

Better spatial acoustics in acute clinical environments: overcoming the infection control challenges in material selection

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Abstract

Published research has established that noise creates adverse effects on patients and staff in acute clinical areas. While the extent of building insulation in the form of walls and doors is frequently not that critical to patient care, the operational noise produced by actual healthcare activities has much more acute effects on patient and staff wellbeing. Evidence exists to show the genuine benefit that acoustic absorbers can have on staff attitudes, patient care and actual medical outcomes. However the actual implementation of absorptive surfaces to reduce reverberation and operational noise is commonly assumed to be an infection risk due to porosity of the surfaces and absorption is subsequently omitted.

Through surveys of infection specialists, designers and literature review, evidence suggests that concerns about infection spread via acoustic ceilings and well designed panels are not well founded for most clinical spaces. Cleaning and infection specialists expectations and procedures do not always align with architectural and acoustic design approaches. The result is missed opportunities to improve patient care without inheriting undue risk for spread of infection.

Common ground exists between improved clinical outcomes, infection control needs (as set out in the Centre for Disease Control and Australasian Health Facility guidelines) and absorptive acoustic products. To reach this common ground, acoustic designers must be conscious of how the personal experience of key healthcare stakeholders can have significant influence on the assumptions and expectations. Acoustic designers need to actively seek guidance from key stakeholders to get an understanding of their specific goals to determine if absorbers can help achieve these goals. For facilities managers, designs that improve re-admission rates are critical. For cleaning and infection control managers, continuity of established cleaning processes and materials that can be wiped down are critical. Failure to convince these stakeholders of the proven benefits for better spatial acoustics will mean more missed opportunities to improve genuine healthcare outcomes.

Keywords: hospitals, infection control, absorbers, AUSHFG, CDC, ceiling tiles

Originally published in the Proceedings of Inter-noise 2017, Hong Kong.

1. Introduction

The need to control the passage of infection is well understood when designing new healthcare projects. However design consultants seem to have a lesser level of understanding among of how to effectively balance this requirement in conjunction with other important aspects. The author's experience of continual involvement in multiple healthcare projects across 13 different hospital sites across New Zealand and Australia over 15 years is that very few design team members have a detailed understanding of which acoustic products will actually pose an infection control risk and which will not. On one hand, this is not surprising as the design team members have their own specialties which are focused in other areas such as architecture, building services or acoustics. At the same time however, good design teams will avoid making assumptions about design requirements when it comes to key user group decisions and requests. The user group consultation and costing processes should ensure that the design team makes no assumptions in understanding the user expectations while balancing the costs of the design with available capital budget.

It is common for acoustic designers to find stiff resistance from healthcare stakeholders or design team members to their ideas of introducing absorptive products in acute care or other spaces because of perceived infection control risks. Yet the question about what those risks may actually be and how they can be managed seems to generally go unanswered in any detail. The general industry understanding appears to be relatively limited to an expectation that anything less than a hard and impervious surface such as plasterboard, vinyl or glass, represents a degree of compromise for infection control. While this is certainly the author's experience, a review of available publications advocating for hard surfaces out of caution shows a similar trend elsewhere. Some typical advice for design teams is:

Acoustics in Healthcare Environments¹:

- Understand that many of the design strategies used for infection control in healthcare environments can have a negative effect on the acoustic environment if not carefully considered. For example, hard surfaces are often specified for their cleanability but these

¹ Ceilings and Interior Systems Construction Association

surfaces often reflect sound, creating reverberation -

UK Health Technical Memorandum:08-01

- Appropriate acoustic treatments can have a dramatic effect on the acoustic comfort in a room. However, the treatments have to be used with care because of the potential implications of infection control, cleaning, impact damage etc. Sound-absorbent treatment should be provided in all areas (including all corridors), except acoustically unimportant rooms (for example storerooms etc), where cleaning, infection-control, patient-safety, clinical and maintenance requirements allow.

Thus, a contentious designer, who wishes to advocate an absorptive treatment to an acute care space, knows infection control is important but has very little guidance on how to demonstrate they have addressed these valid concerns.

The acoustic designer advocating for a well considered sound absorber is likely to be challenged about their recommendation due to historical bias, uncertainty or concern of additional costs. This may occur across a range of key decision makers both in the design team and the wider project team. Because of the real risks that infections pose to patients and healthcare staff, these decision makers are rightly cautious about untried techniques and designs. They perhaps view acoustics as significantly less important to the project's successful outcomes than the need to prevent any possible risk of infectious growth in the absorber. Without understanding these valid concerns, the acoustic advisor or other key design team members cannot address them. Without the concerns addressed, architects and project teams will understandably avoid documenting a 'risk item', preferring to defer to a safer solution of hard finishes that are known to be cleanable.

But this level of understanding does a disservice to previously published acoustic research. This forms a significant basis for justifying the benefits of spatial acoustic treatments that are often omitted, possibly ahead of many other sound insulation items that incur much more significant capital costs but are potentially less warranted. It is not the author's intent in this paper to further add to the objective evidence base to argue for better spatial acoustics outcomes, but rather to provide guidance on how to translate these conclusions into more facilities in a way that still addresses concerns around infection control.

Therefore, if acoustic designers are to successfully engage key decision makers to build an appropriate facility that properly balances acoustic finishes and infection control, they need to:

1. Understand the basic principles of infection control and cleaning to identify appropriate products

2. Gain a greater understanding of where these recommendations will be appropriate
3. Make the decision makers aware of the significant number of studies that show genuine healthcare benefits for improved absorption.
4. Ensure they understand who the key decision makers are and what their concerns are. Specifically, what is the healthcare provider's approved cleaning regime for wall and ceiling finishes.
5. Answer the concerns of key decision makers in a way that clearly states the benefits and manages concerns.

2. What evidence exists?

Some acoustic designers may feel the level of engagement outlined above is excessive when compared to their usual scope on similar sized projects in the residential or commercial building sectors. Accordingly, it is worth considering the reasons why acoustic designers should embark on such a process at all. The answers lie across a number of previously published papers however an extensive summary of building aspects by Salonen et al (2013) noted the following:

Among patients, noise is one of the features of the ambient environment that patients complain about most frequently (Ulrich et al. 2008). Studies have found that among patients, reduced noise levels (e.g. by using noise-reducing finishes such as high-performance sound absorbing ceiling tiles or by using architectural features such as single-bed patient rooms and short corridors (Joseph and Ulrich 2007; Ulrich et al. 2008)) improve sleep, reduce annoyance, improve satisfaction, reduce both pain and the use of pain medications, decrease psychological and physiological stress, reduce emotional exhaustion, reduce headaches, promote better communication between patients and family members, enhance patient privacy and confidentiality, improve safety (reduce medical errors committed by staff), decrease heart and respiratory rates, decrease blood pressure, increase oxygen saturation, decrease confusion and disorientation, shorten recovery time and hospital stays, and reduce re-hospitalization.

A summary of the specific benefits of absorptive surfaces from Ulrich and Joseph (2007) has further collated some previous evidence noting in summary:

At least three studies have shown that installing high-performance sound-absorbing ceiling tiles and panels results in reduced noise levels and perceptions of noise and impacts other outcomes such as improved speech intelligibility and reduced perceived work pressure among staff (Berens and Weigle 1996; Blomkvist et al. 2005; MacLeod et al. 2006; Hagerman et al. 2005). Though decibel levels were not greatly reduced as a result of the ceiling-tile intervention in these studies (reduction of 3 to 6 dB(A)), reverberation times and sound propagation were significantly reduced. This impacted the perception of the unit being less noisy and also improved speech intelligibility, which has implications for

2.1 The evidence for acoustic absorption

Acoustic designers for healthcare space are encouraged to review the extensive range of papers available prior to embarking on the design of any sort of acute facility. While there is a particular need to do so to understand the specialist requirements such as Neonatal Intensive Care Wards (NICU), Audiology, Burns, Birthing, and MRI, designers should not lose sight of the need to still actively design for good patient outcomes in more typical inpatient areas.

Extensive survey work has been completed by a number of authors. A comprehensive and consistent survey of 4 UK hospitals' inpatient areas was documented by Shiers (2011). Her conclusions about the worst noise issues are consistent with other reviews that identified difficulty sleeping due to excessive noise events that is a regular complaint in many hospitals. The sources of noise in question are invariably related to operational effects such as staff, clinical equipment, patients and visitors. The Building Services noise, room to room sound isolation (provided doors are closed) and even external environmental noise sources rarely, if ever, make it onto complaint lists. It is informative to note that the hospitals surveyed were all completed prior to the HTM 08-01 document being published so are highly likely to represent a much lower level of sound isolation than this document requires.

From a purely building design perspective, the simple acoustic solution to reduce the disturbing effects of many of these internal sources would be to introduce acoustic absorption. However adding new finishes incurs capital costs that may not have been budgeted for and may raise concerns if there is a lack of information about how to introduce absorption safely. Professional architects and acoustic engineers are likely reluctant to advance an acoustic design where they suspect patient safety may be compromised. Therefore, acoustic designers engaged to minimize the cost and maximize the health benefits of their designs should have a keen desire to introduce absorptive surfaces as a top priority.

Within reason, the survey evidence of patient annoyance indicates that improving spatial acoustics should take precedence over some of the more traditional sound isolation goals that are often set. For example, HTM 08-01 recommends a sound isolation rating of DnTw 47 between single bedrooms. This requires a substantial wall in the order of STC/Rw 52-55, heavy upgrades to in-ceiling services, upgrades to façade connections and improvements to the corridor walls/doors. All of these are a significant capital expenditure but will be rendered largely useless if the typical nursing practice of maintaining open doors is followed. By contrast, improvements to

absorption will reduce the noise levels of all manner of activities, staff and other patients. The Hagerman et al study (2005) of a Coronary Care Unit that simply switched from reflective tiles to absorptive tiles also noted among a range of other subjective improvements that patients treated during the period that the unit had absorptive tiles considered that the staff attitude was much better than the reflective tile period.

3. Project decision makers: Who are they and what are their key concerns

Just as there is no fixed staff structure that applies to all health care projects there is no specific person that needs to make the decision on the wall and ceiling finishes. Most designers will be engaged via the department of the health care provider that deals with projects. This arm often goes by different names including:

- Capital works
- Facilities
- Projects
- Estates
- Assets

Interviewees for this research indicated that the Project decision makers (the lead client contact at the hospital and the wider group they report to) will be looking most closely at re-admission rates, bed days and the balance of capital vs operational expenses. Hagerman et al's 2005 study noted significantly reduced re-admission rates attributable to absorptive ceilings.

By contrast, the key people that best understand infection control and cleaning procedures will generally be in a different department that consults with the projects department. During this research, it was noted that the infection control and cleaning teams were found to be part of any one of the following departments depending on the particular hospital structure.

- Pathology
- Product Safety Infrastructure Group
- Clinical Support or Operations
- Laboratories
- Chief Nursing Officer
- Community/Commercial/Support Services

Interviewees for this research indicated that the infection and cleaning specialists will be looking most closely at how the acoustic product will be cleaned and whether it will require any specialist approaches.

However, during the interviews, a trend was noted that the extent and, more crucially, the timing to which infection control advice is provided on a new project can vary greatly. Some interviewees noted examples (unrelated to acoustics) of late identification of an issue at construction stage had the potential for significant disruption to the project whereas early queries could have streamlined resolution. For the acoustic advisor who is

considering recommending a spatial absorber that may be contentious, it is recommended that they actively seek out any potential concerns during the preliminary design stage. This should firstly be sought from the health care planner and then secondly from the operations/cleaning team. It should be noted that if the health planner is not able to be convinced of the benefits and means by which concerns could be allayed, the remainder of the economic and user group decision makers are likely to be similarly unenthusiastic about the proposal.

3.1 Approved cleaning regimes

A key aspect that acoustic advisors must appreciate is that hospitals need rigid cleaning procedures so as to ensure all necessary cleaning occurs. Therefore new products that require different cleaning methods are likely to be harder to obtain approval for, if it means a new procedure is required. Acoustic advisors finding resistance to the introduction of wall panels should enquire with the project’s Health Planner first and foremost who can advise on the cleaning procedures that will be used for the walls. Some hospitals may stipulate the cleaning methods that will be used and the infection control team will advise on whether products can be accepted by comparing proposals to the cleaning methods. Conversely other health care providers will take a less prescriptive approach and may simply want to know from the project team what the

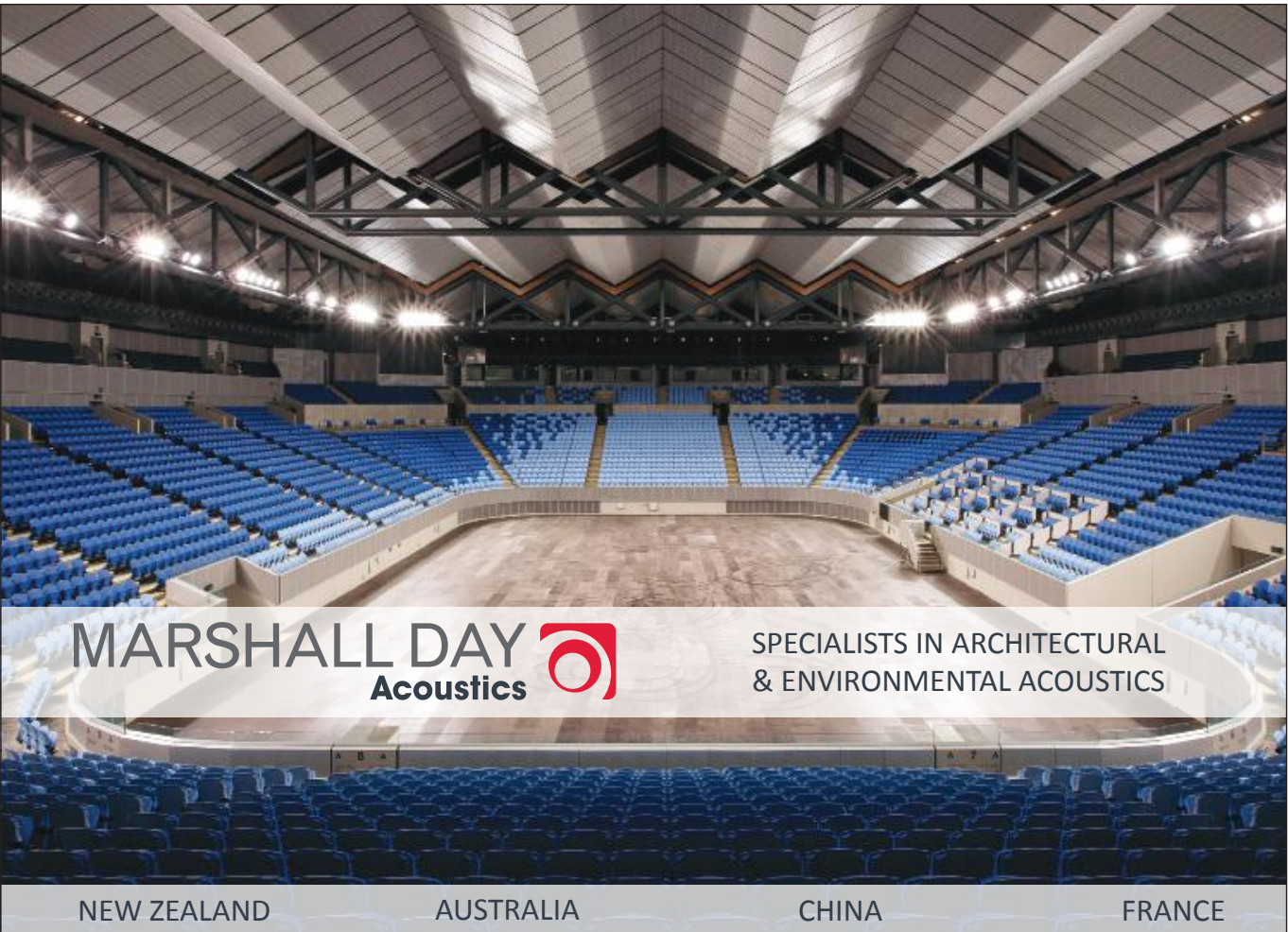
cleaning requirements will be.

4. How do designers avoid possible ‘negative effects’?

Interviewees for this paper noted that the personnel in cleaning or infection control specialist roles often come from a wide variety of backgrounds. This in turn brings a wide variety of responses to new concepts such as softer finishes in clinical areas that have traditionally been plasterboard. If infection and cleaning specialists appear to be resisting the use of soft finishes, it should be remembered that there can never be a zero risk in any patient space because of the necessary movement in and out of the room of healthcare staff and visitors etc.

Successful healthcare is known to not solely rely on good medical procedures and infection control but also getting the right balance on a wide range of environmental² (acoustics, HVAC, thermal, lighting, “views of nature”, ergonomic conditions and furniture), and psychological factors. Accordingly, a pragmatic approach to cleanable acoustic products in patient areas should not require the design to meet an unrealistically high standard of zero risk when the overall patient space is already somewhat compromised. Thus good health care design remains a compromise even as far as infection control is concerned

² per Salonen et al 2013



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to enable the patient to recover the quickest.

Further complicating the introduction of absorptive finishes are the conflicting recommendations for what is appropriate. Eg: Australasian Health Facility Guidelines, U.K. HTM-60 and hospital specific guidelines

Many of these documents will suggest smooth plasterboard ceilings but this is not because of any particular evidence that a more absorptive finish represents an unmanageable infection risk or burden. Indeed; *“The potential for transmission from contaminated hard-surface floors and walls is small unless there is existing moisture or residual stickiness present”*³.

Where suspended tile ceilings are concerned and wipeable finishes readily available, cleaning and infection control advisors are most likely to be concerned about any gaps that the tile system could create if not properly seated. In that sense, a plasterboard tile is overall a worse solution than a well built acoustic tile as the need to manage the gap risk is introduced but no acoustic benefits are realized. Concerns about tile gaps appear to be manageable through proprietary clips if necessary. However, a number of hospitals have adopted absorptive ceiling tiles in patient ward spaces without any known issues related to that configuration (refer 5.4.1).

5. What do infection control regimes really do?

Infection control is now a key component with a dedicated team for all modern healthcare providers. It is typically their role to advise on a wide range of topics including cleaning procedures and design requirements. The USA based Centre for Disease Control is frequently referenced for infection control matters. It notes that what lay people would consider ‘cleaning’ is in fact comprised of two separate processes: cleaning and disinfection.

- Cleaning is the removal of foreign material (e.g. soil, and organic material) from objects and is normally accomplished using water with detergents or enzymatic products. Thorough cleaning is required before high-level disinfection and sterilization because inorganic and organic materials that remain on the surfaces of instruments interfere with the effectiveness of these processes.
- Disinfected means free of pathogens e.g no viruses, bacterium, protozoa, prion, fungi, or other micro-organisms on the surface.

Operations and infection control representatives from two District Health Boards in the Auckland region of New Zealand were interviewed to understand more about the specific cleaning considerations that are relevant when considering introducing softer wall and ceiling finishes into clinical spaces. Auckland District Health

Board (ADHB) operates the central Auckland Hospital base hospital for central Auckland. Counties Manukau District Health Board (CMDHB) operates Middlemore Hospital, the base hospital for south Auckland.

5.1 How does a wall or ceiling get cleaned?

Both ADHB and CMDHB representatives advised that their approved cleaning procedures for walls and ceilings will only ever involve soft cloths rather than scrubbing with a coarse brush. Coarse brushes are avoided so that the surfaces do not become scratched as microscopic grooves are better at harbouring pathogens than those that are smooth. If wiping the surface of a ceiling tile was insufficient to remove visible soiling, cleaning specialists have advised that the tile would be replaced. As with any non-porous item that gets splashed with an infectious substance, if that undesirable substance is removed in a timely manner before it becomes caked on, wiping the surface with an appropriate cleaner will generally be sufficient to remove the undesirable matter.

CMDHB and ADHB respondents noted that it is a widely accepted fact that a clean surface that has not been disinfected can only make someone sick if the pathogens can get transferred off that surface and make it past the human body’s natural defences such as skin. In other words, a surface may not need disinfection if it is not going to come into contact with anyone or anything that may subsequently touch someone.

Cleaning products are distinct from disinfectants. Surfactants are cleaners with detergent basis that break up the matter to be cleaned. Only once the visible matter is removed with a surfactant can a disinfectant be used to kill any non-visible pathogens.

CMDHB representatives noted that the primary disinfectants used in New Zealand for hospital cleaning purposes come in three grades for different purposes.

- **Quaternary ammonium** – the lowest strength disinfectant which is appropriate for items that may come into direct skin contact.
- **Alcohol based** – medium strength disinfectants which have the advantage of drying quickly which is useful for a patient contacting non-critical items such as pressure cuffs. Alcohol disinfectants either dry themselves in a short time or are wiped off.
- **Vaporizing Hydrogen peroxide** – The strongest disinfectant used to clean patient areas. Due to its very strong odor and potential for harm to humans if inhaled, it is only used when people are not present in the room. The two largest hospitals in Auckland city, Auckland Hospital and Middlemore Hospital, utilize automated vaporizing systems that are left unattended to release Hydrogen Peroxide vapour that is then left for sufficient time until all room surfaces

³ refer Alyffie per *Limiting the Spread of Infection in the Health Care Environment*

are contacted. CMDHB representatives noted that these systems are also used extensively in other large hospitals in Australasia and have the advantage of not relying on a staff member to be vigilant with their disinfection regime. While these systems would disinfect walls and ceilings, the main driver for their use is understood to be the consistently high quality of cleaning on surfaces that would be disinfected manually.

5.2 When does a wall or ceiling need to be cleaned?

There appears to be no well published guidance for Australasian facilities that a wall or ceiling with soiling that harbours typical pathogens (e.g. not in a critical isolation setting) can lead to illness unless the infectious substance gets transferred to a semi-critical surface through contact. However, regardless of the actual infection risk, it is standard practice in hospital settings for any visible dirt or soiling to be cleaned off immediately. This is partially because it is naturally unsightly to a patient but also because soiling from body fluids etc is an excellent growth medium for any residual pathogens. As such, walls and ceilings in typical patient spaces need to be able to be wiped clean.

5.3 Center for Disease Control guidance

The Center for Disease Control (CDC) in the USA published the *Guideline for Disinfection and Sterilisation*, 2008 (CDC Guidelines) which contains heavily researched information on best practice for hospital cleaning. Health planners and operations/infection control staff interviewed for this research noted that this guideline document is regarded as an accepted source of guidance. It is informative to note how these guidelines categorize walls and ceilings as ‘non-critical environmental surfaces’.

Of particular interest are the following **with emphasis added**:

- Non critical-items: Noncritical items are those that come in contact with intact skin but not mucous membranes. Intact skin acts as an effective barrier to most microorganisms; therefore, the sterility of items coming in contact with intact skin is “not critical.” In this guideline, noncritical items are divided into noncritical patient care items and noncritical environmental surfaces *Examples of noncritical patient-care items are bedpans, blood pressure cuffs, crutches and computers. In contrast to critical and some semi critical items, most noncritical reusable items may be decontaminated where they are used and do not need to be transported to a central processing area. Virtually no risk has been documented for transmission of infectious agents to patients through noncritical items when they are used as noncritical items and do not contact non-intact skin and/or mucous membranes.*
- Non- critical environmental surfaces include bed rails, some

food utensils, bedside tables, patient furniture and floors. Noncritical environmental surfaces frequently touched by hand (e.g., bedside tables, bed rails) potentially could contribute to secondary transmission by contaminating hands of health-care workers or by contacting medical equipment that subsequently contacts patients /or mucous membranes.

Earlier publications note similar recommendations around the actual level of risk from walls. For example, Alyffie 1999 notes “The potential for transmission from contaminated hard-surface floors and walls is small unless there is existing moisture or residual stickiness present”.

The CDC Guidelines provide detailed recommendations⁴ on the cleaning of walls and ceilings as follows:

4 Selection and Use of Low-Level Disinfectants for Noncritical Patient-Care Devices

- a. Process noncritical patient-care devices using a disinfectant and the concentration of germicide listed in Table 1. Category IB.
- c. Ensure that, at a minimum, noncritical patient-care devices are disinfected when visibly soiled and on a regular basis (such as after use on each patient or once daily or once weekly). Category II.

5 Cleaning and Disinfecting Environmental Surfaces in Healthcare Facilities

- d) Clean walls, blinds, and window curtains in patient-care areas when these surfaces are visibly contaminated or soiled.

It is interesting to note that where there is a recommendation of disinfection and cleaning for non-critical patient care devices (4A & 4C) that will touch skin, the recommendation is only for cleaning of walls (5D). Furthermore, it is relevant that there is no recommendation for cleaning or disinfection of ceilings anywhere in the extensive CDC guidelines. That is not to suggest that wall and ceiling surfaces do not need the ability to be effectively disinfected if circumstances require, but it is highly unlikely to form part of regular procedures.

5.3.1 New Zealand specific examples

Both ADHB and CMDHB procedures are essentially consistent with the CDC recommendations where walls and ceilings in normal inpatient areas such as ward spaces, consulting rooms and treatment rooms are actively cleaned and disinfected by hand only when visibly soiled. However they are not wiped or disinfected on a regular basis.

The exceptions to this would be if patient immunity was lower or a patient presented with a particularly infectious disease in which case the walls would be disinfected at the end of the patients time in that room.

⁴ page 83, Recommendations for disinfection and sterilization in healthcare facilities

5.4 Australasian Health Facility Guidelines

The Australasian Health Facility Guidelines (AUSHFG) are frequently referenced for new healthcare fit outs and buildings as a design requirement in the Australian and New Zealand marketplace. In the Australian healthcare industry where the guidelines originated from, compliance with these guidelines often forms a mandatory requirement for funding approval. In New Zealand these are not likely to be mandatory for projects at the current time but the expectations for general compliance are increasing. The following excerpts represent the relevant portions that acoustic advisors should be aware of if they need to comply with these guidelines:

PART C

03.12 CEILINGS AND CEILING FINISHES - INFECTION CONTROL

- Each area within a facility will require a different degree of infection control management or standard of hygiene. Collaboration with the facility infection control representative and compliance with the current infection control policy in each jurisdiction is a required part of the risk management process.
- Select and design ceilings to support the level of infection control management required in each space.
- Ceilings are covered by AS Handbook 260 Hospital acquired infections - Engineering down the risk (Stds Aust 2003a) as follows. In Section 5 - Rooms suitable for Infection Control purposes - recommendations for ceilings for Type 4 and 5 rooms (standard isolation and respiratory isolation) include:
 - ease of cleaning and suitability for cleaning methods to be used;
 - continuous, impervious and durable finishes;
 - elimination of joints, gaps and features supporting microbial growth;
 - ability to withstand disinfecting and cleaning agents without deterioration; and
 - sealed penetrations for fittings in walls and ceilings e.g. pipes, light fittings, for Type 5 rooms for respiratory isolation.
- Although ceilings rarely become soiled with any hazardous matter, use a smooth washable finish in areas where splash or spillage might occur e.g. Resuscitation Rooms in Emergency Departments, Operating Rooms or where routine wash down or isolation is required.

Use of Acoustic Finishes

- Most acoustic ceiling tile products consist of absorbent materials with a porous surface and are generally used with a suspended grid system either exposed or concealed. Both of these factors usually exclude their use in areas where infection control or hygienic conditions are required.

- Acoustic products specifically produced for use in clean areas should be assessed on their tested performance.
- The use of acoustic tiles should be avoided in areas where splash spillage can occur.

PART 3.14 WALLS

(No specific provisions are given here other than the following general requirement to select wall finishes to adequately address the following):

- durability and resistance to impact from furniture, trolleys, aggressive patients, etc;
- ease of cleaning and retention of appearance over time;
- fire hazard properties; and
- requirements for infection control.

Part D

04 SURFACES AND FINISHES

04.01 General

- All surfaces in patient care areas should be smooth and impervious, and easily cleanable.
- Where there is likely to be direct contact with patients, or with blood or body fluids, floors and walls should be surfaced with smooth, impermeable seamless materials such as vinyl.

04.02 Ceilings

- Ceilings in operating and delivery rooms, isolation rooms, nurseries and sterile processing rooms should be monolithic from wall to wall without fissures, open joints or crevices that may retain or permit the passage of dirt particles.
- Acoustic and/or lay-in ceilings should not be used where particulate matter may interfere with hygienic environmental control.

04.06 Walls

- Other than special treatments included as feature face work in public or staff recreation areas, wall finishes should be smooth and easily cleaned, and where in the immediate vicinity of plumbing fixtures, water resistant.

5.4.1 Discussion of AUSHFG requirements

While the AUSHFG guidelines require cleanable surfaces, they do not preclude the possibility of appropriate impermeable materials being used on walls provided they can be cleaned. For manufacturers looking to provide products into healthcare environments, it will be important to provide a high level of robust technical documentation that evidences the ability of normal cleaning products and methods (refer 5.2) to result in a clean and infection free surface in the event it becomes soiled. Similarly, manufacturers of absorptive panels need to develop details and fittings that secure the panels without introducing problematic edges, gaps or ledges that will gather dust.

Likewise, the possibility of ceiling tiles is not precluded

in most spaces other than via Part D 4.02 for “operating delivery rooms, isolation rooms, nurseries and sterile processing rooms” unless there is a risk of particulate matter interfering with “hygienic environmental control”. The AUSHFG do not expand on the extent of interference deemed appropriate but it is informative to note that many ward spaces such as the new Royal Adelaide Hospital, the Royal Children’s Hospital (Melbourne) and the Edmund Hillary Block (Middlemore Hospital, Auckland) all feature acoustic ceiling tiles. In other words, precedents exist at major hospitals for appropriate ceiling tile applications in patient areas. It is expected that particulate matter concerns relate more to degradation of the tile surface or if tile removal and exposure of the ceiling void would be overly problematic to the use of the room. Operations personnel at ADHB and CMDHB both noted that removal of acoustic tiles is relatively rare (more often due to water damage rather than soiling) but not problematic in ward spaces as this is typically done with the patient out of the room. Possible scenarios where particulate matter concerns would exist may be those that are required to be clean and dust free 24-7 such as clinical sterilization spaces.

6. Conclusions

The use of acoustic absorbers tiles has been evidenced to provide genuine improvements to the patient environment. Where these are in the form of wipeable absorptive wall panels at high level or wipeable absorptive ceiling tiles

that cannot readily be touched, the cleaning requirements should not be particularly onerous for compliance with the CDC or AUSHFG guidelines. Local hospital or regional guidelines may exist that are prioritised above the CDC or AUSHFG requirements but evidencing compliance with these internationally recognized documents will strongly aid the case for including absorbers.

With a well thought out wipeable panel and system that has no gaps which are hard to clean around the panels, there appears to be no evidence that would preclude the use of absorptive panels on plasterboard ceilings even in acute spaces such as surgeries or bone marrow transplant wards. However, such an approach is not the norm and acoustic designers will need to champion the benefits to the project team to see the change occur. Manufacturers will need to provide a well researched and evidenced system that can meet the normal cleaning procedures used in hospitals to get buy-in from cleaning and infection control specialists.

7. Acknowledgements

The author would like to thank the following individuals for their valuable insights: Elizabeth Bryce and Terry Rings – Counties Manukau District Health Board; Shankara Amurthalingam – Auckland District Health Board; Paul Longridge and Tonya Hinde – Billard Leece Partnership;

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they recommended that to ensure clarity the word 'specifications' be used instead of 'guidelines.'

- (d) Achieving compliance - Appendix VI and the methods which triggered its implementation did not provide any direction or guidance around how to demonstrate compliance with the requirements set out in the Appendix, thus creating uncertainty. Parties suggested it would be appropriate to allow compliance with the requirements of the Appendix to be demonstrated by way of a compliance certificate provided by a person suitably qualified in acoustics, stating that the proposed construction would achieve the specified internal noise environment.
- (e) Ventilation specifications – Parties proposed changes to Table 2 to ensure the mechanical ventilation specifications were achievable, appropriate for Invercargill and account for recent advances in technology. The amended specified noise mitigation treatments would ensure that an appropriate internal design sound level of 40dB L_{dn} was achieved within habitable rooms and SEL 65dB L_{AE} within bedrooms within the SESEB. This would maintain the amenity of persons residing in these areas while at the same time reducing the potential for adverse reverse sensitivity effects on IAL. The changes to the mechanical ventilation provisions would also enable residents within the SESEB and/or OCB to keep their windows closed to reduce the effects of aircraft noise, while still maintaining an appropriate level of outdoor air exchange and utilising readily available equipment.

Overall, the Court held the proposed changes were efficient and ensured that the requirements of Appendix VI were effective and provided greater certainty for Plan users and the consent authority and would better achieve the purposes of the Act.

Court held:

By consent under s 279(1)(b), appeal allowed to the extent that the Court directed the Council to amend the

proposed District Plan in accordance with the Annexure A and B.

No order as to costs.

Disclaimer - This article has been provided to help raise an initial awareness of some recent cases involving acoustic issues. It does not purport to be a full listing of all decisions which have acoustic issues, nor does it replace proper professional advice.

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Jeremy Kelly – Silver Thomas Hanley; Adam Flowers - CCM Architects; Nicholas Wedde and Sandee Stanley – Klein Architects.

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