



Insulation solutions for transport hubs

A holistic approach to designing and specifying for
comfort, health and sustainability





Contents

Introduction	5
How the built environment impacts passenger experience and staff wellbeing	6
Role of insulation	7
A holistic approach to transport hub design	8
Insulation solutions and applications	10
References	12



Providing more than just transport services, modern transport hubs aim to create a seamless, convenient, and enjoyable experience for travellers.





Introduction

Traditionally, transport hubs, such as airport terminals and railway stations, primarily consisted of indoor environments designed for transient passengers. These spaces were designed to ensure a comfortable atmosphere for travellers while also maintaining a suitable working environment for the relatively smaller number of staff members.

In recent years, transport hubs have evolved beyond mere transit points. They are becoming multipurpose commercial spaces, offering a range of services and facilities to improve the travel experience as well as areas to relax and unwind between trips.

Providing more than just transport services, modern transport hubs aim to create a seamless, convenient, and enjoyable experience for travellers. Therefore, architects and designers need to pay greater attention to how these spaces are designed and how they impact the experience of travellers and staff.

This whitepaper will delve into the transformation of transport hubs, focusing on how thoughtful specification of insulation can address aspects such as indoor air quality, acoustic comfort, fire safety, and sustainability. It will offer insights into how insulation solutions can enhance the experience for all users as well as the operation of these facilities.



How the built environment impacts passenger experience and staff wellbeing

The quality of the indoor environment (IEQ) is directly related to the health and well-being of those who occupy the space.¹ Put simply, IEQ refers to the conditions inside the building, including, but not limited to, air quality, lighting, acoustic conditions, and thermal comfort.

There is a large body of evidence linking the quality of a building's indoor environment to occupants' health, satisfaction, comfort, wellbeing, cognitive function and productivity.² In addition, studies have shown that IEQ has a strong correlation with buildings' energy efficiency and use.³

In this respect, transport hubs are particularly complex. A transit hub's interior spaces should accommodate both a comfortable working environment and a comfortable travelling

environment. There is a growing diversity of spaces, from retail to hospitality, as well as heterogeneous functions across different terminals. The ideal IEQ parameters across these spaces can vary.

It has been established that environmental variables such as noise and visual disturbances, poor air quality, temperature, and lighting in transport hubs have an impact on satisfaction and productivity. For example, thermal comfort studies across three airport terminals in the United Kingdom demonstrated that passengers and staff present different satisfaction levels with the indoor environment, while their thermal sensation is greatly affected by the characteristics and function of the terminal spaces.⁴



A transit hub's interior spaces should accommodate both a comfortable working environment and a comfortable travelling environment.

Role of insulation

Insulation is one of the most effective design strategies for improving environmental parameters such as air quality, acoustics and thermal comfort in a transport hub. When specified correctly, insulation offers the following benefits:

- **Temperature control.** The mechanism by which insulation maintains comfortable room temperatures is by delaying the transfer of heat from one area to another. By reducing heat transfer, insulation ensures that the space stays warm in winter and cool in summer, thus reducing the reliance on heating and cooling systems.
- **Acoustic comfort.** Insulation materials can absorb and dampen sound, reducing noise levels and creating a quieter, more pleasant environment.
- **Air quality.** By reducing the number of outside allergens and pollutants that enter a space and controlling humidity levels, insulation can improve the quality of the air inside.
- **Energy efficiency.** By reducing heat gain in the summer and heat loss in the winter, insulation lowers the amount of energy needed to heat or cool the space. In line with sustainability objectives, this lowers operating costs while also lessening the transport hub's lifecycle environmental impact.

All these aspects need to be considered together when designing modern transport hub environments. Below, we consider a holistic approach to transport hub design that addresses these variables to create a well-insulated indoor environment that enhances passenger satisfaction and staff productivity.



A holistic approach to transport hub design

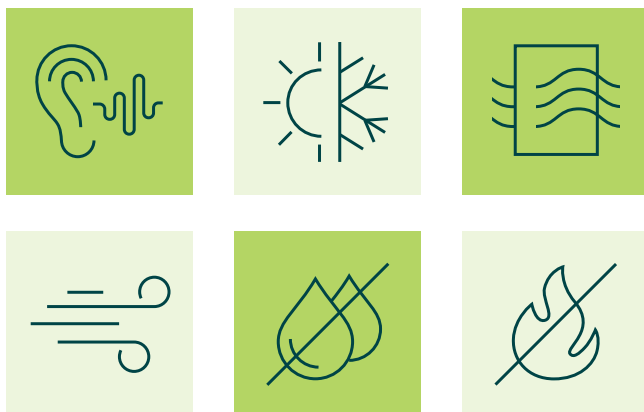
Importance of acoustic comfort

Transportation hubs like airports, train stations and rapid transit bus stops are typically large open spaces with complex acoustic requirements. Train stations and airports, in particular, share some of the same acoustic issues, particularly a preponderance of hard, reflective surfaces that result in echoes, reverberation, poor intelligibility and auditory fatigue. In train stations, one of the largest and most constant sources of noise are trains, which are often in close proximity to areas occupied by passengers.

A study investigating passengers' perceptions of the acoustic environment in airport terminals in China demonstrated that most passengers were dissatisfied with the quality, loudness, and coordination of the sound environment.⁵ Adverse sound sources included crowd conversations and dragging luggage, both of which lower the acoustic environment's quality and harmony assessment, according to this study.

Insulation in walls and ceilings is pivotal to enhancing the acoustic quality of a transport hub's working environment by addressing both external noise sources and the sound quality within an interior space. Noise from outside traffic and machinery is less likely to seep into the indoor environment when a building is well-insulated. Inside the building, the cacophony of sounds from constant announcements, outside vehicle movements, and passenger conversations can be dampened with insulation to minimise auditory disturbances and increase comfort and speech clarity.

Enhancing acoustic quality within a transport hub can significantly reduce stress and fatigue for workers, fostering a more enjoyable and productive work environment. Proper sound insulation not only contributes to employee well-being and job satisfaction but is also crucial for the effective operation of the facility. Lower noise pollution enables busy passengers to have a more peaceful experience, allowing them to focus on important announcements and tasks.



Controlling indoor thermal comfort, air quality and building condensation

Like with acoustics, the thermal conditions within a transport hub can be varied and complex, as can the perception of the thermal environment by travelers and staff. For example, in a United Kingdom thermal comfort study looking at three airport terminal buildings, it was noted that the degree of satisfaction that passengers and employees have with the indoor environment varies, and the features and functionality of the terminal areas have a significant impact on their perception.⁶

Another study, this time focusing on airport terminals in a cold region of China, highlights some of the different factors to consider when specifying insulation to control thermal comfort.⁷ The report suggested adding features that tailor the thermal parameters of different functional spaces in an open, diverse airport space. By comparison, in a narrower airport space with longer stay times and lower levels of activity, there was a greater need to divert and distract passengers from any thermal discomfort.

Another essential component of keeping a comfortable and healthy atmosphere is indoor air quality (IAQ), particularly in busy transportation hubs. Airports, train stations and bus terminals are potential breeding grounds for a variety of pollutants that affect both customers and staff due to the continuous flow of people and vehicles. This is a well-documented issue, with one study of a metro station in Tianjin, China, noting that staff members felt significantly dissatisfied with the IAQ in winter and reported sick-building syndrome symptoms, including mucosal irritation, headache, exhaustion and dizziness.⁸

Insulation contributes to a comfortable transport hub environment by keeping interior temperatures relatively steady, which lessens the stress that comes from environments that are too hot or cold. In transit hubs, where large doors are opened frequently and outside weather can have a significant impact on indoor temperatures, this stability is especially crucial.

In airports and train stations, insulation in the walls and ceilings improves the air quality in two key ways. First, insulation such as wall wraps and roof sarkings act as a barrier that reduces the infiltration of outdoor pollutants. Second, by helping control temperature and humidity levels, the right type of insulation aids in preventing the growth of mould and mildew, both of which can proliferate in moist or inadequately ventilated environments.



Furthermore, insulation has the potential to improve HVAC (heating, ventilation, and air conditioning) system efficiency. When buildings are well-insulated, HVAC systems do not have to work as hard to maintain a stable indoor temperature, which in turn leads to more consistent and effective ventilation. Improved ventilation systems can more effectively filter and circulate air, removing indoor pollutants and allergens.

Protecting people and buildings from fire

Passive fire protection strategies, such as incorporating fire-resistant, non-combustible and low-flammability insulation materials used to slow or impede the spread of fire or smoke, play a crucial role in airport and transportation hub infrastructure. Fire-resistant materials help contain and slow the spread of fire, giving occupants more time to evacuate safely. This is particularly important in transport hubs, which often have high passenger volumes and complex layouts.

Furthermore, transport hubs are vital infrastructure nodes that serve as critical points for transportation networks. Fire-resistant materials help protect the structural integrity of these facilities, minimising damage and preserving their functionality during and after a fire incident.

As with any other building, transport hubs must meet the requirements of the National Construction Code (NCC). Architects and developers must also consider the standards and minimum requirements set forth by insurers.

Meeting sustainability objectives

Transport hubs are well-known high-energy consumers. An airport is almost akin to a small city with complex energy systems because of its large volume and variety of functions. Reports suggest that energy use comprises as much as 10% to 15% of these facilities' entire operating budget, and that lighting and cooling account for 46% of their overall energy use.⁹

Particularly in harsh climates, HVAC systems account for a sizeable portion of transport buildings' annual total energy consumption. As a result, increasing the HVAC system's energy efficiency would significantly lower the energy usage and CO₂ emissions of transport hub buildings.

As the research shows, thermal insulation in walls and ceilings is critical to improving the efficiency of HVAC systems in transport buildings. In a study of the Hasan Polatkan International Airport, it was found that the absence of thermal insulation causes the amount of energy consumed and the associated environmental effects to increase.¹⁰ The airport terminal building's walls and roof were studied in order to determine the optimal insulation thicknesses and environmental payback. Applying thermal insulation to the roof and walls would reduce heat loss from these surfaces by 56% and 48%, respectively.

Find out more online at
www.insulation.com.au

Insulation solutions and applications

FLETCHER INSULATION

With a holistic approach to developing the best insulation solutions for all types of commercial buildings, Fletcher Insulation has designed insulation solutions that consider a range of performance parameters that are important for the transport sector. These parameters include energy efficiency, thermal bridging, fire resistance, internal comfort, acoustics, moisture, air tightness, and durability.

Roofing

The **Permastop**® range of building blankets has outstanding thermal and acoustic properties. Particularly suitable for metal roofs, Permastop reduces heat transfer and minimises the internal reverberation and flow of distracting noise from outside the building, such as rain on a metal roof. It also helps minimise the risk of condensation that can form on metal cladding.

Roof Razor combined with Permastop can reduce thermal bridging. Roof Razor allows full recovery of the insulation blanket between the safety wire mesh and metal cladding. By combining these products, your building will achieve optimum thermal performance and meet or exceed NCC requirements.

For buildings with a concrete roof structure, your best choice is **Pink® Thermal Slab**. With excellent thermal and acoustic absorption properties, this product drives energy efficiency and helps control noise and temperature fluctuations common to concrete roofs. Pink® Thermal Slab provides excellent fire performance for ceiling lining applications, achieving AS 5637.1 Group 1 NCC fire classification. This product is also certified under the Codemark scheme, which provides confidence and certainty through the issue of a Certificate of Conformity, demonstrating 'evidence of suitability' requirements of the NCC.



The thermal conditions within a transport hub can be varied and complex, as can the perception of the thermal environment by travellers and staff.

External walls

For buildings with a structural steel frame and external cladding, **Pink® Partition insulation** between studs is the ideal solution. All glasswool insulation suitable for external walls is Codemark-certified. The Codemark scheme provides confidence and certainty through the issue of a Certificate of Conformity, demonstrating 'evidence of suitability' requirements of the NCC.

For hotter, more humid climates, specifiers opt for **Sisalation® Multipurpose (456)** taped and sealed, along with Pink Partition insulation between studs. Sisalation Multipurpose (456) is an extra heavy duty, flexible water and vapour barrier, designed as a second layer of protection from water ingress for commercial wall and roofing applications.



Fitout applications

Pink Partition insulation is perfect for metal-framed partitions, wall systems, and suspended ceilings. As well as delivering energy efficiencies, it features excellent thermal and acoustic qualities, making it a great choice for transport hub spaces where noise control is essential. This product is non-combustible, so it not only helps protect lives but also limits damage in the event of a fire.

Acting as both a noise barrier and a noise absorber, **Soundlag 4525C** is an excellent insulation product for reducing noise break-out from pipes, valves, fan housings, and ductwork.

For plant and machinery rooms with concrete or stud walls, **Pink Thermal Slab** offers exceptional thermal and fire performance, effective in controlling the noise levels and temperature fluctuations of roofs, floors, and walls.



HVAC

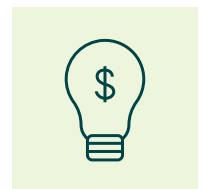
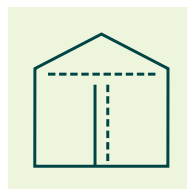
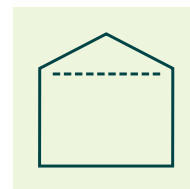
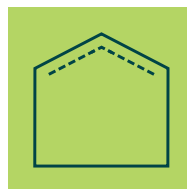
Fletcher Insulation's HVAC solutions help transport facilities operate more sustainably. With proven thermal performance, they'll help contain the cost of heating and cooling and create a more comfortable environment while minimising energy costs.

Fletcher's sound attenuation products complete their holistic systems approach by minimising HVAC noise when it is in operation.

Non-combustible and safe to use, the Fletcher Insulation HVAC range is flexible, lightweight, and strong, making it ideal for all types of transport environments.



Inside the building, the cacophony of sounds from constant announcements, outside vehicle movements, and passenger conversations can be dampened with insulation to minimise auditory disturbances and increase comfort and speech clarity.



References

- 1 Zhang, Fan, Shichao Liu, Wenye Hu and Manuj Yadav. (2022), Effects of indoor environmental quality on human performance and productivity, *Frontiers in Built Environment*, Vol. 8 2022: <https://doi.org/10.3389/fbuil.2022.1095443>.
- 2 Ibid.
- 3 Roumi, Soheil, Rodney Anthony Stewart, Fan Zhang and Mat Santamouris, (2021), Unravelling the relationship between energy and indoor environmental quality in Australian office buildings, *Solar Energy*, Vol. 227, No. 6, 2021: 190-202.
- 4 Kotopouleas, Alkis and Marialena Nikolopoulou, (2014), Understanding thermal comfort conditions in airport terminal buildings, In Conference: Proceedings of 8th Windsor Conference: Counting the Cost of Comfort in a Changing World at: Cumberland Lodge, Windsor, April 2014.
- 5 Liu, Mengjin, Zhibin Gao, Fei Chang, Wei Zhao, Junquan Wang, Hui Ma and Chao Wang, (2023), Passengers' Perception of Acoustic Environment in the Airport Terminal: A Case Study of Tianjin Binhai International Airport, *Buildings*, Vol. 13, Issue 10 2023: 2585.
- 6 Above n 4.
- 7 Ibid.
- 8 Ibid.
- 9 E Source Companies LLC. "Airports." OUC. <https://ouc.bizenergyadvisor.com/article/airports> (accessed 1 August 2023).
- 10 Kadri Akyuz, Mehmet, Onder Altuntas and Mehmet ZIya Sogut (2017), Economic and Environmental Optimization of an Airport Terminal Building's Wall and Roof Insulation, *Sustainability*, Vol. 9, Issue 10 2017: 1849.



09/2024