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SE EVELLO

Corridor Overheating

Intelligent Mitigation Solutions

SE CONTROLS

SE EVELLO

What is corridor overheating?

It is widely accepted that corridor overheating is a common issue within certain types of buildings including high-rise residential dwellings.

Winter energy efficiency measures, heat losses from communal heating networks and increased urbanisation have all contributed to the gradual internal temperature rise within corridors and other communal spaces.

As these spaces often have little or no ventilation provision the heat accumulates, creating an uncomfortable environment for residents.

Adaptive Algorithm

SE Evello uses self-adapting control algorithms and targets ventilation to the hottest areas in buildings where multiple zones utilise the same smoke shaft.

The solution prioritises these areas with increased ventilation while ventilation is reduced in more temperate areas. In buildings where zones are connected directly to the external environment, for example end of corridor AOVs, the algorithm intelligently adjusts the vent opening threshold temperature dependent on prevalent weather.

Compatible with Natural and Mechanical Systems

SE Evello can be used with both natural and mechanical smoke ventilation systems.

The latter uses a dedicated additional day-to-day extract fan, which is intelligently controlled to ensure that it is only used when required, with the preference to allow the thermal stack effect to move air. By employing the latest fan design technology, including sickle bladed aerofoils and serrated trailing edges, efficiency is maximised and noise is reduced.

How it works

Based on over 2 years of data from live test sites, SE Evello is an innovative system solution designed to ease the effects of heat accumulation whilst creating a more comfortable environment in communal spaces and corridors.

Designed to utilise and integrate with a building's existing smoke ventilation system, the system constantly monitors internal air temperatures on every floor and manages ventilation demand via the smoke extract system. The overheated air can be vented to the atmosphere and replaced by cooler outside air, which reduces the internal temperature.

Understanding the dynamics of overheating

For a number of years, SE Controls has been directly involved with various consultants, developers and contractors to not only address the issue by providing specific solutions to improve ventilation and cooling, but also to obtain a more detailed understanding of the dynamics involved in the overheating of corridors and circulation spaces.

By undertaking detailed studies of real buildings and combining them with theoretical computer thermal modelling, it has not only been possible to refine the modelling algorithms and make them even more accurate, but also design effective solutions that can address the problem using a building's existing smoke control system.

Overheating corridors
A Case Study

Results analysis – the heat is on

Our study focussed on two example buildings:

A London building with ventilated corridors

Kent building with unventilated corridors

External temperatures:

Over the duration of the study, the external temperature ranged from a minimum of -6°C during December to a maximum of 30°C in July, giving and average of 12°C throughout the period.

Min -6°C

Max 30°C

Average 12°C

Temperature measurement and adaptive comfort

Hourly temperatures in the first floor lobby of both buildings were monitored to obtain a clearer picture of the internal thermal profile, while corresponding hourly external weather information from RAF Northolt provided relevant 'ambient' temperature data for the same period.

During the study, a MET Office Level 2 heatwave warning (max temperature of 30 degrees Celsius) was issued for 18th to 20th July.

Corridor temperature comparison:

The London building, which utilised its smoke ventilation system to provide supplementary environmental ventilation, the average temperature was 18.6°C with corresponding minimum and maximum figures of 10.3°C and 27.3°C respectively.

Min 10.3°C

Max 27.3°C

Average 18.6°C

However, in stark contrast, a Kent building with unventilated corridors recorded some disturbing results with temperatures ranging from 22.3°C up to an extremely uncomfortable high of 33.8°C with an average 28.5°C.

Min 22.3°C

Max 33.8°C

Average 28.5°C

Acceptable temperatures:

Even more concerning is the fact that for 64% of the total monitoring period, the Kent property's temperature exceeded 28°C, which is significantly above current CIBSE guidance on overheating thresholds where 28°C should be exceeded for less than 1% of the time.

The comparison:

The comparative temperature distribution analysis for both buildings also showed a significant difference with the most frequent internal temperature for Kent being 28-29°C, while in London, the figures were 8 degrees cooler at 20-21°C.

A London building with ventilated corridors cooler at 20-21°C

Kent building with unventilated corridors warmer at 28-29°C

Conclusions

Although this study was focussed specifically on temperature parameters within the two buildings, it must be remembered that where no ventilation is present in sealed or 'landlocked' spaces, the air will usually be stagnant and of poor quality, often containing pathogens along with other contaminants, which cannot be readily 'flushed' or vented from the building.

By utilising existing smoke ventilation systems and adapting their operation, without compromising their life critical primary operation characteristics, a simple and cost effective solution is already available that mitigates overheating, improves air quality and helps buildings comply with relevant adaptive comfort guidelines.

The only question that remains, is how many other buildings suffer from the same extreme overheating and air quality issues as those measured in Kent, which are likely to be caused unintentionally, purely by complying with Building Regulations? From the results of SE Controls' own numerous research studies, the answer is ..."probably more than we think."

Our learnings from this case study and a number of others has enabled SE Controls to create a series of tactical strategies that sit beneath the primary strategies of direct and indirect ventilation. In direct applications, there is access to an outside facing vent or window which can be used as part of the strategy.

In indirect applications, there is no access to an outside facing vent or window and therefore components of the smoke ventilation system can be used to achieve the required result of a well ventilated space.

Once the primary strategy is defined, the secondary strategies can be selected or deselected depending on the layout and design of each individual building or space. This approach allows the Evello system to be tailored to almost any requirements and also remaining highly agile in situations where the strategy needs to be amended after the point of installation and comissioning.

Strategies

System strategy

Direct Ventilation	Direct ventilation is a primary strategy utilised when there is availability of air passing directly to and from the internal (corridor) space through an externally facing ventilator such as louvred ventilator or automated window.
Indirect Ventilation	Indirect ventilation is a primary strategy utilised when there is no direct externally facing ventilator to and from the internal (corridor) space and air moves through a vertical riser such as the smoke shaft or a dedicated ventilation shaft.

Tactical strategies available

When the primary strategies have been selected and assigned to systems with the building (sometimes very large schemes may have a mix of strategies) the system can be commissioned with a series of tactical settings which govern and hone the operation of the primary strategy. These are as follows:

Restricted Opening	For indirect ventilation there is a restricted amount of air by volume that can be in any extract shaft at any one time, all automated vents into the shaft must be able to be positioned to optimise performance.
Operational Time	If the background operation of the ventilation system isn't required between any two times in a twenty-four hour period, the system can be stopped and locked for ventilation purposes .
Operational Time by Zone	If the background operation of the ventilation isn't required between any two times in a particular zone (and this can defined as an individual AOV) in a twenty-four hour period, the system can be stopped and locked for ventilation purposes.
Fan Speed Optimisation	Related to the specific design of a building and in addition to restricting the modulation of vents into the shaft, this strategy allows minimum and maximum fan speeds to be set for corridor ventilation so as not to de-pressurise or over-pressurise a corridor space. Evello can group temperature sensors so that they govern a response from a specific fan
Associated Vents	A fully networked Evello system is able to group vents for common opening (such as top of stair) with an associated corridor vent, as would be expected in smoke ventilation operation but for the purposes of the hot corridor mitigation. This is vital if the stair doors and other compartment doors are on hold-open devices by others during the long periods when the smoke ventilation system is in a quiescent state.
Mixed Mode Secondary Strategies	Evello strategies for direct and indirect ventilation can be employed in the same scheme, such as where there is externally facing AOV windows or glazed louvres which can be used for make-up air for the smoke ventilation and also the day to day ventilation performance.
Independent 0-10V control of actuators	Evello secondary strategies, where conditions allow, can enable the movement of a rotary motor on a damper (such as to be found on a smoke shaft damper or a dedicated slot damper) in addition to a power open and power close actuator allowing efficient utilisation of hardware.

Inputs

- **OSLink temperature sensor**
- **Outdoor temperature sensor**
- **Rain sensor**
- **Wind speed & rain sensor**
- **Building management system**
- **Fire alarm**
- **Time**

Hardware Requirements

OS2 controller

Outputs

- **Slot dampers.** Fitted in the staircase to bring in replacement air.
- **Smoke dampers.** For access to the smoke shaft.
- **Dedicated NV fans.** To help with air movement.
- **Window.** For direct access to outside air.
- **AOV roof vent.** For direct access to outside air.

Creating a healthier & safer environment

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