Technical paper

National Lift Tower
The world's tallest drainage test facility
"Seeing is Believing"

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10/2017

Abstract

The ability to test drainage systems for the types of buildings being built today is important, to ensure that the drainage system works as designed. For high-rise buildings 30, 50 floors or more the design and materials used should be tested, to meet the loadings and usage patterns for these buildings, to ensure the waste is removed as quickly, self-cleansing and that the barriers provided by water trap seals are maintained. The 1950-1970 testing that forms the basis for many national codes carried out physical testing on buildings of that era, so the testing for high-rise buildings was carried out for 10 to 25 floors. How can the data from these tests meet the demands for taller buildings? Since the late 1970 researchers have been able to model drainage systems for high-rise buildings and provide valuable data and findings, but the ability to have a high-rise test platform provides confidence to the industry that the materials and systems used work, which helps validate the modelling research.

Context of this paper

This technical paper is part of a library op technical papers. Refer to the below overview of all our technical papers and click on the title for a digital link.

Research	Relevance	Design	Solutions	Materials	Installation	Terminology	Standards

Introduction

The National Lift Tower (NLT) in the United Kingdom is a building that is 127.45 metres (418.1 feet) tall, 14.6 m (47.9 ft) in diameter at the base and tapers to 8.5 m (27.9 ft) at the top.

Due to the height of this test facility, it is ideal for testing drainage and vent systems solutions for tall buildings. It is currently the tallest drainage test facility in the world.

Within the facility the drainage systems can be tested representing a 40 floor drainage system. The space within the building allows different drainage solutions to be compared, and for current code recommendations to be tested for the demands of high-rise buildings.

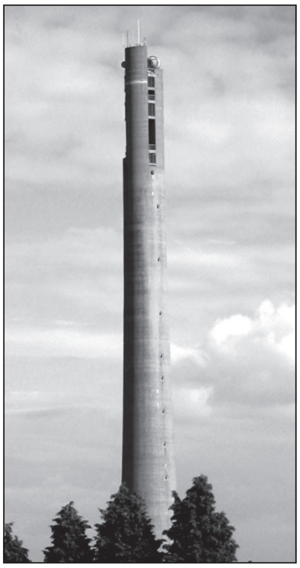

Figure 1.

Figure 2.

Why is testing required?

The first thing to understand about drainage codes, is that they are mainly based on **"old-research"** carried out in the 1950 and the 1960, with the majority of the research undertaken at the Bern Switzerland, and in the United Kingdom. Although there have been early research for tall buildings, the buildings tested had **limited discharging of appliances**.

- In Europe, the Vocational training school in Bern, realised a joint research with a number of European groups, CSTB (France), CSTC (Belgium), SIB (Sweden), IBT Germany and SVGW (Switzerland) based on testing on a 10-floors building.
- In the United Kingdom, the BRE studies were undertaken at first on 5 floor buildings and, in the 1960s, moved to 10 floor buildings with 100 mm stacks and 25 floor buildings with 150 mm stacks. This research was based on data collected from buildings and laboratory testing and was published as a code of practise in the early 1970s.
- In the United States the codes are based on research from the 1930s mainly through the work of Hunter.

Also, all these researches have been **based on steady state conditions**, meaning that they focused on the applied water flowrates to drain diameters and slope. The drainage and vent system also has air and the time dependent water flows within the drainage network entrain an airflow that is therefore itself unsteady.

So current codes are based on old data, research on limited height buildings (10 to 25 floors) and on steady-state conditions, to understand system performance for modern day high-rise buildings testing must be conducted.

Setup

The vertical shafts allow for different pipes systems and configurations to be installed. Due to the access that the facility provides it is also ideal for carrying out live demonstrations (seeing is believing).

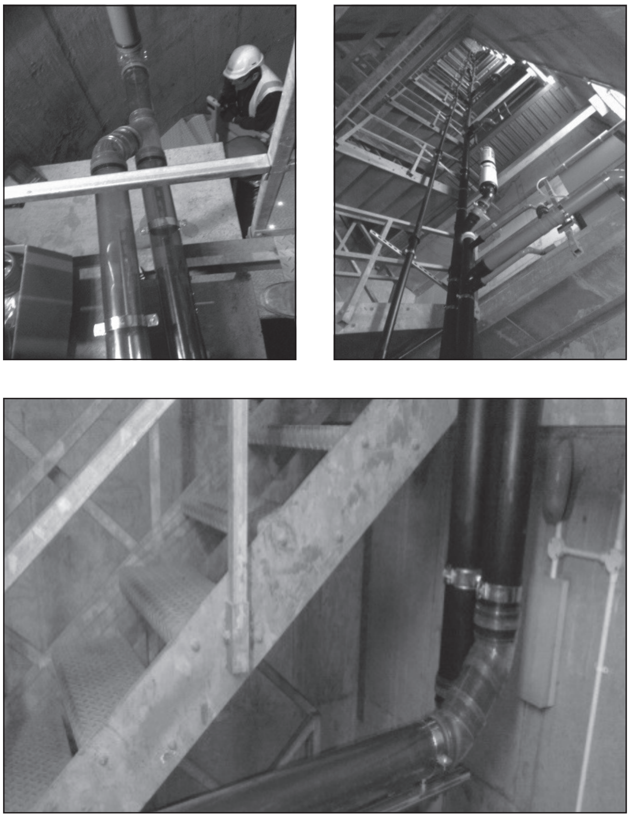

Figure 3.

The current configuration in the tower is based on the EN12056-2, with a one floor stub stack and a 5 meter offset, with 100 meters of vertical stack above this.

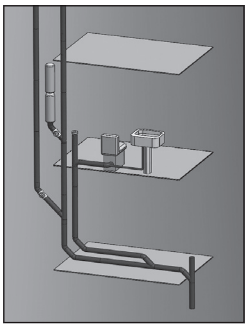
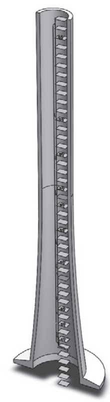
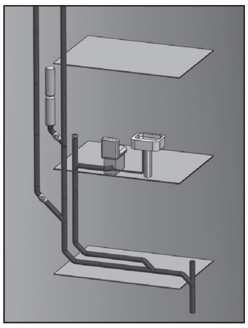

Figure 4.

The current configuration in the tower is based on the EN12056-2, with a one floor stub stack and a 5 meter offset, with 100 meters of vertical stack above this.

The stack diameter 100 mm, with a 50 mm secondary vent with cross vents every 3 floors. The vent pipes can be isolated from the stack using gate valves. Active venting is also installed on the system consisting of AAVs and P.A.P.A. so that the systems can be compared.

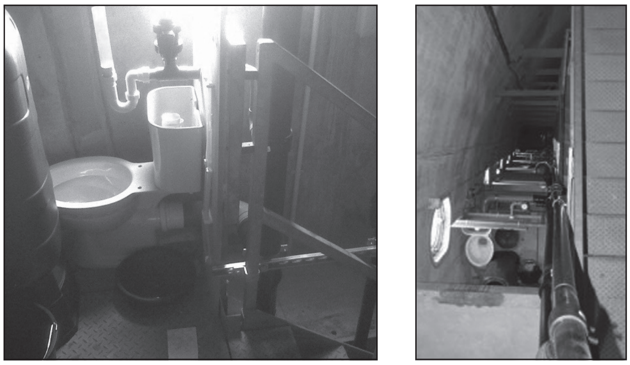

Figure 5.

Pressure transduces are also installed so that the pressure in the pipes and different locations can monitored and recorded.

Figure 6.

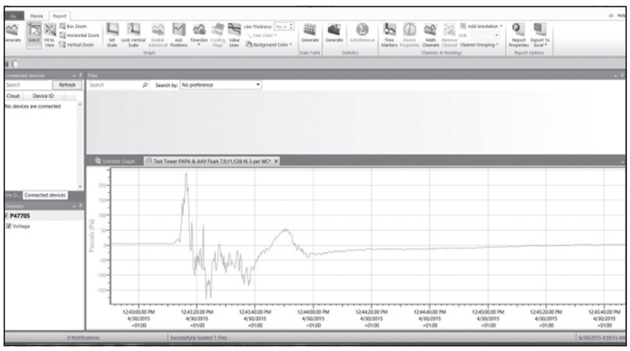

Figure 7.

Conclusion

The NLT provides the perfect platform for testing modern high-rise drainage and vent systems, both to code designs as well as different system solutions such as active drainage ventilation and stack-aerators.

The validation and testing on the tower can work with simulation tools such as AIRNET and vice versa so the findings can be used to develop new systems and support the industry with data and empirical testing results for future high-rise standards.

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- Solution - Active Ventilation Single Stack Drainage

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