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Air for the drainage system – limiting roof penetrations in tall buildings

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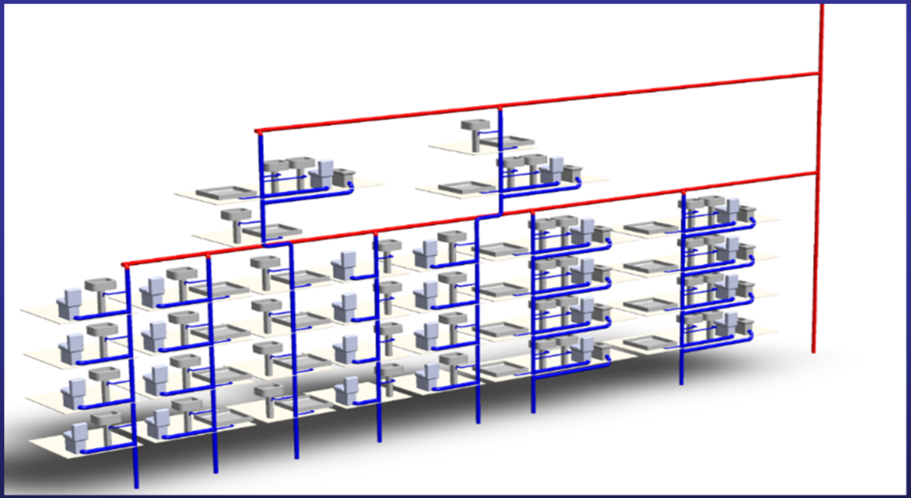
Introduction

- All buildings are different, and developers and architects often wish their buildings to stand out aesthetically
- Space is a premium commodity
- Building services engineers (BSE) and Mechanical, Electrical and Plumbing Engineers (PME) are required to make their designs fit the ever decreasing allocation of space.

In architectural models they never show the drainage vents at the top of the buildings

One of the main methodologies that the public health engineers and MEPs currently use to hide the vent pipes, involve linking the stacks at the top of the building, so that three or more stacks have only one roof penetrations to atmosphere



Linked Vents

- In practise every stack should be connected to atmosphere if passive drainage venting is used.
- The principle being that if there are discharges within the stack, the vent at the top of the stack will provide air through the drainage vent pipe network to relieve the negative transients generated in the system.
- The same vent pipe network is also perceived to provide relief paths for the positive transients generated within the drainage network.

- It should be remembered that all the research on passive drainage venting in the past, and which has gone on the inform codes and standards worldwide have been based on the assumption that each stack is vented individually to atmosphere.

- Within plumbing drainage codes themselves, it is also assumed that each stack is individually vented, although there has been room in some codes to interpret that as long as the stacks are connected to atmosphere it will meet the requirement of the codes.

- A 24 floor building was assessed by numerical modelling to see how it performed when linked vents were used.
- The system is designed to EN12056 and simulations were carried out using AIRNET (Swaffield, 2010)

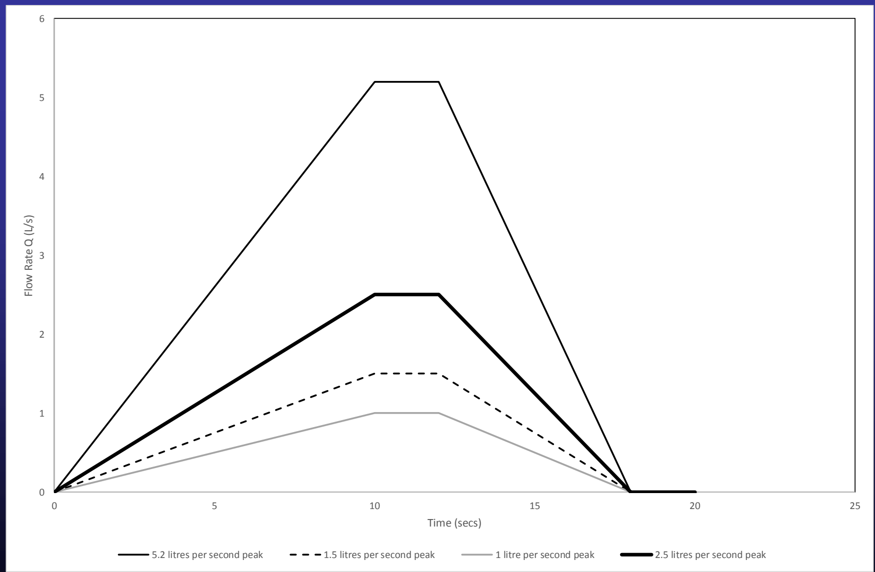
- An AIRNET analysis of this building was carried out to see what would happen if the system was loaded to its design capacity, 5.2 l/s.

- If one of these stacks was loaded to its maximum and there was some other activity in other stacks, would the single vent pipe be capable of proving the complex air requirements of the system?

- The best way to assess the issue is to look at water trap seal retention in parts of the building which might be vulnerable under heavy usage load conditions.

- Three loading profiles were used in the simulations: 5.2 l/s peak, 1.5 l/s peak, 2.5l/s peak and 1 l/s peak.

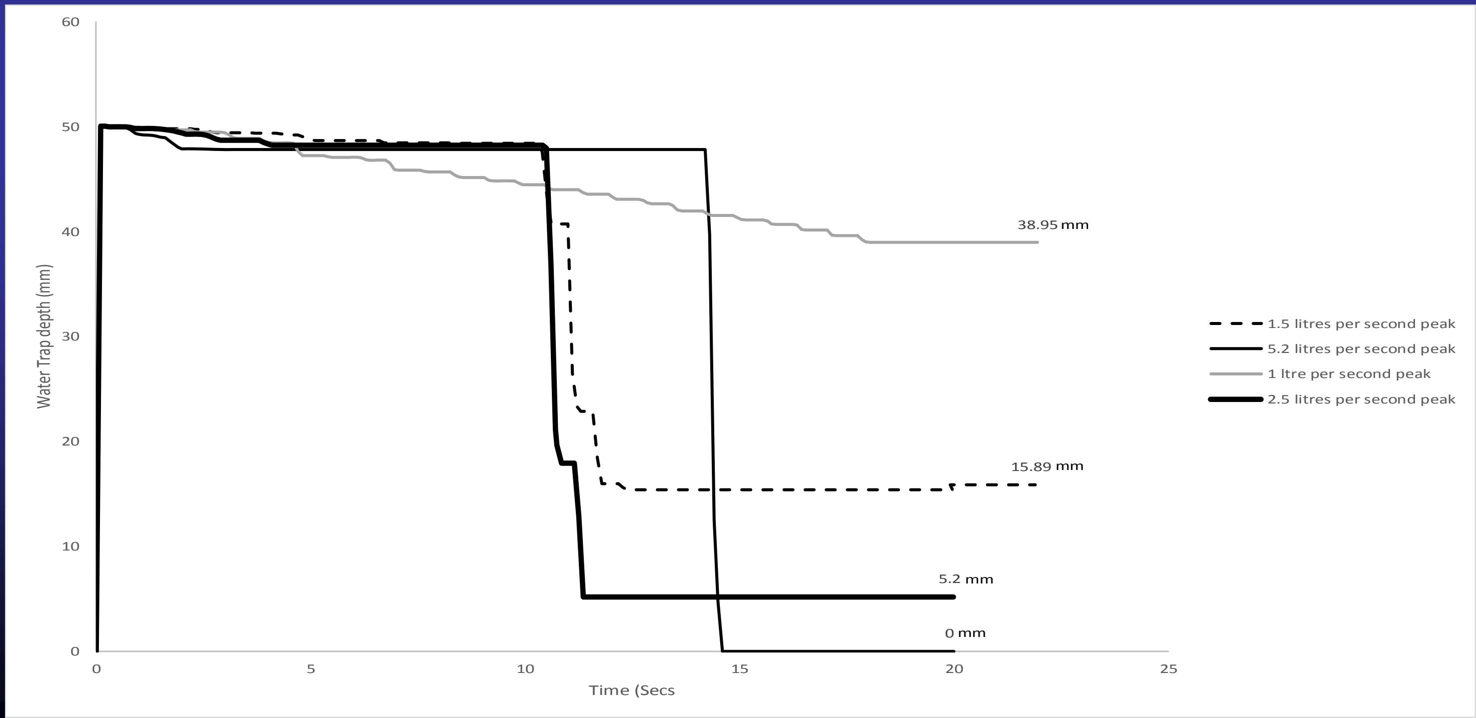
- The flow rate is allowed to steadily increase over a period of 10 seconds to mimimize the risk of pressure transient generation due to rapid increase in flow rate rather than the loading itself.



- Simulations were run in AIRNET to ascertain the vulnerability of the trap at the bottom of Stack 1. This was considered to be a worst case scenario, since it is the furthest away from the vent pipe and so the effectiveness of any venting capability will be at its minimum.

Location of trap seal under investigation

- It can be seen that only the lowest flowrate (1l/s) results in a system which is not vulnerable to seal loss. Even at 2.5 l/s there is significant seal depletion, but the trap has still some water left after the event. It can clearly be seen that this system cannot cope with the fully loaded 100 mm pipe at 5.2 litres per second under these venting arrangements



- The **active drainage ventilation** principle works by local intervention to remove or attenuate an incoming transient that, if left, would lead to trap seal depletion. This is achieved by placing AAVs and the P.A.P.A™ onto the standard pipes of the system to limit the surge pressures adjacent to the traps by reducing the rate of local changes in flow conditions

- **Active drainage ventilation** reduces the effects of the negative and positive transients, balancing the pressure within the drainage system – if the system pressure exceeds +/- 40mm WG (400Pa) the water trap seals can be lost by induced or self siphonage

- **Negative pressure** (transients) are dealt with through the introduction of local airflow using AAVs on the branches. Air is allowed in through the AAV as required, which then seals tight to prevent sewer gases from leaking out into the habitable space.

- **Positive pressure** (transients), are absorbed by the P.A.P.A.™, slowing them down from the speed of sound (320m/s) to a harmless 12m/s, which is then released back into the system to naturally dissipate.

Active venting should be considered as functionally “superior” over traditional “passive” venting:

- The removal of long, and possibly, convoluted vent connections to atmosphere reduces the time taken before local relief can be applied – allowing the pressures to be balanced quicker with active venting.

- Local suppression prevents transient propagation throughout the network prior to relief – removing the risk of the siphonage of multiple traps.

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Conclusion

- Public health engineers and MEPs have to find solutions to meet the architectural requirements for their clients. In many case they are trying to limit the drainage vents to atmosphere as well as hiding them from view.
- Linked venting arrangements seem to offer the perfect solution and a compromise between aesthetics and practical venting, however simulations show that this venting arrangement is lacking in that it increases water trap seal vulnerabilities. Maximum safe loadings reduce drastically (to about 1.5 litres/second peak) when this venting arrangement is used on its own.

- The architectural requirements can be met, only when active drainage ventilation is used.

- **Thank you!**

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