for the intended use and cleaning regime.

Bedding / Adhesive: Adhesives are covered by AS 4992.1 which lists a variety of adhesives. It is usual to specify only that an adhesive conform to the standard; however, a specialist product would be required for applications such as food preparation areas.

### **7.7 Installation**

The minimum moisture content for a concrete floor slab before installation of a tiling system is covered under Australian standards and by the individual manufacturer's requirements.

The effect of differential movement is usually eliminated by movement joints and the selection of an appropriate system. However significant differential movement in the sub-base, impact and applied loadings (including earthquake shock) may exclude the use of ceramic tiling.

Slip sheets or separation membranes are used to isolate the tiled surface from structural movement, and to insulate the structure from acoustic impact. Seldom used in small areas, slip sheets may be required for large areas and for tiling using epoxy grouts, e.g. food preparation areas. Reinforcement is used in the mortar bed (usually over a slip sheet) where movement in the substrate is expected.

Installation should comply with AS 3958.1 which covers bond breakers, adhesives and bedding, underlays, screeds, reinforcement, waterproof membranes and other general system requirements.

### **7.8 Maintenance**

Ceramic tile flooring in general use areas can be cleaned with water and alkaline detergent using a mop or mechanical cleaner. In food preparation and other specialised areas specific cleaning methods are required. For warranty purposes the manufacturer's maintenance recommendations should be followed.

## 8 TERRAZZO

### 8.1 General

Terrazzo provides a hard, durable, cost effective, attractive and easily cleaned surface. Terrazzo is widely used in major public spaces such as shopping centres, public transport facilities and similar applications. As a hard, smooth surface terrazzo flooring may present an unacceptable risk in the healthcare environment. However terrazzo may be suitable for high volume traffic public concourses or 'shopfront' areas in major healthcare complexes - subject to the following conditions.

For use in public areas terrazzo should have the required wet slip resistance. Hazards include water from foot traffic through external entries and spillages of liquids or foods. As a hard surface it generates and reflects noise, and may be associated with the increased risk of injury from falls with associated liability. In the shopping centre environment this safety risk is dealt with by regular patrolling and immediate removal of spills and contamination. This may be economically unviable in the public healthcare environment or for smaller areas.

The term 'Terrazzo' includes cement based tiles, poured in-situ cement and aggregate (monolithic) installation, 'flexible' synthetic resin tiles, and poured thin gauge cementitious based compounds and synthetic products - see *Seamless Coatings*. Polished in-situ concrete slabs can be included in this floor category.

The installation of terrazzo involves wet trades, curing time for poured and synthetic forms, and finishing processes (grinding) for the cement based products. The generation of noise, cement dust and the VOCs associated with some synthetic products can provide OHS and indoor environment quality (IEQ) problems in occupied areas. This should be considered if undertaking refurbishment or rectification work in circulation routes and in occupied areas.

## 9 CEMENTITIOUS TOPPINGS

### 9.1 General

Cementitious (and granolithic) toppings provide an economic, hard, durable surface suitable for fire stairs, walkways, and for utility, plant, service, 'back of house' and external areas.

Slip resistance, porosity and hygienic surfaces are achieved through mix adjustment, admixtures, surface treatment or with an applied finish. Surfaces can be graded to falls for drainage. Quality control is variable (as for most on-site wet trades) and hairline cracking and other defects are common. Shrinkage and movement control joints are required for larger areas. Interior surfaces are generally trowelled or floated leaving a smooth finish, surface texture or a non-slip finish is achieved by brushing or dusting with fine carborundum based aggregate.

## 10 SEAMLESS COATINGS

### 10.1 General

Seamless coatings include a variety of liquid or trowel applied synthetic resin products that set or 'cure' to provide a floor finish. Products are generally epoxy, polyurethane or acrylic based.

Epoxy resin systems are the most common type for general flooring and can be self levelling, with a finished thickness from 150 microns to 6 mm - the thinner coatings requiring more frequent re-application. Self-levelling cement based screeds having an integral surface finish are also common.

Refer to *Cementitious Toppings*.

With the exception of some formulations VOC emissions are generally high. Products should comply with relevant OHS regulations and any Health Authority requirements.

The technical specifications for this group of products are usually covered by overseas Standards and

certification. Some products will be covered by the Australian Paint Approval Scheme (APAS). Typical areas where these finishing systems are used include:

- food preparation and wet processes
- hygiene and store areas
- laboratories and clean-rooms
- workshop and loading docks
- chemical storage areas, plant rooms.

Note: Seamless coatings are generally unsuitable for use in patient care areas.

Coatings applied on-site are subject to variable environmental conditions, labour skills, condition and preparation of materials etc. Quality control of the sub-base, application and curing processes is often difficult to achieve. Minimum coating thickness, surface quality and slip resistance value as-installed may be difficult to guarantee.

Other coatings and sealing agents are designed for specific applications such as:

- sealing and marking car parking, vehicle and pedestrian areas
- sealing or waterproofing services plant rooms
- protecting floor surfaces subject to severe chemical or marine environments.

## **11 CORK, TIMBER, LAMINATES**

### **11.1 General**

This section looks briefly at other floor finishes that are often used in the commercial and retail environment, but have a more limited use in healthcare principally due to the BCA requirements for class 9a buildings - see *Fire Hazard Properties*, long term wear and maintenance.

### **11.2 Timber**

Timber provides a hard, decorative flooring material, widely used in education, retail, commercial and residential buildings. Timber is found less often in healthcare buildings, but may be considered for use in (non class 9a) areas used for sports, physiotherapy, religious services, non-patient residential, meetings, multi-purpose spaces and external decks.

Timber flooring is available as solid timber boarding or parquet as a fixed or floating floor, either fixed directly to a slab or to battens. Finishing includes sanding and multiple coats of oil, epoxy, or polyurethane compounds. Only products with low VOC emissions should be used.

Traditional solid timber boarded floors require sanding and re-coating; the coatings wear rapidly and show marking and indentation. Limitations to use in healthcare are hardness, the number of joints, high maintenance, low cost efficiency, instability and moisture movement, susceptibility to insect attack and performance in a fire.

Solid timber is not recommended for external decking in patient care area. The shrinkage, deterioration and movement of individual boards constitute a high risk of STF, combined with the risk of injury from falling on a hard surface. Timber composites with low movement and low maintenance offer a better solution if lightweight decking is proposed.

### **11.3 Timber Composites**

A number of simulated timber flooring materials are marketed in the form of planks or boards. These consist of a ply, wood strip or composite core and are physically stable. The normal thin timber face material is pre-finished with melamine or synthetic resin and can mark and wear rapidly. These products are intended for fast installation, replacement rather than repair, and are designed for residential or short-term retail use. Composite decking is available with concealed fixings and low maintenance characteristics.

### **11.4 Cork**

Cork is available in tile and sheet form tiles are made either prefinished or untreated - to be sanded and sealed in-situ (6mm thick min). Cork, in common with timber, provides warmth and a natural aesthetic but has the advantage of resilience, underfoot comfort and sound reduction. Cork shares many of the limitations of timber and is more porous. Resilient backed vinyl, rubber or linoleum provide more functional and cost effective alternatives. Vinyl ranges include simulated cork (and timber) designs and there are cork-linoleum products available.

Installation is similar to other resilient finishes systems, and maintenance is similar to linoleum.

Cork flooring is covered by BS EN 12104.

### **11.5 Fire Hazard Properties**

Materials such as timber and cork (including the surface coatings) do not in general comply with BCA Fire Hazard Properties for 9a buildings, despite this they can be used in other classifications that often constitute a healthcare complex, (i.e. where a facility contains multiple classifications). Alternatively the fire rating may be exempted under certain conditions.

## **12 MATS AND MATTING**

### **12.1 General**

Matting plays an important part in a facility's risk management and maintenance strategies.

A major use of floor matting is to remove and retain contamination from footwear while more specialised matting is often used in a similar manner for bacterial or static control. Ideally all matting should be considered during the design stages; with set downs provided to ensure that the surface of the inset mat is level with the adjacent floor surfaces.

### **12.2 Loose mats**

The use of loose 'on floor' mats is not recommended as they constitute a potential source of STF. This should not prevent the intentional use of loose mats and matting in highly specialized areas for a specific function, e.g. OHS, or where mats are retrofitted to overcome to an existing problem.

Preferably the floor surfaces in new buildings should be selected with the appropriate performance characteristics, to avoid the use of later remedial or supplementary 'applied' solutions.

### **12.3 Entrance Matting**

#### **12.3.1 General**

The design of entrances should aim to prevent rain, snow, ice, wind and temperature from entering the building. This is usually achieved through the use of wind lobbies, canopies, self-closing doors, threshold design, differential air pressure, floor heating and matting.

Entry matting provides the only means of removing contamination (wet and dry) from footwear, which if carried into the building create a potential STF risk, and will accelerate damage to the interior floor surfaces. Effective and well maintained matting will also reduce the frequency of floor cleaning.

The most effective solution consists of a combination of both exterior and interior entry matting. Exterior scraper matting (or grids) removes the large particles, prevents soil from entering the building and controls surface water. Interior matting removes any remaining soil and fine particles.

Entry mats should have the following properties:

- durable and able to be easily cleaned and maintained
- high moisture retention and fast drying
- resistant to heel and wheel indentation
- not 'track', i.e. direct or guide wheel movement
- resistant to mould and bacteria
- slip resistant with the ability to remove gross contamination from footwear
- not show tracks and marking.

Matting should be recessed level with the adjacent floor surface. The recess and matting should be drained and allow easy access for cleaning. Excessive changes in slip resistance between adjacent surfaces should be avoided as these can cause tripping.

The density and surface construction should allow for footwear, walking aids, wheeled equipment and wheelchairs without inhibiting or causing a hazard. For wheelchair use the matting length should ideally cover one rotation of the wheel at least (*BS 7953*), preferably more.

Where ambulance trolleys (small wheels) access the building, loose or uneven surfaces, ridges (entry mats) or studded flooring may cause difficulties and risks for ambulatory users and persons with disabilities. This applies equally to the movement of patients on wheeled equipment, such as trolleys and wheelchairs.

External surfaces at entrances should be self-draining and have the appropriate slip resistance. External matting should be weather proof and self-draining in addition to the previous requirements for entry mats.

In addition to wet floor surfaces, entrances present increased risks for persons with disabilities from the problems arising from crowd movement, distracted attention, and attending to multiple tasks such as door opening. Floor finishes at entries should also address the potential safety issues of reflected light and glare through glazing or through the door opening.

In view of the unique issues and the accentuated risk at entrances, the requirements of the DDA and BCA should be fully complied with.

Note: The design and active maintenance of exterior surfaces is as equally important as the provision of matting. Sweeping and pressure washing to reduce the transport of soil, grease and oil into the building will simultaneously reduce the risk of injury from STF.

### 12.3.2 Types and materials

Mats and matting can be classified as suitable for heavy or light duty use; and are available in flexible and rigid formats - supplied in standard or custom sizes. Flexible matting in roll form can be used as a textile covering for large or small areas.

It is recommended that only heavy duty recessed products are used in healthcare facilities. The following typical heavy duty recessed products are made for interior and/or exterior use:

- Grids formed from aluminium extrusions with inserts; insert materials range from carpet, rubber, polypropylene, carborundum/vinyl, natural coir. Some types have a hinged roll-back construction to facilitate cleaning, with a high rolling load capacity and integral fames and drainage pans.
- Construction as above but with less durable vinyl/acrylic rails.
- Construction using aluminium bars with alternate corrugated rubber or vinyl strips. However this type may be a risk to some user groups (those with walking aids, etc), and constitute a general OHS risk.

Note: Flexible matting is not recommended for heavy duty performance.

Flexible lightweight mats designed to be laid on an existing floor surface are usually proprietary products made from textured rubber (synthetic or natural), PVC backed coir, cushion (spaghetti) vinyl loop, needle punch polypropylene fibres on a PVC backing, etc. They are commonly found in residential, light commercial and retail, and are not recommended for healthcare use, see *General* above.

Note: Special carpet tiles with dirt removal and holding properties can incorporate within the overall carpet tile grid, but should only be used as a supplement to high performance entry matting.

## 12.4 BCA requirements

The relevant BCA requirements for flooring including, egress, exits and accessibility apply to both exterior and interior matting. Interior matting as a flooring material within the building envelope must comply with the BCA fire hazard requirements.

## 12.5 Cleaning

It is recommended that only heavy duty matting that can be cleaned in-situ without the need to be removed is used; cleaning will involve frequent vacuuming and occasional washing. If matting that requires temporary removal for cleaning is used, then on removal it should be immediately replaced with spare matting to avoid creating a safety hazard.

## 13 OUTDOOR FLOORING

### 13.1 General

For the purposes of this document 'outdoor flooring' refers to areas which form a continuation and extension of an interior space or activity. These include open or covered areas such as:

- circulation areas, e.g. links.
- active areas, e.g. multi-function, exercise, activity areas and hydrotherapy pools.
- static areas, e.g. food consumption, inpatient areas, lounges, balconies.

### 13.2 Materials and Performance

Materials should be selected for function, performance under adverse conditions and cost efficiency. Some materials are manufactured for specific uses, e.g. pool surrounds, walkways.

A number of products and materials are made for exterior use:

- granulated rubber composition sheet, tile or interlock pavers. See *Rubber*
- synthetic outdoor carpet, Bonded type 100% polypropylene with latex backing. See *Textile Floor Coverings*
- plastic (PVC) matting or interlock tiles
- traditional paving - brick and concrete, (timber and gravel are not recommended).

Hard surfaces may contribute to injury from falls, and resilient surfaces are therefore recommended for public and patient-care use. Precautions against safety hazards (see *Section 2*) should be followed.

Performance requirements are similar for covered and open outdoor areas, having either completed or partial exposure to the effects of sun and weather. Products should be resistant to moisture mildew and rot in addition to resistant to the effects of sun and weather. Note: BCA fire hazard requirements do not apply to external areas.

In circulation areas and for ramped surfaces appropriate slip resistance ratings and visual cues are a BCA requirement.

Hard paving and landscaping materials such as brick, concrete and bitumen are outside the scope of this document. However pedestrian safety with regard to STF and injury from falling on hard surfaces should be considered as a priority in selection. This will include any factor that contributes to STF, such as subsidence, surfaces that are or may become uneven, worn or degraded, or have inadequate slip-resistance in wet or oily conditions, either initially or through wear.

For issues relating to pedestrian movement onto and within the site, see the relevant clauses covering safety and accessibility in *Section 2*.



## 14 SURFACING AND ATTACHMENTS

A wide range of proprietary floor surface treatments and fixtures are made for use on new and existing floors, most are designed for a specific function:

### Slip resistance:

For new flooring the required slip resistance ratings should be provided by using a finish with the appropriate properties. For existing surfaces that fail to provide the required rating, there are a number of methods that can be used to help achieve this, these include specialised cleaning techniques, chemical etching, mechanical roughening, and applied slip resistant surface compounds. Alternatively a new thin sheet or textile flooring material can often be laid directly over the existing surface, without removal of the existing surface.

### Accessibility:

Under the DDA, BCA and AS 1428 there are a number of accessibility measures that need to be implemented for persons with disabilities. These include floor indicators, non-slip strips to stair nosing's; and visual indicators for changes in slip-resistance or gradient.

### Junctions:

A range of proprietary items exist to deal with a variety of floor junction and edge conditions. These include cover strips and transition strips (thickness) between different materials. These attached items, unless they are well designed and securely fixed, may be damaged by wheeled and cleaning equipment creating a safety hazard. In this context many of the plastic accessories intended for light residential/commercial use are unsuitable for healthcare and public spaces. Purpose designed accessories may be required to overcome deficiencies in 'off the shelf' products.

### Joints:

Movement in the structure or sub-base is usually dealt with using a designed joint, i.e. construction pours, movement and shrinkage. Accessories are made to meet different floor traffic conditions and where a fire resistance rating is required, products should comply with BCA (overseas testing and ratings may be inadmissible).

Some floor finishes such as resilient sheet flooring, may be able to accommodate small sub base movements within the material itself.

Note: BCA fire hazard properties requirements apply to floor surface coatings, but do not usually extend to small flooring attachments.

## 15 SCHEDULE OF RECOMMENDED FLOOR FINISHES

### 15.1 General

The recommendations given in *Tables B* and *C* should be read in conjunction with any recommendations for floor finishes provided in any of the following *Australasian HFG*:

- Standard Components - Room Data Sheets (RDS)
- Part B - Health Planning Units (HPU)
- Australasian HFG Parts C for OHS, and Safety, and Part D for Infection Control Requirements

There are approximately 50 generic area types listed in the RDS. Each RDS provides a floor finish and skirting recommendation, listing 'seamless covered vinyl' for most patient and clinical areas.

See <[http://www.healthfacilityguidelines.com.au/standard\\_components\\_index.htm](http://www.healthfacilityguidelines.com.au/standard_components_index.htm)>.

'Vinyl' and the codes for vinyl are used in the RDS for brevity and should be interpreted as 'Resilient Finish - fit for purpose'.

AusHFG *Part B* covers individual Hospital Planning Units (HPUs) with specific HPU floor finishes given under *Finishes - Floor Finishes*. See <<http://www.healthfacilityguidelines.com.au/guidelines.htm>>.

Since the *AusHFG* are in a continuing process of review and amendment and published online, the current version should always be checked for changes.

### 15.2 Floor Finishes

Textile floor coverings are generally not recommended in areas with frequent spillages, e.g. incontinent patients, and in any public area where severe mistreatment (gum, food etc.) is expected. It is therefore important to confirm the precise functional and user requirements, e.g. infection control/manual handling/cleaning etc., in each case and use a suitable alternative finish.

*Table A* lists materials by generic type, with a code that includes joint and skirting type. Additional or less common requirements are listed separately under *Comments* column in *Tables B* and *C*.

*Table B* lists *Standard Areas* common to most HPUs. The *Type* column provides alternatives, to be selected as appropriate for use.

*Table C* lists 'Non Standard' areas within specific HPUs that are not included in *Table B* under 'Standard areas'. Where alternatives are given select the appropriate finish, taking into account adjacent areas and HPU zone recommendations where applicable.

Areas subject to liquid spills and contamination that require adequate wet slip resistance are shown with '(SR)'. The degree and type of slip resistance should be selected in accordance with *AS/NZS 4586* and *HB 197*, see *Appendix D*.

Wet areas are covered in more detail in *NSW Health, 2007, Report - Wall and floor finishes for wet areas*.



STANDARD AREAS – FLOOR FINISHES GUIDE		
AREA	TYPE	COMMENT
BAY BEVERAGE / ROOM	3 (SR)	
BAY HANDWASHING	3 (SR)	
BAY LINEN TROLLEY	1 / 3	MATCH CORRIDOR
BAY MOBILE/OTHER EQUIPMENT.	1 / 3	MATCH CORRIDOR
BAY FLOWERS	3 (SR)	
BAY VENDING	1 / 3	MATCH CORRIDOR
BAY VENDING - LIQUIDS	3 (SR)	
ADL BEDROOM*, OVERNIGHT ROOM	1* / 3	
BEDROOM - PATIENT (LOW SOILING RISK) *	1* / 3	
BEDROOM - PATIENT (SPILLS, SOILING)	3	MODERATE SPILLAGE OR SOILING
BIOMEDICAL WORKSHOP	1 / 3	CONDUCTIVE
CHANGE STAFF	1* / 3 / 4	
CLEAN UTILITY	3 (SR)	CHECK SR RE. SPILL TYPE, LOTIONS ETC.
CLEANERS ROOM	3 (SR)	
CLEAN-UP	3 (SR)	
CORRIDOR - NON CLINICAL USE	1 / 2 / 3	
CORRIDOR - PATIENT CARE *	1* / 3	
CORRIDOR - BACK OF HOUSE	3 / 4 / 5	
DIRTY UTILITY	3 (SR)	
DINING *	1* / 3	TYPE '3' FOR PUBLIC AND HIGH USAGE.
DISPOSAL *	3 / 4 (SR)	
ENSUITE, BATHROOM, ADL BATHROOM	3 / (4) (SR)	'C' MAY BE USED FOR SMALL ENSUITES ONLY. REFER WET AREA FINISHES,
GROUP ROOM *	1* / 3	MATCH USE
INTERVIEW	1 / 3	
ISOLATION ROOM	3	VSW - ALL ROOM CLASSIFICATIONS
LAUNDRY - PATIENT, ADL LAUNDRY	3 (SR)	VSW (SR)
LOUNGE PATIENT / VISITOR *	1* / 3	
MEETING ROOM, SEMINAR - STAFF	1	
MULTI-PURPOSE, GROUP THERAPY, MEETING *	1* / 3	
MULTI-PURPOSE, DINING, CRAFT, ACTIVITY *	3 / 3 (SR)	MATCH USER REQUIREMENTS
OFFICE, ADL COMPUTER ROOM	1 / 2	
OFFICE	1 / 2 / 3	
OVERNIGHT STAY	1	
PANTRY, ADL KITCHEN	3 (SR)	
PATIENT BAY / HOLDING *	1* / 3	
PATIENT BAY / ACUTE TREATMENT	3	

PLAY - PATIENT CARE *	1* / 3	
PLAY – WAITING *	1* / 3	ACOUSTIC, UNDERFOOT COMFORT.
PLASTER ROOM	3 (SR)	
LAUNDRY / PATIENT	3 (SR)	
PROCEDURE ROOM	3	
PROPERTY BAY	1 / 3	
RECEPTION / CLERICAL / PHOTOCOPY	1 / 2 / 3	ACOUSTIC CONTROL
SHOWER - PATIENT, PUBLIC	3 / (4) (SR)	SEE ENSUITE.
SHOWER - STAFF	3 / (4) (SR)	SEE ENSUITE.
STAFF ROOM	1 / 2 / 3	
STAFF STATION	1 / 3	
STAIRS AND RAMPS - GENERAL	1 / 2 / 3	FIRE EGRESS STAIRS, REFER BCA.
STAIRS AND RAMPS - UTILITY	3 / 4 / 5	MATCH FUNCTION / LOCATION
STORE DRUGS	2 / 3	
STORE BULK	2 / 3 / 4	
STORE CLEANERS	2 / 3 / 4	
STORE EQUIPMENT	1 / 2 / 3 / 4	
STORE FILES	1 / 2	
STORE GENERAL	1 / 2	
STORE PHOTOCOPY	1 / 2	
STORE STERILE STOCK	3 / 4	
TOILET	3 / (4) (SR)	SEE ENSUITE
TREATMENT ROOM / AREA	3	SR IF REQUIRED FOR USE, SEE HPU
TUTORIAL	1 / 2	
WAITING	1 / 1* / 2 / 3	
WAITING SUB	1 / 1* / 2 / 3	
WORKSHOP	2 / 3 / 4 / 5	
X-RAY VIEWING AND REPORTING	1 / 2 / 3	

## 15.5 TABLE C – Additional Floor Finishes Guide for Health Planning Units

Where areas are not listed refer to *Table B Standard Areas*. Where alternatives are given select the appropriate finish for each set of conditions. Consider also adjacent areas, and HPU zone recommendations provided in *Australasian HFG - Part B*.

HEALTH PLANNING UNITS - FLOOR FINISHES		
ACTIVITY SPACE	FINISH	COMMENT
<b>ADMINISTRATION, STAFF ACCOMMODATION</b>		
RECEPTION, COMMITTEE ROOM, COMMON ROOM, INTERVIEW, LIBRARY, REST ROOM.	1	
OFFICE, CIRCULATION	1 / 2	
STORE	1 / 2	
BEDROOM	1	
<b>ADULT ACUTE MENTAL HEALTH UNIT (INCLUDING PICU)</b>		
<i>GENERAL: AVOID STRONG COLOUR AND PATTERN, USE COLOUR FOR WAYFINDING.</i>		
SECLUSION / QUIET ROOM	3	CUSHION BACKED SECURELY FIXED
<b>AMBULATORY CARE UNIT</b>		
<i>GENERAL: NON-INSTITUTIONAL, ACOUSTIC CONTROL, SLIP RESISTANCE, INFECTION CONTROL, MOVEMENT OF TROLLEYS AND MAINTENANCE.</i>		
PATIENT BAY - ACUTE TREATMENT	3	
<b>AMBULATORY MENTAL HEALTH UNIT</b>		
<i>GENERAL: AVOID STRONG COLOUR AND PATTERN</i>		
PUBLIC AREAS	1 / 3	
STAFF OFFICES & AMENITIES	1	
<b>CHILD &amp; ADOLESCENT MENTAL HEALTH UNIT (INCLUDING PSYCHIATRIC INTENSIVE CARE UNIT (PICU), SECURE UNIT AND OPEN UNIT)</b>		
<i>GENERAL: AVOID STRONG COLOUR AND PATTERN, USE COLOUR FOR WAYFINDING.</i>		
EXAM / ASSESSMENT ROOM	1 / 3	
CHILD PLAY	3	
MULTI-PURPOSE	1 / 3	
GYMNASIUM	1 / 3	SPORTS PRODUCTS
<b>CLINICAL INFORMATION UNIT</b>		
<i>GENERAL: CLERICAL WORK AREA, HIGH TROLLEY MOVEMENT, ACOUSTIC CONTROL.</i>		
BAY - MOBILE EQUIP	1 / 2	
RECORDS STORE -ACTIVE	1 / 2	
RECORD PROCESSING, WORK AREAS	1 / 2	
<b>COMMUNITY HEALTH UNIT</b>		
<i>GENERAL: NON-INSTITUTIONAL ENVIRONMENT. ACOUSTIC CONTROL, NON SLIP, INFECTION CONTROL, MOVEMENT OF TROLLEYS AND MAINTENANCE.</i>		
AUDIOLOGY	1 / 3	
CARDIAC - PULMONARY	1 / 3	
CONSULT - STRESS TEST	1 / 3	
PODIATRY	3	
PLASTER ROOM	3 (SR)	
PARENTING ROOM	1 / 3	
PHYSIOTHERAPY	1 / 3	

<b>HEALTH PLANNING UNITS - FLOOR FINISHES</b>		
<b>ACTIVITY SPACE</b>	<b>FINISH</b>	<b>COMMENT</b>
<b>DAY PROCEDURE / SURGERY UNIT</b>		
<i>GENERAL: REFER OPERATING UNIT.</i>		
RELATIVE / PATIENT WAITING	1	NON CLINICAL
PROCEDURES UNIT	3	AS OPERATING UNIT
<b>EMERGENCY UNIT</b>		
<i>GENERAL: PATIENT CARE AREAS USE TYPE 3 (SPILLS, ACOUSTIC CONTROL, UNDERFOOT COMFORT, INFECTION CONTROL). OFFICES, CLERICAL, SEMINAR / MEETING ROOMS USE TYPE 1.</i>		
AMBULANCE TRIAGE	3	
COMMUNICATIONS BASE (ASNSW)	1 / 3	
PRIMARY CARE AREA	3	AS OPERATING UNIT
<b>HOSPITAL MORGUE / AUTOPSY UNIT</b>		
ENTRY / WAITING / VIEWING	1	NON INSTITUTIONAL/CLINICAL
AUTOPSY ROOM / CLEAN UP	3 / 4	CE WASH DOWN/GRATES (LEVEL), INFECTION CONTROL
AUTOPSY SUPPORT	3	AS OPERATING UNIT
<b>INPATIENT ACCOMMODATION UNIT</b>		
<i>GENERAL: ACOUSTIC CONTROL, NON SLIP, INFECTION CONTROL, BEDS/ TROLLEY MOVEMENT, APPROPRIATE CLEANING.</i>		
<i>FOR FINISHES REFER TO 'STANDARD AREAS'</i>		
<b>INTENSIVE CARE UNIT - GENERAL</b>		
<i>GENERAL: SIMILAR TO CRITICAL CARE UNITS. E.G. CORONARY CARE, PAEDIATRICS, NEO NATAL</i>		
PATIENT BAY	3	INCLUDES ALL PATIENT BAY TYPES.
EQUIPMENT CLEANUP / SUB PATHOLOGY	3 (SR)	
RESPIRATORY / BIOMEDICAL WORKROOM	3	ANTI-STATIC
<b>INTENSIVE CARE - NEONATAL / SPECIAL CARE</b>		
<i>GENERAL: ACOUSTIC CONTROL, UNDERFOOT COMFORT, VISUALLY ATTRACTIVE, MOVEMENT OF HEAVY EQUIPMENT, MAINTENANCE, INFECTION CONTROL. FOR NON-CLINICAL AREAS.</i>		
ENTRY / RECEPTION / HUB	1 / 3	
PATIENT AREAS	3	
COT BAY	3	INCLUDES ALL COT BAY TYPES AND GENERAL CARE
ISOLATION ROOM AND LOBBY	3	FOR ALL ROOM CLASSES
PARENT-INFANT ROOM	1* / 3	
FEEDING / EXPRESSING ROOM	3	
CLINICAL SUPPORT AREAS	3	
FAMILY SUPPORT AREAS	1 / 3	
STAFF OFFICES AMENITIES	1 / 3	
<b>MATERNITY UNIT</b>		
<i>GENERAL: NON CLINICAL AMBIENCE</i>		
MATERNITY WARD		
BEDROOM	3	
NURSERY - GENERAL CARE	3	
BATHING / EXAMINATION	3 (SR)	
BREASTFEEDING ROOM	3	
FORMULA PREPARATION ROOM	3	
NURSERY	3	
BIRTHING ROOM (LDR)	3	
CIRCULATION	1* / 3	
DELIVERY SUITE		

<b>HEALTH PLANNING UNITS - FLOOR FINISHES</b>		
<b>ACTIVITY SPACE</b>	<b>FINISH</b>	<b>COMMENT</b>
DELIVERY ROOM	3 (SR)	ABNORMAL DELIVERY ROOM VSW
CIRCULATION	3	
<b>MEDICAL IMAGING</b>		
HARD COPY / DIGITISER ROOM	3	
PACS SERVER ROOM	3	CHECK ANTI-STATIC
STORE - FILM/CASSETTES/PLATES	3	OPTICAL DISCS STORAGE ROOM
GENERAL X-RAY ROOM	3	SCREENING ROOM (FLUOROSCOPY)
CHANGE CUBICLE - PATIENT	1 / 3	
COMPUTED RADIOLOGY (CR) PROCESSING	3	
DARK ROOM	3 (SR)	
DAYLIGHT PROCESSING		
CONTRAST MEDIA PREPARATION ROOM/BAY	3	
ULTRASOUND ROOM	3	
MAMMOGRAPHY ROOM	3	
MAMMOGRAPHY PROCESSOR	3	
ULTRASOUND/ MAMMOGRAPHY PREP ROOM/LAB		
CT SCANNING ROOM	3	
CT CONTROL ROOM	3	
CT COMPUTER ROOM	1 / 3	CHECK ANTI-STATIC
ANGIOGRAPHY ROOM	3	SEE OPERATING UNIT
ANGIOGRAPHY CONTROL / EQUIP	3	SEE CT
MRI SCANNING ROOM	3	ASSOC ROOMS SEE CT
<b>MULTIPURPOSE SERVICES UNIT</b>		
<i>GENERAL: SUB-ZONES AS FOR SIMILAR FUNCTIONAL HPUS. E.G. ACOUSTIC CONTROL, SPILLS, NON SLIP,</i>		
ENTRY / RECEPTION ZONE	1 / 3	REFER AMBULATORY CARE
PRIMARY CARE ZONE	3	REFER AMBULATORY CARE
EMERGENCY & IMAGING ZONE	3	REFER EMERGENCY
ACUTE CARE AREA	3	REFER ICU
RESIDENTIAL AREA	1 / 3	HOME-LIKE ENVIRONMENT FOR LOW CARE. REFER INPATIENT, SPILLS/SOILING
SUPPORT AREAS & MORGUE	3	REFER EMERGENCY AND MORGUE
STAFF AREAS	1 / 3	REFER ADMINISTRATION
<b>OPERATING UNIT</b>		
<i>GENERAL: IMPERVIOUS, HIGH INFECTION CONTROL, EASILY CLEANED, STAIN RESISTANT, UNDERFOOT COMFORT, WHEELED TRAFFIC.</i>		
ADMISSIONS/RECEPTION AREA	3	
PRE-OPERATIVE HOLDING AREA	3	
OPERATING ROOMS AREA		
OPERATING ROOM, GOWNING	3	CONTRAST FOR SMALL DROPPED ITEMS
ANAESTHETIC INDUCTION ROOM, EXIT BAY	3	
SCRUB UP, CLEAN-UP ROOM, FLASH STERILISING	3 (SR)	
OR SUPPORT AREA	3	
STERILE STOCK / SET-UP	3	
ANAESTHETIC WORKROOM, BIOMEDICAL EQUIPMENT, AUDIOVISUAL WORKROOM	3	CHECK ANTI-STATIC
PERFUSION ROOM	3	
POST-OPERATIVE AREA	3	REFER - STANDARD AREAS
RECOVERY AREA	3	
STAFF AREAS	3	REFER - STANDARD AREAS



<b>HEALTH PLANNING UNITS - FLOOR FINISHES</b>		
<b>ACTIVITY SPACE</b>	<b>FINISH</b>	<b>COMMENT</b>
<b>ORAL HEALTH UNIT</b>		
ENTRY / RECEPTION	1 / 3	REFER - STANDARD AREAS
TREATMENT / SUPPORT	3	
STAFF AREAS	1 / 3	REFER - STANDARD AREAS
<b>PAEDIATRIC/ ADOLESCENT UNIT</b>		
<i>GENERAL: NON-INSTITUTIONAL 'POSITIVE' ENVIRONMENT.</i>		
BED ROOM	1* / 3	SPILLS
ISOLATION ROOM	3	
FEEDING, FORMULA ROOM ETC	3	SEE MATERNITY
PLAY	1* / 3	
RECREATION	1* / 3	OLDER CHILDREN
QUIET STUDY	1 / 3	
CIRCULATION	1* / 3	SPILLS
<b>PATHOLOGY UNIT</b>		
<i>GENERAL: COMPLY WITH LABORATORY/INFECTION CONTROL CODES/STANDARDS. LEVEL SURFACES NOT GRADED TO WASTES.</i>		
SPECIMEN COLLECTION		
RECEPTION / WAITING / CLERICAL	1 / 3	SEE STANDARD AREAS
SPECIMEN COLLECTION ROOM, STORE STERILE STOCK	3	
LABORATORY AREAS	3	CHECK ANTI-STATIC
<b>PATHOLOGY UNIT (CONTINUED)</b>		
ANATOMICAL PATHOLOGY	3 (SR)	OILS, WAXES
STORE - FLAMMABLE LIQUIDS	3	CHECK SET DOWNS
STAFF AREAS	1 / 3	SEE STANDARD AREAS
<b>PHARMACY UNIT</b>		
<i>GENERAL: HYGIENE AND EASE OF CLEANING, INFECTION CONTROL SOME AREAS. COMFORT UNDERFOOT.</i>		
MAIN PHARMACY	3	
PREP ROOM (MANUFACTURING)	3	
STORES - ALL	3	
STERILE MANUFACTURING SUITE	3	
<b>PSYCHIATRIC EMERGENCY CARE CENTRE (PECC)</b>		
<i>GENERAL: REFER ADULT ACUTE MENTAL HEALTH UNIT (INCLUDING PICU)</i>		
<b>RADIATION ONCOLOGY UNIT</b>		
MAIN ENTRY / RECEPTION / ADMINISTRATION	1 / 3	REFER MEDICAL IMAGING
PLANNING ZONE	3	
MOULD ROOM SUITE	3	
MEDICAL PHYSICS	3	
RADIATION TREATMENT	3	
PATIENT ASSESSMENT	1 / 3	
CLINICAL TRIALS AREA	1 / 3	
TEACHING / RESEARCH / STAFF AREAS	1 / 3	SEE STANDARD AREAS

<b>HEALTH PLANNING UNITS - FLOOR FINISHES</b>		
<b>ACTIVITY SPACE</b>	<b>FINISH</b>	<b>COMMENT</b>
<b>REHABILITATION / ALLIED HEALTH UNIT</b>		
<i>GENERAL: HIGH STF RISK, NON INSTITUTIONAL, ACOUSTIC CONTROL.</i>		
ENTRY / RECEPTION AREAS	1 / 3	REFER AMBULATORY CARE UNIT
ALLIED HEALTH AREAS	1 / 3	REFER AMBULATORY CARE UNIT
OCCUPATIONAL THERAPY AREAS	1 / 3	CHECK USER REQUIREMENTS
PHYSIOTHERAPY AREAS	1* / 3	
SHARED CLINICAL SUPPORT AREAS	3	SEE STANDARD AREAS
STAFF AREAS	1 / 3	SEE STANDARD AREAS
AUDIOLOGY SUITE	1 / 3	SEE STANDARD AREAS
GROUP ROOM	1 / 3	CHECK USER REQUIREMENTS
OCCUPATIONAL THERAPY	1 / 3	CHECK USER REQUIREMENTS
STORES - MATERIALS / EQUIPMENT	3	
STORES - TIMBER AND METAL	4	
PHYSIOTHERAPY	1* / 3	
GYMNASIUM	1 / 3	GYM FLOORING TO SUIT ACTIVITIES
PLASTER /SPLINT ROOM	3	WORKROOM
STORE - EXERCISE EQUIPMENT	1 / 3	
WORKSHOP	3 / 4	
HYDROTHERAPY		REFER WET AREA FINISHES
POOL SURROUND	4 / 6	WET SLIP RESISTANCE
CHANGE AREAS	3 (SR)	WET SLIP RESISTANCE
REHABILITATION WARD		REFER INPATIENT ACCOMMODATION UNIT
BEDROOM	1 / 3	SPILLS
<b>RENAL DIALYSIS UNIT</b>		
<i>GENERAL: NON INSTITUTIONAL, WHEELED EQUIPMENT, ACOUSTIC CONTROL, COMFORT UNDERFOOT, INFECTION CONTROL.</i>		
TREATMENT BAYS	3	CHECK USER REQUIREMENT, WATER AND BLOOD SPILLS.
ISOLATION ROOM	3	
EQUIPMENT CLEANING AREA	3	
WATER TREATMENT PLANT ROOM	3	
DIALYSIS FLUIDS BAY	3	
DIALYSIS PREPARATION AREA	3	
<b>STERILE SUPPLY UNIT</b>		
LOAN EQUIPMENT STORE	2	
RECEIVING AREA - USED ITEMS	3	
TROLLEY WASH	3 (SR)	WET AREA
CLEANING / DECONTAMINATION	3 (SR)	
PACKING / CLEAN WORKROOM	3	
STERILIZER LOADING / UNLOADING	3	
STERILIZER COOLING	3	
STERILE STOCK - WARDS, OR	3	
OFFICE ETC	1 / 3	
<b>MAIN ENTRANCE</b>		
<i>GENERAL: NON INSTITUTIONAL AND LOW MAINTENANCE, SOME HEAVY TRAFFIC AREAS, HIGH STF RISK, SPILLS, STAINS AND GENERAL MISTREATMENT BY PUBLIC.</i>		
FOYER, INTERVIEW, SUB WAIT	3	
STAFF, RECEPTION, ADMISSIONS, OFFICE, SECURITY, CIRCULATION	1 / 3	
STORE	1 / 3	
SHOP	1 / 3	
LIFT LOBBY, STAIRS	1 / 3	

<b>HEALTH PLANNING UNITS - FLOOR FINISHES</b>		
<b>ACTIVITY SPACE</b>	<b>FINISH</b>	<b>COMMENT</b>
<b>DINING / CAFETERIA</b>		
<i>GENERAL: NON INSTITUTIONAL, HEAVY TRAFFIC, ALL USER GROUPS, HIGH STF RISK, SPILLS, STAINS, MISUSE, EASILY MAINTAINED.</i>		
FOOD CONSUMPTION	1* / 3	LIQUID SPILLS, FOOD, STAINING,
COFFEE SHOP	1* / 3	
SERVERY - CUSTOMER	3 (SR)	
SERVERY - WORK AREA	3 / 4 (SR)	VSW OR CE - RE. OIL/FAT SPILLS
<b>CENTRAL KITCHEN</b>		
<i>GENERAL: SPECIFIC (SR) REQUIREMENTS FOR EACH PROCESS/FUNCTIONAL AREA. EARLY SPECIALIST FLOORING ADVICE REQUIRED. (AC NOT RECOMMENDED).</i>		
COOKING	4 (SR)	CE - RE. OIL/FAT SPILLS
BULK PROVISIONS, DAY STORE	4	CE
BEVERAGE PREPARATION	4 (SR)	CE
DISPOSABLES, EQUIP STORE	4	
FOOD PREP AREAS	3 / 4 (SR)	VSW
FISH STORE, COLD ROOMS		SPECIALIST FIT OUT AND FLOOR
TROLLEY - PARKING	3 / 4	
WASH-UP - CENTRAL AND PAN	3 / 4 (SR)	CE
<b>LAUNDRY</b>		
<i>GENERAL: SLIP RESISTANCE FOR WET AREAS.</i>		
DISINFECTION, SOLUTION / PREP / STORAGE	3 / 4 (SR)	
WASHING, DRYING	3 / 4 (SR)	
ASSEMBLING	4	
STAFF AREAS	1 / 3	
DRY WORK AREAS - RECEPTION, BARRIER, CLASSIFICATION ETC.	3	
PLANT	4	
<b>LOADING DOCK - BACK OF HOUSE</b>		
<i>GENERAL: SLIP RESISTANCE FOR SPILLS/WET AREAS.</i>		
CIRCULATION	3 / 4	(SR) AS REQUIRED
STORES	3 / 4 / 5	MATCH USE/AREA. SEAL TYPE '5'
STAFF	3 / 4	
LOADING DOCK	5 (SR)	'GT' SEALED
<b>AMBULANCE STATION</b>		
AMBULANCE AREA ENCLOSED	4 / 5 (SR)	SEAL 'AC' AND 'SCT' FOR OIL SPILLS.
STORES / UTILITY	3	
OFFICE	3	
<b>ENGINEERING PLANT</b>		
BOILER / CALORIFIER	4 / 5 (SR)	'C' AND 'GT' - SEALED
SWITCHROOM	4 / 5	'AC' AND 'SCT' - SEALED
AIR HANDLING	4 / 4	AC' AND 'SCT' - SEALED

## APPENDICES

### 16 APPENDIX A - TERMINOLOGY

#### 16.1 Terminology - General

Standards Australia terms are used supplemented by International Standards Organisation, Associated and Australian Trade Organisations.

<i>Abrasion resistance</i>	<i>Classified by PEI rating from 0 to 5</i>
<i>Australasian HFG or Aus HFG</i>	<i>Australasian Health Facility Guidelines</i>
<i>Building Code of Australia</i>	<i>The regulation controlling construction of all buildings in Australia, and any subsequent amendments or updates</i>
<i>Contamination</i>	<i>Any substance on a walking surface (wet or dry) that may reduce slip resistance, (e.g. water, talc, lotions, oil/fat).</i>
<i>Critical Heat Flux (CHF)</i>	<i>A term used in AS ISO 9239-1 also called Critical Radiant Flux (CRF) in the BCA</i>
<i>Differential movement</i>	<i>Uneven movement of different parts</i>
<i>Disabled facilities</i>	<i>Facilities that are designed for use by people with a disability</i>
<i>Durability</i>	<i>Ability to maintain performance over time (EU Construction Project Directive Directive- CPD 89/106/EEC)</i>
<i>Fire hazard</i>	<i>"The danger in terms of potential harm and degree of exposure arising from the start and spread of fire and the smoke and gases that are thereby generated" (BCA)</i>
<i>Hardness</i>	<i>Classified by Moh's scale from 1 to 10 based on minerals</i>
<i>Heterogeneous</i>	<i>Separate wear layer bonded to a base material</i>
<i>Homogeneous</i>	<i>Uniform composition throughout material</i>
<i>Informative</i>	<i>For information and guidance only (Australian Standards)</i>
<i>Macro-rough</i>	<i>Surfaces with embedded but protruding aggregate or similar material</i>
<i>Micro-rough (rough)</i>	<i>Irregularities in a surface measured in microns - refer to 'Rough'</i>
<i>Natural</i>	<i>Existing in nature - as opposed to artificial or synthetic materials</i>
<i>Non-slip flooring</i>	<i>or 'Safety flooring', possessing slip resistant properties</i>
<i>Normative</i>	<i>Refers to the part integral to the application of an Australian Standard</i>
<i>Patient Care Area</i>	<i>Part of a healthcare building normally used for the treatment, care, accommodation, recreation, dining and holding of patients including a ward and treatment area (BCA)</i>
<i>Pendulum test value (PTV)</i>	<i>Used in BS 7976 Pendulum testers - refer to slip resistance value</i>
<i>Plastic</i>	<i>Synthetic or semisynthetic polymerisation product</i>
<i>Product</i>	<i>Used generically for a manufactured article not a branded article</i>
<i>Profiled surface</i>	<i>A surface with a designed geometric vertical profile</i>
<i>Rough (micro-rough)</i>	<i>Surfaces with a roughness (Rz) measured by a roughness meter</i>
<i>Roughness (Rz)</i>	<i>The measurement of average peak to trough height as measured by a micro-roughness meter</i>
<i>Safety flooring</i>	<i>Refer to 'non-slip flooring'</i>
<i>Slip resistance</i>	<i>Coefficient of friction of floor surface under varying condition and use, determined by an approved test method</i>

<i>Slip resistance value (SRV)</i>	<i>PTV achieved using a Four-S rubber slider</i>
<i>Sub-floor</i>	<i>Surface or building element receiving the applied finish, also referred to as 'Base', 'Substrate'</i>
<i>Sustainable</i>	<i>General non-technical term referring to ESD principles</i>
<i>Vinyl</i>	<i>PVC (polyvinylchloride) - refer to 'Plastic'</i>

## 16.2 Abbreviations

<i>24/7</i>	<i>24 Hours / 7days a week operation</i>
<i>ACCS</i>	<i>Australian Carpet Classification Scheme</i>
<i>ACHS</i>	<i>Australian Council on Healthcare Standards</i>
<i>AgBB/DIBT</i>	<i>German Health Authority task force / German Institute for Construction Technique (VOC emissions)</i>
<i>AusHFG</i>	<i>Australasian Health Facility Guidelines</i>
<i>AWTA</i>	<i>Australian Wool Testing Authority</i>
<i>ANSI</i>	<i>American National Standards Institute</i>
<i>APAS</i>	<i>Australian Paint Approval Scheme</i>
<i>AS</i>	<i>Australian Standard(s)</i>
<i>AS ISO</i>	<i>ISO adopted as an Australian Standard</i>
<i>AS/NZS</i>	<i>Australian and New Zealand Standard(s)</i>
<i>ASTM</i>	<i>American Society for Testing and Materials Standards</i>
<i>BRE</i>	<i>Building Research Establishment, UK</i>
<i>BS</i>	<i>British Standard(s)</i>
<i>CEN</i>	<i>Comité Européen de Normalisation</i>
<i>CIAL</i>	<i>The Carpet Institute of Australia Limited</i>
<i>CIRIA</i>	<i>The Construction Industry Research and Information Association, UK</i>
<i>COF</i>	<i>Coefficient of Friction</i>
<i>CP</i>	<i>Code of Practice</i>
<i>CPD</i>	<i>Construction Products Directive (EEC)</i>
<i>CSIRO</i>	<i>Commonwealth Scientific and Industrial Research Organisation</i>
<i>DDA</i>	<i>Disability Discrimination Act 1992</i>
<i>DR</i>	<i>Draft Australian standard</i>
<i>ECS</i>	<i>Environmental Classification Scheme</i>
<i>EEC</i>	<i>European Economic Community</i>
<i>EMAS</i>	<i>Environmental Management and Auditing Systems (EEC)</i>
<i>EPDM</i>	<i>Ethylene Propylene Diene (synthetic rubber), see SBR</i>
<i>EPGB</i>	<i>The Environmental Performance Guide for Building</i>
<i>EPR</i>	<i>Environment Performance Report</i>
<i>EN</i>	<i>European Norm (Standard)</i>

<i>ESD</i>	<i>Ecologically sustainable development - term used in legislation - includes sustainable design, energy efficiency and similar issues. Also a term used for Electrostatic Discharge.</i>
<i>GAMC</i>	<i>Government Asset Management Committee</i>
<i>GBCAUS</i>	<i>Green Building Council of Australia. (Green Star System)</i>
<i>GECA</i>	<i>Good Environmental Choice Australia Ltd</i>
<i>GEI</i>	<i>GREENGUARD Environmental Institute (USA)</i>
<i>HB</i>	<i>Australian Standards Handbook</i>
<i>HPU</i>	<i>Health Planning Units</i>
<i>HSE</i>	<i>Health and Safety Executive, UK</i>
<i>HSL</i>	<i>Health and Safety Laboratory, UK</i>
<i>IEQ</i>	<i>Indoor Environment Quality</i>
<i>ISO</i>	<i>International Standards Organisation</i>
<i>LCA</i>	<i>Life Cycle Assessment</i>
<i>MRSA</i>	<i>Methicillin Resistant Staphylococcus Aureus</i>
<i>NATA</i>	<i>National Association of Testing Authorities</i>
<i>NF</i>	<i>Normes françaises (French Standards)</i>
<i>NFSI</i>	<i>National Floor Safety Institute, USA</i>
<i>NUCCA</i>	<i>National Upholstery and Carpet Cleaning Association</i>
<i>OHS</i>	<i>Occupational Health and Safety (State and Commonwealth)</i>
<i>PD</i>	<i>Policy Directive (NSW Health)</i>
<i>PEI</i>	<i>Porcelain Enamel Institute, USA</i>
<i>POCT</i>	<i>Point-of-care testing</i>
<i>POFP</i>	<i>Process of Facility Planning (NSW Health)</i>
<i>PSAE</i>	<i>Pseudomonas Aeruginosa</i>
<i>PTV</i>	<i>Pendulum test value</i>
<i>PU, PUR</i>	<i>Polyurethane treatments, Polyurethane reinforced</i>
<i>PVC</i>	<i>Polyvinyl Chloride or 'Vinyl'</i>
<i>RDS, RLS</i>	<i>'Room data sheet', 'Room data sheet' within AusHFG</i>
<i>SBC</i>	<i>Sustainable Buildings Canada</i>
<i>SBR</i>	<i>Synthetic Butyl Rubber</i>
<i>STF</i>	<i>Slips, trips and falls</i>
<i>SRV</i>	<i>Slip Resistance Value</i>
<i>VCT</i>	<i>Vinyl Composition Tile</i>
<i>VOC</i>	<i>Volatile Organic Compound</i>
<i>VRE</i>	<i>Vancomycin-Resistant Enterococcus</i>
<i>WLC</i>	<i>Whole of Life Costing</i>
<i>WLV</i>	<i>Whole Life Value</i>

## **17 APPENDIX B - REFERENCES**

### **17.1 Acts and Regulations**

#### Australian

BCA - Building Code of Australia 2006 edition (as amended)

Disability Discrimination Act 1992, Commonwealth Consolidated Act, Act No. 135 (1992)

NSW Occupational Health and Safety Act, 2000

NSW Occupational Health and Safety Regulations, 2001

Private Hospitals and Day Procedures Act, 1988

Private Hospitals Regulation, 1996

Day Procedures Centres Regulation, 1996

#### International

EMAS Regulation (EC) No 761/2001 - *Environmental Management and Auditing Systems*

### **17.2 Standards**

The Standards listed are limited to those referenced in the text, and those referenced by regulation and these Standards. Standards dealing with test methods, 'determination of properties' etc. is omitted. Check for new Standards, Amendments and Draft Standards.

#### General

AS 1428 *Design for access and mobility*

AS 1428.1-2001: *General requirements for access-New building work*

AS 1428.2-1992: *Enhanced and additional requirements-Buildings and facilities*

AS 1428.3-1992: *Requirements for children and adolescents with physical disabilities*

AS/NZS 1428.4-2002: *Tactile indicators*

AS/NZS 2107-2000: *Acoustics - Recommended design sound levels and reverberation times for building interiors*

SS HB 49.2-1993: *Sporting surfaces*

#### Risk management, safety, environment, quality

AS 2865-1995: *Safe working in a confined space*

AS/NZS 2982.1-1997: *Laboratory design and construction - General requirements*

AS/NZS 4360-2004: *Risk management*

AS/NZS ISO 9000-2006: *Quality management systems - Fundamentals and vocabulary*

AS/NZS ISO 14000 Set-2005: *Environmental Management Standards Set*

AS 4674-2004: *Construction and fit out of food premises*

AS/NZS 4801-2001: *Occupational health and safety management systems-Specification with guidance for use*

AS/NZS 4804-2001: *Occupational health and safety management systems-General guidelines on principles, systems and supporting techniques*

Australian Standards HB 139-2003: *Guidance on Integrating the Requirements of Quality, Environment, and Health and Safety Management System Standards*

Australian Standards HB 260-2003: *Hospital acquired infections - Engineering down the risk*

Australian Standards HB 436-2004: *Risk management guidelines - Companion to*

NF EN ISO 22870-May 2006: *Point-of-care testing (POCT) - Requirements for quality and competence*

#### Slip resistance - flooring

AS/NZS 3661: *Slip resistance of pedestrian surfaces*

AS/NZS 3661.2-1994: *Guide to the reduction of slip hazards*

AS/NZS 4586-2004: *Slip resistance classification of new pedestrian surface materials*

AS/NZS 4663-2004: *Slip resistance measurement of existing pedestrian surfaces*

Australian Standards HB 197-1999: *An introductory guide to the slip resistance of pedestrian surface materials*

#### Resilient flooring

AS 1884-1985: *Floor coverings-Resilient sheet and tiles-Laying and maintenance practices*

BS EN 548:2004. *Resilient floor coverings. Specification for plain and decorative linoleum*

BS EN 650:1997. *Resilient floor coverings. Polyvinyl chloride floor coverings on jute backing or on polyester felt backing or on polyester felt with polyvinyl chloride backing. Specification*

BS EN 651:1997. *Resilient floor coverings. Polyvinyl chloride floor coverings with foam layer. Specification*

BS EN 685:2007. *Resilient, textile and laminate floor coverings. Classification*

BS EN 686:1997. *Resilient floor coverings. Specification for plain and decorative linoleum on a foam backing*

BS EN 687:1997. *Resilient floor coverings. Specification for plain and decorative linoleum on a corkment backing*

BS EN 688:1997. *Resilient floor coverings. Specification for corklinoleum*

BS 1711:1975. *Specification for solid rubber flooring*

BS EN 12104:2000. *Resilient floor coverings. Cork floor tiles. Specification*

#### Ceramic Tiling

AS 2358-1990: *Adhesives - For fixing ceramic tiles*

AS 3958 *Ceramic tiles*

AS 3958.1-1991: *Guide to the installation of ceramic tiles*

AS 3958.2-1992: *Guide to the selection of a ceramic tiling system*

AS 4459 series Parts 1 - 16: *Methods of sampling and testing ceramic tiles*



AS 4662-2003: *Ceramic tiles - Definitions, classification, characteristics and marking*

AS 4992 *Ceramic tiles - Products for installation*

AS 4992.1-2006: *Ceramic tiles - Grouts and adhesives - Terms, definitions and specifications for adhesives*

AS 4992.3-2004: *Ceramic tiles: Products for installation - Grouts: Definitions and specifications*

BS 6431: *Ceramic floor and wall tiles*

#### Textile floor Coverings

AS/NZS 1385-2007: *Textile floor coverings - Metric units and commercial tolerances for measurement*

AS/NZS 2450-1994: *Textiles - Natural and man-made fibres - Generic names*

AS/NZS 2454-2007: *Textile floor coverings - Terminology*

AS/NZS 2455 *Textile floor coverings - Installation practice*

AS/NZS 2455-2007: 1: Part 1: *General*

AS/NZS 2455.2-2007: Part 2: *Carpet tiles*

AS/NZS 2622-1996: *Textile products - Fibre content labelling*

AS/NZS 2914-2007: *Textile floor coverings - Informative labelling*

AS/NZS 3733-1995: *Textile floor coverings - Cleaning maintenance of residential and commercial carpeting*

AS 4288-2003: *Soft underlays for textile floor coverings*

#### Other floor coverings

BS EN 13748-1 *Terrazzo tiles. Terrazzo tiles for Internal use.*

### **17.3 Guidelines and Directives**

Australasian HFG (Health Facility Guidelines) [www.fbe.unsw.edu.au/chaa](http://www.fbe.unsw.edu.au/chaa)

*Part A- Introduction and Instructions for Use*

*Part B- Health Facility Briefing and Planning*

*Part C- Design for Access, Mobility, OHS and Security*

*Part D- Infection Prevention and Control*

*Part F- Project Implementation (FF and E) - Reference document*

*Standard Facility Cost Planning Guidelines - Reference document*

*Standard Components Room Data Sheets (RDS)*

NSW Health Publications [www.health.nsw.gov.au](http://www.health.nsw.gov.au)

*Infection Control Policy - PD2007\_036, 2007*

*Infection Control Policy: Prevention & Management of Multi-Resistant Organisms (MRO) – PD 2007\_84, 2007*

*High Environmental Performance for Buildings*, Policy Directive PD2005\_306 2005

*Workplace Health and Safety - A Better Practice Guide*, NSW Health Department, Circular 2001/22

*Management in Health Facilities* - NSW Health Department, December, 2003

Australian Council on Healthcare Standards [www.achs.org.au](http://www.achs.org.au)

ACHS 14-2001: *Fundamentals for Infection Control*

ACHS 720-1999: *Fundamentals for Operating Suites*

## **17.4 Technical Publications and Further Reading**

### General

*Age and Aging Vol 33 No 3 - British Geriatrics Society 2004*

Bowman, R 2003, *Designing for slip resistance*, Melbourne, CSIRO

BRANZ 018-2000 - *Selecting Flooring*, BRANZ, NZ

Carpenter, J Lazarus, D Perkins, C 2006, *Safer surfaces to walk on - Reducing the risk of slipping C652*, CIRIA, London

Davis Langdon, 2005, Info Data series, *Safe Design* [www.davislangdon.com](http://www.davislangdon.com)

Edwards, S Bartlett, E & Dickie, I 2000, *Whole life costing and life-cycle assessment for sustainable building design*, BRE Press, UK

Makison, C Swan, J 2005, R&D Project B (03)02, *The effect of humidity on the survival of MRSA on hard surfaces*, Health and Safety Laboratory (NHS Estates), Department of Health, UK.

NATSPEC, Specifications and Technical Notes (various), Construction Information Systems Ltd  
[www.natspec.com.au](http://www.natspec.com.au)

NSW Department of Commerce, Office of NSW Procurement, *Government, Contract 295 - Floorcoverings and Window Furnishings*, [www.contractservices.nswp.commerce.nsw.gov.au](http://www.contractservices.nswp.commerce.nsw.gov.au)

Ozanne-Smith, J., Guy, J., Kelly, M. and Clapperton, A. 2008, *The relationship between slips, trips and falls and the design and construction of buildings*, Melbourne: Monash University Accident Research Centre.

Tile Association 2004, *Slip resistance of hard floors*, The Tile Association, London, UK

Waterman, A Bourke K, 2004, *Whole Life Value: sustainable design in the built environment*, BRE Press, UK.

### Sustainability, Indoor Air Quality

AgBB/DIBT, *Health related Evaluation Procedure for Volatile Organic Compound Emissions (VOC and SVOC) from Building Products*, Germany, [www.eurofins.com](http://www.eurofins.com)

BDP (Building Design Professionals), *Environment Design Guide*, Royal Australian Institute of Architects, [www.architecture.com.au](http://www.architecture.com.au)

Building Research Establishment, BRE *Environmental profiles of construction materials - website for the Centre for Sustainable Construction*, BRE, UK, [www.bre.co.uk](http://www.bre.co.uk)

Davis Langdon 2004, Info Data series, *The Cost of Going Green* <[www.davislangdon.com](http://www.davislangdon.com)

Department of the Environment and Heritage 2001, *State of Knowledge Report: Air Toxics and Indoor Air*

*Quality in Australia*, Commonwealth of Australia [www.environment.gov.au](http://www.environment.gov.au)

GECA, Final Standard No: GECA 07-2006, Issued: 1 April 2006, *The Australian Ecolabel Program, Australian Voluntary Environmental Labelling Standard, Wool Pile, Wool Blend and Modular Wool Carpet*, Good Environmental Choice Australia Ltd

## **17.5 Organisations and Trade Associations**

Information is available from:

Australian Tile Council, [www.austriantilecouncil.com.au](http://www.austriantilecouncil.com.au)

Australian Paint Approval Scheme (APAS), [www.apas.gov.au](http://www.apas.gov.au)

BRANZ Ltd, [www.branz.org.nz](http://www.branz.org.nz)

Building Research Establishment UK (BRE), [www.bre.co.uk](http://www.bre.co.uk)

Centre for Health Assets Australasia (CHAA), [www.chaa.net.au](http://www.chaa.net.au)

Construction Industry Research & Info Assoc UK (CIRIA), [www.ciria.org](http://www.ciria.org)

Ecospecifier, Australia, [www.ecospecifier.org](http://www.ecospecifier.org)

GECA, Good Environmental Choice Aust Ltd, [www.aela.org.au](http://www.aela.org.au)

The Green Building Council of Australia (GBCAUS), [www.gbcaus.org](http://www.gbcaus.org)

Green Globes, [www.greenglobes.com](http://www.greenglobes.com)

GREENGUARD Environmental Inst. (GEI), USA, [www.greenguard.org](http://www.greenguard.org)

HSE (Health and Safety Executive), [www.hse.gov.uk](http://www.hse.gov.uk)

Infotile, Ceramic Tile Industry Organisation, [www.infotile.com.au](http://www.infotile.com.au)

NSW Department of Commerce / NSW Procurement - Contracting Services, [www.commerce.nsw.gov.au](http://www.commerce.nsw.gov.au)

Sustainable Buildings Canada (SBC), [www.sbcanada.org](http://www.sbcanada.org)

The Resilient Floor Covering Institute (RFCI), [www.rfci.com](http://www.rfci.com)

The Vinyl Council of Australia (VCA), [www.vinyl.org](http://www.vinyl.org)

## **18 APPENDIX C - FIRE HAZARD PROPERTIES**

Refer to the current BCA Specification C1.10a *Fire Hazard Properties - Floors, Walls and Ceilings, Tables 1 and 2* for the fire hazard properties for flooring and wall lining application in buildings with and without sprinklers.

## **19 APPENDIX D - SLIP RESISTANCE**

### **19.1 Standards**

The following Australian Standards cover requirements relating to the slip resistance of floor surfaces:

AS Handbook HB 197: *An introductory guide to the slip resistance of pedestrian surface materials* provides a general explanation of the subject with flooring selection and classification guides. Written as a 'guide' for information use only, it is designed to assist in the use of the principal Standard AS/NZS 4586.

AS/NZS 4586: *Slip resistance classification of new pedestrian surface materials* provides the various classification groups and recognised test methods.

AS/NZS 4663: *Slip resistance measurement of existing pedestrian surfaces* is concerned with methods of testing, and is commonly used in auditing existing surfaces.

Note: Standards are subject to regular review and should be checked for currency when used.

## 19.2 Slip Resistance - Test methods

The test methods currently employed in the Australia Standards with the various classifications relating to each method are summarised below.

### 1. Wet Pendulum Test

Classifications indicate the contribution of the floor to the risk of slipping when wet.

V - Very low (risk)  
W - Low  
X - Moderate  
Y - High  
Z - Very high

The descriptions of the classifications are from HB 197 Table 2. Table 1 adds to the interpretation of these definitions. The wet pendulum test method is based on a risk management approach.

The test methods can use 'Four S rubber' or 'TRL rubber' sliders, the method used to obtain the mean value must be stated. Refer AS/NZS 4586 (Draft DR07066CP) Table 2 for value ranges.

Note: May not be applicable to heavily profiled surface with a high slip resistance.

### 2. Dry Floor Friction Test

F - Floor friction tester value COF (Coefficient of friction)  $\geq 0.40$   
G - Floor friction tester value COF  $< 0.40$

Note: May not be applicable to heavily profiled surface with a high slip resistance.

### 3. Wet Barefoot Ramp Test

The classification indicates the range of the ramp inclination (in degrees) allowing a safe limit in walking:

A -  $\geq 12^\circ < 18^\circ$   
B -  $\geq 18^\circ < 24^\circ$   
C -  $\geq 24^\circ$

### 4. Oil-Wet Ramp Test.

Similar to the wet ramp but uses special footwear and engine oil of specified viscosity.

R9 -  $\geq 3^\circ < 10^\circ$   
R10 -  $\geq 10^\circ < 19^\circ$   
R11 -  $\geq 19^\circ < 27^\circ$   
R12 -  $\geq 27^\circ < 35^\circ$   
R13 -  $\geq 35^\circ$

Note: These test figures (widely used a 'general' rating) represent one condition affected by variables such as tester's gait, practice on ramp, posture and weight. An 'R10' test result may be almost an R9 at worst or R11 at best.

### 5 Displacement Volume Test

This measures the size of the displacement space of severely profiled/structured surfaces. Values given as 'Surface related minimum volume of Displacement space'.

V4 - 4 cm<sup>3</sup>/dm<sup>2</sup>  
V6 - 6 cm<sup>3</sup>/dm<sup>2</sup>

V8 - 8 cm<sup>3</sup>/dm<sup>2</sup>  
V10 - 10 cm<sup>3</sup>/dm<sup>2</sup>

Note: Applicable to floors in industrial work areas subject to contamination. Used in conjunction with oil-wet ramp test values for commercial and industrial areas. Refer SAA HB197 Table 5.

#### **Additional proposals for AS/NZS 4586 (Refer to AS Draft DR07066CP)**

Appendix F: Surface roughness method of measurement

Note: The peak to trough roughness  $R_z$  is measured with an approved testing device, provides a quick and convenient method of testing existing surfaces to provide a Surface roughness value SRV, (unsuitable for very rough or profiled surfaces).

#### **Appendix G: Slope design value (SDV) and slope correction value (SCV) determination**

Note: Tables are provided for the calculation of SDV and SCVs.

#### **Appendix H: Pedestrian selection flooring guide for normal conditions**

Note: Revises and expands existing *SAA HB 197, Table 3* for minimum pendulum and ramp test recommendations.

### **19.3 Slip resistance - General**

AS/NZS 4586 (Draft revision DR07066) proposes that internal pedestrian surfaces subject to a reasonably foreseeable risk of contamination (water or other) be classified by at least one of methods 1, 2 or 3 listed above. Additional requirements and qualifications apply.

The recommendations in *SAA HB 197* should be read in conjunction with *AS/NZS 4586. Appendix H: Pedestrian selection flooring guide for normal conditions*, revises and expands *Table 3 in SAA HB 197* for minimum pendulum and ramp test recommendations.

Heavily profiled surfaces and junctions should be considered with reference to trip hazards as described in *AS 1428 parts 1 and 2* under walkways and ramps.

## 20 APPENDIX E – INFECTION CONTROL RISK CATEGORIES

Reproduced from NSW Health, *Infection Control Policy - PD2007\_036*,

Section 5, Table 11. *Functional areas categorised according to risk.*

VERY HIGH RISK	HIGH RISK	MODERATE RISK	LOW/MINIMAL RISK
OPERATING THEATRES	EMERGENCY DEPARTMENT	GENERAL WARD	ADMINISTRATIVE AREAS
INTENSIVE CARE UNIT	CENTRAL STERILIZING SERVICE DEPARTMENT (CSSD) AND STERILE SUPPLY AREAS	LEVEL 1 NURSERY	NON-STERILE SUPPLY
LEVEL 2 AND 3 NURSERIES		KITCHENS	RECORD STORAGE AND ARCHIVES
SPECIAL NEEDS AREAS, (E.G. PATIENTS WHO ARE IMMUNOSUPPRESSED, HAEMODIALYSIS UNITS AND AREAS USED FOR INSERTION OF CENTRAL VENOUS CATHETERS)	MICROBIOLOGY LABORATORIES	CAFETERIA	ENGINEERING WORKSHOP
WARD INVOLVED IN AN OUTBREAK OF A TRANSMISSIBLE DISEASE OR INFECTION		LABORATORIES	PLANT ROOMS
		MEDICAL IMAGING (UNLESS PERFORMING INVASIVE PROCEDURES)	EXTERNAL SURROUNDS
		PUBLIC THOROUGHFARES	
		OUTPATIENT CLINICS	
		PATHOLOGY	
		PHARMACY	
		PROCEDURE ROOMS	
		TREATMENT ROOMS	
		WAITING ROOMS	
		MORTUARY AREA	
		AMBULANCE	

Note: Risk categories can be changed during outbreaks or epidemiologically significant states.

## 21 APPENDIX F - TEXTILE FLOOR COVERINGS

### 21.1 Carpet Classification

The *Australian Carpet Classification Scheme (ACCS)* is a voluntary industry labelling and grading scheme for textile floor-coverings manufactured in Australia or imported for use within Australia. The ACCS is managed by the Carpet Institute of Australia (CIAL).

Under the Scheme, textile floor coverings are classified in accordance with the *ACCS Technical Guidelines*. The ACCS is a multi-fibre grading scheme providing information on carpet quality and performance in terms of durability and appearance retention. The ACCS is a registered Certification Trademark Scheme.

Refer: *ACCS, 2006, Australian Carpet Classification Scheme Technical Guidelines*.

Carpet qualities are classified under the *ACCS labelling system* according performance under expected traffic loadings in standard site conditions.

Note: Pure wool and wool blend carpets can also be classified under the *Woolmark/Woolmark Blend Scheme*. No differences in classifications assigned by the three Schemes are expected. It is anticipated that carpets complying with *Woolmark/Woolblendmark* and ACCS requirements should carry both classification levels.

The performance or useful life of a carpet may be described as appearance retention properties rather than simply wear in the sense of fibre loss. Appearance retention refers to the ability of a carpet to resist excessive or premature appearance loss - usually seen as flattening, loss of texture or structure, colour change or pattern loss. Appearance retention also takes into account the ability of the carpet to resist or conceal soiling.

The *ACCS, 2006, Code of Practice for Environmental Management*, provides a guide to good environment management in all aspects of carpet manufacturing and the subsequent carpet life cycle performance.

#### Classification Categories and Points

The residential labels feature a six-star system - the more stars the better the durability and appearance retention properties of the graded carpet.

- 1 star - Light Duty
- 2 stars - Medium Duty
- 3 stars - Heavy Duty (lower to mid range)
- 4 stars - Heavy Duty (mid to higher range)
- 5 stars - Extra Heavy Duty (lower to mid range)
- 6 stars - Extra Heavy Duty (mid to higher range)

The contract/commercial labels provide a four star rating system.

- 1 star - Light Duty
- 2 stars - Medium Duty
- 3 stars - Heavy Duty
- 4 stars - Extra Heavy Duty

These ratings are based on points awarded (100 point total) in assessment of the following properties, each having a maximum number of points from 5 to 20 points:

- Surface pile mass/Pile Height
- Volume density
- Tuft density
- Dynamic loading
- Static loading
- Propensity for soiling
- Abrasion resistance

Discretionary points awarded by the assessment panel include: Yarn twist, set, appearance and construction, Pile construction and character, Special properties.

The methods of testing and calculation of the points is fully explained in CIAL literature and beyond this document.

Refer: *ACCS, 2006, Australian Carpet Classification Scheme Technical Guidelines,*

## **21.2 Carpet Labelling**

Refer to *AS/NZS 2914-2007: Textile floor coverings - Informative labelling.*

## **21.3 Carpet Construction**

Refer: *AS 2454: Textile Floor Coverings - Terminology* for comprehensive descriptions and cross-section diagrams of carpet construction.

The descriptions below are extracts from Carpet Institute of Australia - *Understanding Carpet*, [www.carpetinstitute.com.au](http://www.carpetinstitute.com.au)

### **21.3.1 Types**

There are three main types of carpet produced in Australia: Woven carpet, tufted carpet and modular carpet.

#### **Woven**

This is the traditional method of making carpet. Woven carpet is sometimes referred to Axminster or Wilton (type of weaving looms). Compared to tufting, woven carpet manufacturing is slower, more labour intensive and more expensive than tufted carpet, but with unlimited designs, woven carpet is used for prestige installations and where intricate patterns, custom design work and durability are important.

#### **Tufted**

The tufting process is similar to the action of a sewing machine; yarn is sewn into the backing cloth, forming loop pile carpet, cutting the top of the loop produces cut pile carpet. The tufted backing cloth (whether loop or cut pile) has synthetic latex adhesive applied backing and a secondary backing fabric is then attached to stabilize the carpet.

#### **Modular (Tiles)**

Modular carpet or carpet tiles are produced by inserting tufts into a PVC or bitumen compound which has been coated onto a backing fabric. Modular carpet is produced mainly for the contract market.

#### **Bonded Carpet**

There are many variations on this basic principle of bonding pile fibres or yarns to a supporting fabric base. Bonded carpets offer:

- greater use of pile yarn/fibre
- use of shorter fibres
- no secondary backing delamination
- high output efficiency

#### **Flocked Carpet**

Flocked carpets are a type of bonded carpet where individual fibres are embedded end-on into an adhesive



coated backing cloth by applying an electrostatic charge. The length of the fibre is generally limited to 2-3 mm.

#### Needle Punched Carpets

Needle punching is the principal method of producing mechanically bonded fabric. This process is also known as needle-felting or needle-bonding. The high rate of production of needle-punched fabric, and elimination of spinning, enables needle-punched carpets to be produced at relatively low cost.

#### 21.3.2 Carpet Styles

The CIAL website also cover various cut pile and loop pile styles under *Carpet Styles*, only those applicable to Healthcare use have been reproduced here.

##### Level Loop

A simple loop pile with tufts of equal height normally in a 'tight' construction using fairly fine yarn. Other Loop Pile Styles include, Sisal, Cord, Multilevel Loop, Textured Loop.

##### Cut Pile

There are different classifications of cut pile carpets, and these refer mainly to the twist level of the pile yarn and description of the pile length.

##### Velvet

Both velour and velvet have a short pile length. The loop lines can be either uniform in height or a sequence of alternating low and high loop rows. Velvet yarn has very little twist and may not be heat set. The pile tufts are burst similar to velour but velvet has a slightly longer pile length.

Other Cut Pile Styles include Velour, Plush, Saxony, Hard Twist / Frieze, Shag, Twist, Heather Twist.

### 21.4 Laying and installation

The principle methods for installing carpet are outlined below:

#### Direct-stick

Direct-stick is the method most suitable for broadloom, strip and carpet tiles in the majority of healthcare applications. An adhesive is used to fix the covering directly to the sub-floor without an underlay; this method is not suitable for all carpet types.

For carpet tiles a pressure sensitive adhesive can be used which remains permanently tacky allowing for tile removal and replacement.

In the absence of an underlay and the cushioning effect some carpet types may have a reduced lifespan. Acoustic qualities will be reduced but hygiene and the ease of pedestrian and wheeled movement is improved. Correct preparation of the sub-floor surface is essential.

#### Double-bond

The most common method now used for installing broadloom for commercial use. Underlay is fixed to the sub-floor with adhesive before installing the carpet by direct-stick.

Stretching and delamination in use are avoided by correct specifying and installation. Patterns may be difficult to match at seams since stretching is not used in installation.

Applicable to areas requiring additional acoustic absorption of underfoot comfort, e.g. board rooms, worship/reflection, staff overnight stay.

#### Carpet gripper system

A traditional method for more economic rather than double-bond used for broadloom and woven carpets where an underlay is used. One or two rows of gripper strips are fixed to the sub-floor continuously around the perimeter of the area; the underlay is then attached to the sub-floor by tape or spot fixing methods depending on the underlay type. Carpet is laid over the underlay and held by the gripper strips after tensioning or stretching.

Refer: AS/NZS 2455 *Textile floor coverings - Installation practice. Part 1: General, Pt 2: Carpet tiles. AS 4288: Soft underlays for textile floor coverings*

### **21.5 Textile Floor Coverings - Testing**

The AS/NZS 2111 series, *Textile floor coverings - Tests and measurements* covers the range of test available, these are listed in Part 0: *Introduction and list of methods*. Imported products that have been tested to overseas Standards may require testing to Australian Standards for compliance with regulations, or for evaluation and validation.

### **21.6 Textile Floor Coverings - Major Technical Features**

The following carpet properties and performance are covered in ACCS, 2006, *Australian Carpet Classification Scheme Technical Guidelines*, The Australian Carpet Classification Scheme:

- surface pile mass/pile height ratio
- volume density
- tuft density
- dynamic loading
- static loading
- propensity for soiling
- abrasion

Extract from *Australian Carpet Classification Scheme Technical Guidelines*:

*It is now widely held that the performance or useful life of a carpet is determined by appearance retention properties rather than simply wear in the sense of fibre loss. Appearance retention refers to the ability of a carpet to resist excessive or premature appearance loss - usually seen as flattening, loss of texture or structure, colour change or pattern loss.*

*Appearance retention also takes into account the ability of the carpet to resist or conceal soiling.*

*The ACCS Panel believes that there is as yet no definitive test or tests to accurately predict the appearance change in a carpet which can occur in actual use.*

## **22 APPENDIX G - CERAMIC TILING**

### **22.1 Properties**

AS 4662: *Ceramic tiles - Definitions, classification, characteristics and marking*, classifies tiles into groups according to their method of manufacture (shaping), and their water absorption.

Manufacturing 'Method A' covers extruded tiles, 'Method B' covers dry pressed tiles suitable for interior wet areas. 'Water absorption E' is classified into the following groups 1 (*low*), 2 (*medium*), and 3 (*high*), these are be divided into sub groups.

The properties within each tile group are then defined under the headings:

- dimensions and surface quality
- physical properties
- chemical properties.

Each of these headings contains a range of characteristics such as:

- surface flatness
- water absorption
- breaking strength
- abrasion resistance
- coefficient of linear thermal expansion (including crazing resistance)
- coefficient of friction
- impact resistance
- resistance to staining
- resistance to chemicals.

*Annex N* provides a classification of glazed tiles for floors according to their *abrasion resistance* (PEI); this ranges from 'Class 0 - glazed tiles' not recommended for use on floors, to 'Class 5 - glazed tiles' suitable for severe pedestrian traffic over sustained periods.

## **22.2 Grouts and Sealants**

*AS 4992.3: Ceramic tiles: Products for installation - Grouts: Definitions and specifications* classifies grouts into 2 types, 'Cementitious grout' (CG) (including liquid admix or latex additive), and 'Reaction resin grout' (RG). These are further divided into classes such as 'normal', 'improved' and 'fast setting', each having a list of minimum performance requirements.

## **22.3 Bedding - Adhesive**

Refer to *AS 4992.1: Ceramic tiles - Grouts and adhesives - Terms, definitions and specifications for adhesives*, for types and classes of thin bed adhesive.

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