Insol's Wind Tunnel Reduces Risk and Improves Safety for the Building Industry

As extreme weather events can result in catastrophic consequences, testing for the potential danger of wind impacting building structures is of paramount importance.

Challenge

To engineer, build and install a wind tunnel allowing testing of the impact of wind on building structures.

Solutions

High-level motor control

- The Allen-Bradley® CompactLogix™ PLC provides high performance and integration of safety, motion and drive capabilities
- High-level motor control for each of the four fans in the wind tunnel is provided by the PowerFlex® 755 AC variable speed drives

Results

Improved risk mitigation and safety.

- Insol's wind tunnel is able to generate flow velocities of up to 200km/hour
- The tunnel has full variable speed control over the four centrifugal fans, maximum control of wind speeds allows for low-speed acoustic testing as well as high speed structural tests.
- Wind testing helps to improve risk mitigation and safety for the building industrys

Insol's wind tunnel is able to generate flow velocities of up to 200km/hour.

Background

As either a purpose to stand out of the crowd or blend in with the surroundings, architectural facades are one of a building's most important exterior elements.

Smart new technologies and materials can help boost energy efficiency. Facades can help to reduce heat loss in cooler climates or maintain cooler temperatures inside buildings in warmer climates.

Designs and materials are continuing to push the boundaries of what is possible. This presents a number of important considerations for architects and facade engineers alike.

An area of contention is how building facades will react to weather patterns, especially wind. Wind causes a number of issues such as the unwanted production of sound or the physical degeneration of the facade. In more extreme cases, sudden failure of facade elements at considerable height is likely to have catastrophic consequences.

In addition, there are issues around liability that are not directly covered by the building code or design specifications. Therefore, given the inherent safety and functional considerations, testing facades for structural integrity and wind noise provides the best possible scenario.

Rockwell Automation

To make this testing possible, Insol – a New Zealand based family business specialising in the manufacturing and installation of highly customised and complex facades for commercial construction – decided to build a wind tunnel to test architectural facades. This testing is key to help improve risk mitigation and safety.

Engineering the wind tunnel

Engineering one of the largest wind tunnels in the Southern Hemisphere was a significant undertaking. As such, Insol called on EIS Group, a Rockwell Automation Recognized System Integrator, for their expertise in automation and process control.

EIS Group was tasked with the concept engineering, control and drive system selection, deployment and support. "A project like this requires out of the box thinking and some smart engineering," said Dean Addie, general manager, EIS Group. "We knew that the Rockwell Automation control and drive systems would meet the requirements for the wind tunnel and worked closely with NHP and Rockwell Automation to deliver the best available solution."

The Allen-Bradley® CompactLogix™ controller provides high performance and integration of safety, motion and drive capabilities in one controller. High-level motor control for each of the four fans in the wind tunnel is provided by the PowerFlex® 755 AC variable speed drives. As the wind tunnel is not connected to the electrical grid, there are four generators powering each of the drives.

High-level motor control for each of the four fans in the wind tunnel is provided by the PowerFlex 755 AC variable speed drives.

"There are a number of considerations when connecting drives to generators in relation to harmonics, so by using the Rockwell Automation harmonic modeller software we were able to monitor the harmonics of the generator back into the drives to make sure it was working well," said David Kendall, channel account manager, Rockwell Automation.

"The collaboration with EIS was critical to the success of the project. There was a real strength in the relationships

The wind tunnel is an open jet, high power, short tunnel design and configuration, specifically developed to allow for one-to-one scale building façade testing.

and their full capability of design, engineering, deployment and support meant that all aspects of the project were focused on in detail," he added..

Gale-force wind on demand

"There are design parameters around how you would design pressures on a building surface but when it comes to seeing how things will act under actual wind-load – that is something you will not find in a textbook," said Greg Simmons, ceo, Insol.

There is no real specific guidance about how to consider the loading on some of these very complex architectural features. If an architect was to design a façade screening system for a hotel, for example, and under heavy wind conditions a significant amount of noise is generated, that would interfere with hotel guests' comforts and impact their ability to sleep.

Issues caused by wind can be felt both physically and financially. Whether the issue is unwanted noise, physical degradation of the façade or even a potentially catastrophic failure, it is best practise for safety and risk mitigation, to conduct the most thorough testing possible. Insol's wind tunnel makes this possible.

The wind tunnel is a high power, open jet, short tunnel design and configuration, specifically developed to allow

> ***A project like this requires out of the box thinking and smart engineering.***

for one-to-one scale building façade testing in its 3-metre diameter turntable. It is able to generate flow velocities of up to 200km/hour. The tunnel has full variable speed control over the four centrifugal fans, maximum control of wind speeds allows for low-speed acoustic testing as well as high speed structural tests.

Next generation facades

Architectural facades are becoming increasingly customised and unique. They are pushing the boundaries of what is possible with advancements in new materials, designs and technologies. This makes thorough scientific testing of the impacts of wind on building structures imperative as in extreme cases, the consequences of product failure can be fatal.

Regulating authorities continue to request more information on terms of testing and calculations for many

Façade designs and materials are continuing to push the boundaries of what is possible. This façade on the Lichfield Street Carpark in Christchurch, New Zealand features stainless steel struts and nodes, offset with aluminium diamond-shaped "scales" and translucent acrylic panels.

building structures including facades, roofing products and solar panels. To aid this, Insol's wind tunnel is available for hire to the building industry. This testing provides an effective risk assessment which in turn helps address insurance and council permit requirements.

Undertaking an innovative and novel project such as a wind tunnel is never easy but thanks to open communication, teamwork and technical expertise, Insol's wind tunnel has achieved its goal of increased risk mitigation and safety.

"It is hard to find a better working relationship. EIS have an extensive capability in house and are able to adapt to the requirements of the project. Furthermore, the support that EIS received from Rockwell Automation was remarkable, making the collaboration between all companies involved critical to the success of the project," said Simmons.

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