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Beyond Power and Cooling: The Building Fabric's Role in Data Centre Resilience.

As data centres evolve to meet increasing performance, sustainability and resilience demands, the role of the building fabric is changing. No longer simply an enclosure, it is becoming part of the infrastructure, supporting thermal control, protecting against environmental risk and contributing to long-term operational performance.

Data centres are now widely recognised as critical national infrastructure, supporting cloud computing, artificial intelligence and the wider digital economy. As demand accelerates, operators and developers face increasing pressure to deliver facilities that are more resilient, more energy-efficient and capable of continuous operation.

Much of the industry's focus has understandably been on power and cooling systems. However, as operational demands increase, another factor is moving up the agenda: the performance of the building itself.

In modern data centres, the building fabric, understood here as the envelope and passive protection systems, is no longer simply the shell around digital infrastructure. It is becoming part of the infrastructure, influencing thermal stability, environmental resilience, fire performance and lifecycle value.

In effect, the building fabric no longer sits outside the infrastructure. It forms part of the facility's uptime architecture.

From Structure to System

Historically, the building envelope has been treated as a secondary consideration, providing weather protection and basic environmental control while performance was driven by mechanical and electrical systems.

That distinction is becoming less clear.

Increasing rack densities, particularly driven by AI workloads, are placing greater demands on cooling systems and internal environmental control. At the same time, external pressures such as rising temperatures and more frequent extreme weather events are making stable operation more difficult to maintain.

Research from the Uptime Institute indicates that 45% of operators have experienced an extreme weather event that threatened continuous operations, with nearly 9% reporting an outage or significant disruption as a result. This highlights that resilience is no longer solely a function of power and cooling systems.

In this context, the building fabric becomes more closely tied to operational performance.

Four Ways the Building Fabric Functions as Infrastructure

A useful way to understand this shift is to consider four ways in which the building fabric now supports infrastructure performance.

1. Thermal Control

As facilities move towards higher-density environments, maintaining consistent thermal conditions becomes more complex. Many operators are now managing hybrid cooling environments, where air-cooled and liquid-cooled systems coexist within the same facility. Commentary from Data Center Knowledge suggests that these mixed-density halls are often more operationally challenging than fully air- or fully liquid-cooled environments, because they require operators to manage different cooling architectures and risk profiles within the same facility.

Standards bodies such as ASHRAE define tight environmental conditions for IT equipment, reinforcing the importance of maintaining stable internal conditions through both cooling strategy and envelope performance.

Thermal control is not determined by cooling plant alone. The performance of ductwork, chilled-water pipework and associated HVAC infrastructure also influences how efficiently stable internal conditions can be maintained across the facility. Guidance such as CIBSE Guide B2 highlights the importance of controlling air leakage and maintaining service efficiency within ventilation systems. Technical guidance on chilled-water systems similarly reinforces the role of insulation in reducing thermal losses, controlling condensation risk and supporting long-term system performance. In high-availability environments, this means HVAC insulation should be understood as part of the thermal control strategy rather than a secondary specification item.

In that context, the building envelope plays a critical supporting role. Heat gain through roofs and façades, air leakage and envelope inefficiencies can increase cooling load and reduce system efficiency. Designing for airtightness, insulation performance and reduced heat gain through the building envelope supports more stable internal conditions, reduces avoidable cooling load and improves operational reliability.

2. Climate Defence

Climate resilience is now a core design requirement rather than a future consideration.

Data centres must operate reliably under increasingly variable environmental conditions, including extreme temperatures and flooding events. Water ingress remains one of the most persistent operational risks in data centres, with even relatively minor failures capable of affecting service continuity.

Industry risk guidance and operational commentary identify roof interfaces, plant zones and service entry points as areas of heightened vulnerability, where failures in detailing, waterproofing or long-term durability can lead directly to operational disruption, asset risk and costly remediation.

As a result, waterproofing, façade performance and interface design must be treated as critical components of infrastructure rather than secondary construction details.

3. Passive Fire Protection

Fire risk in data centres is less about large-scale events than about the consequences of localised incidents, particularly smoke spread and contamination.

Guidance on data-centre fire and smoke resilience from insurers such as Aviva emphasises that even relatively minor incidents can lead to disproportionate operational disruption, particularly when smoke spreads beyond the point of origin and beyond the intended compartment.

In practice, smoke can travel through relatively small openings if service penetrations are not adequately sealed or protected. This reinforces the need for robust compartmentation strategies, rated separations and consistent detailing across interfaces to maintain the integrity of fire protection systems.

4. Lifecycle Performance and Carbon

Sustainability considerations are also reshaping how data centres are designed.

While operational energy remains a major focus, embodied carbon and lifecycle performance are becoming increasingly significant. Data centres are complex assets, with a large proportion of their carbon footprint associated with mechanical and electrical systems. Industry initiatives such as the iMasons Climate Accord highlight the importance of assessing whole-life carbon across both building and infrastructure systems, while guidance from RICS reinforces the importance of durability and lifecycle value in reducing long-term environmental impact.

Within that context, the building fabric contributes through durability, material efficiency and reduced need for replacement or intervention over time. Systems that maintain performance over extended asset lifecycles, with minimal degradation, support both operational resilience and more efficient lifecycle carbon outcomes.

Why Early Integration Matters

These factors point towards a broader shift in how data centres are designed and delivered.

Rather than treating building fabric, mechanical systems and operational requirements as separate elements, there is increasing recognition that they must be considered together from the earliest design stages. Early coordination helps ensure that envelope performance, fire strategy and environmental resilience align with cooling and operational requirements.

This approach reduces specification risk, improves performance outcomes and supports more efficient delivery, particularly in the context of accelerated construction programmes and phased expansion.

Organisations such as the Data Centre Alliance play an important role in supporting this integration, helping to share best practice and promote standards across the sector.

Conclusion

As data centres continue to evolve, the demands placed on their performance, resilience and sustainability will only increase.

In this environment, the building fabric is taking on a more defined role within the overall infrastructure of the facility. Its contribution to thermal control, environmental resilience, passive fire protection and lifecycle performance is becoming increasingly critical to long-term success.

For designers, developers and operators, this represents a necessary shift in perspective, recognising that reliable performance depends not only on the systems within the building, but on how the building itself is designed, detailed and protected to support them.

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