WINDLAB™

BY INSOL

FAÇADE TESTING LABORATORY

INSOL®

WINDLAB™ BY INSOL

Façades | Engineered | Designed | Assembled | Constructed

WE'RE ADVANCING FAÇADE ENGINEERING AND TESTING.

RESEARCH, EXPERTISE AND TESTING COMBINE TO IMPROVE SAFETY, REDUCE RISK, AND DRIVE BETTER OUTCOMES FOR FUTURE FAÇADES

EXECUTIVE SUMMARY

Welcome to WINDLAB™

The consequences of product failure can be fatal. This is why we have developed The Insol Façade Testing Laboratory (or WindLabTM), the largest testing facility of it's type to mitigate risk by providing vital data to help us answer:

It Safe? Can We Break It?
We have been operating in this specialist field since 2003. As the complexities of screening have increased, going beyond published guidelines and knowledge, there is a need for more scientific and analytical understanding.

Is It Noisy?
Wind noise is difficult to predict. The acoustics of bespoke screening can be the cause of significant occupant discomfort and substantial financial cost to building owners, designers and contractors.

Our wind tunnel has an open jet, high power, short tunnel configuration. It's specifically designed to meet 1:1 scale building façade elements for structural integrity and windnoise.

Able to generate flow velocities of up to 200km/h, variable speed controls over the 1.5megawatt, 4 centrifugal fans allow maximum control of wind speeds which enables low-speed acoustic testing as well as high-speed structural tests.

Greg Simmons
CEO

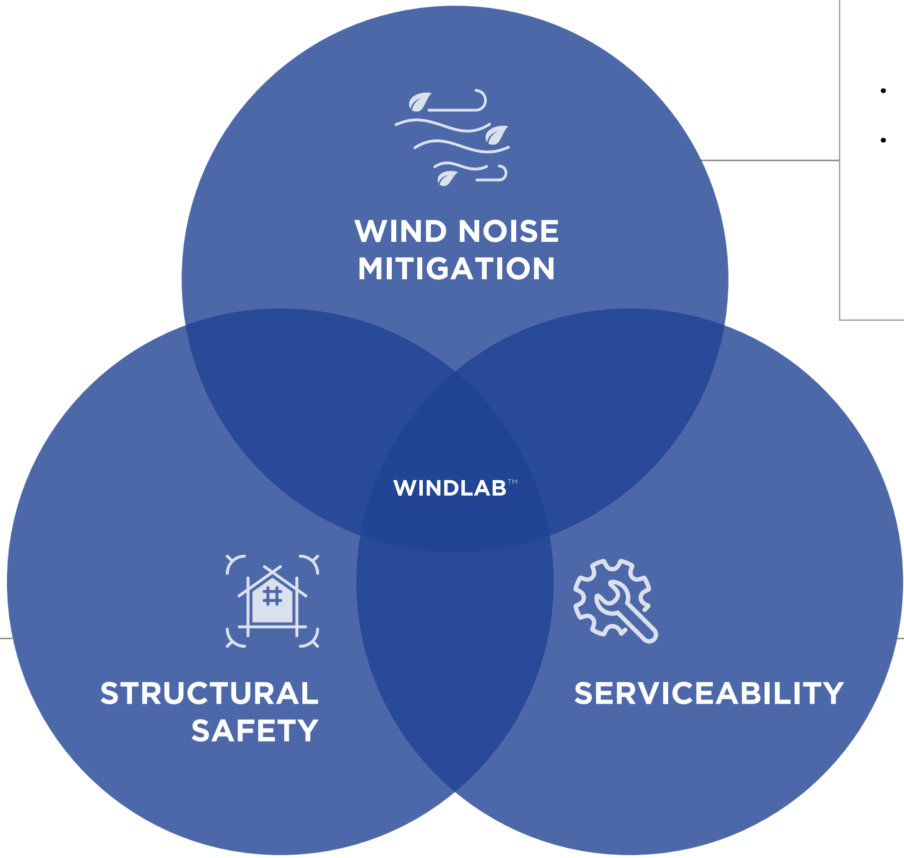
Shane Hart
Client Relations

Daniel Forrest
Project Manager

IMPROVING OUTCOMES WITH FAÇADE DESIGN

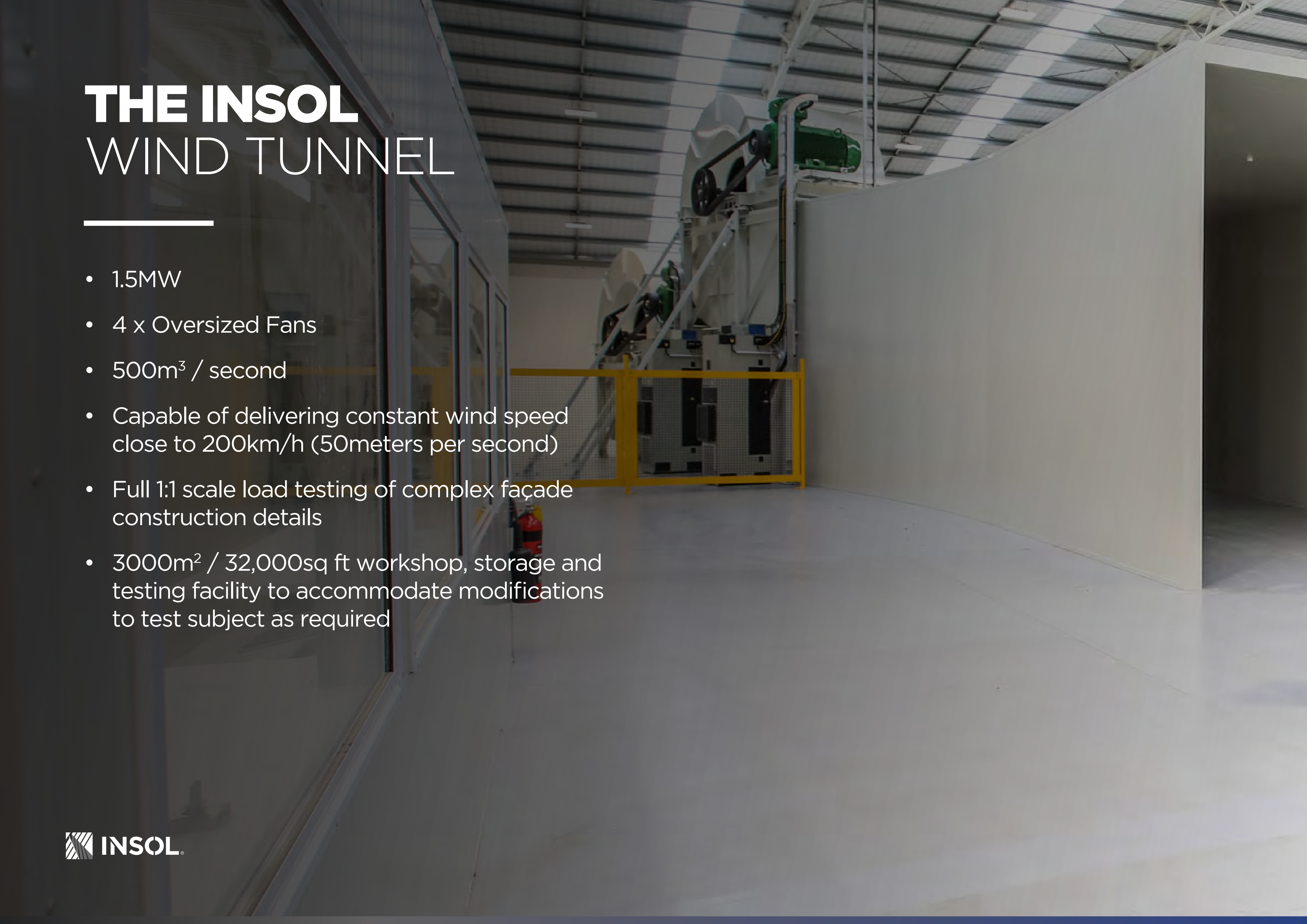
Façade testing with Insol's WindLab will help meet project goals, optimise complex designs and identify and mitigate risks prior to construction.

- Reduced acoustic disturbances
- Identify potential for wind-induced vibrations, fatigue, or instability



- Safe structures under extreme wind conditions
- Optimise Design

- Enhanced operability in high winds
- Quiet and functional Façade systems



THE INSOL WIND TUNNEL

- 1.5MW
- 4 x Oversized Fans
- 500m^3 / second
- Capable of delivering constant wind speed close to 200km/h (50meters per second)
- Full 1:1 scale load testing of complex façade construction details
- 3000m^2 / 32,000sq ft workshop, storage and testing facility to accommodate modifications to test subject as required

CLICK OR SCAN QR TO VIEW

AWES-QAM-02-2024

Architectural screens are increasingly bespoke, requiring custom designed extrusions, building connections or brackets.

- AS/NZS1170.2 and other literature applicable to local regions are not comprehensive enough for many installations.
- Wind loading assumptions applicable to windows and cladding are often not relevant.
- Some or most designs cannot be fully assessed using computational methods like CFD (Computational Fluid Dynamics).

The Australian Wind Engineering Society is responsible for the first comprehensive industry guidelines for full scale wind testing of building envelope components, created as a direct response to industry concerns about the rising risk of wind-induced incidents in the built environment.

The AWES-QAM-2-2024 standard was developed to provide guidance to construction professionals on conducting full-scale wind testing of building envelope components and architectural features.

Part A: Wind Tunnel Tests for Aerodynamic Shape Factors
Focuses on static samples to determine quasi-steady shape factors, covering wind tunnel setups, configurations, and data reporting.

Part B: Tests for Wind-Induced Dynamic Excitation
Addresses dynamic tests on prototypes to assess wind-induced vibrations, structural stability, and fatigue life, including specific configurations and reporting requirements.

Part C: Functionality Testing of Façade Components
Covers tests for operable façade elements (e.g., windows, sunshades, ventilated systems) to ensure safe functionality under serviceability wind conditions.

Part D: Wind Tunnel Tests for Wind-Noise
Examines the potential for wind-noise generation in full-scale façade prototypes, including tonal noise identification and acoustic performance reporting.

Global Relevance: This test standard offers internationally applicable guidelines for improving design and construction practices under wind conditions. WindLab Façade testing laboratory can meet all guidelines for wind testing of large-scale building envelope components as set out in AWES-QAM-2-2024

Copy of the full test standard is avaliable from Insol at
insol.co.nz/windtunnel-qualityassuranceforwindtesting

STRUCTURAL AND WIND NOISE RISK MATRIX

Our quest for safety and risk mitigation have led to the development of our own risk matrix tools for in-house use. These aid us in assessing possible risk and identifying when testing is needed.

STRUCTURAL RISK MATRIX & SCORING SYSTEM

Score	1	2	3
BUILDING HEIGHT	0-10M	N/A	10+ M
SCREEN DETAIL	Fixed screens with simple and common details e.g. 200mm airfoil louvres bracket fixed to steel structure	Fixed screens with complex and bespoke geometry e.g. faceted perforated sheet metal set at varying angles or louvre blades with long cantilevers	Dynamic screens e.g. pivoting, bi-folding, sliding etc
DESIGN WIND PRESSURE*	0-1 KPA	1-1.5KPA	1.5+KPA
SURROUNDING BUILDING CONTEXT	Simple with no amplifying features e.g. mounted to a flat wall or within a blind recess	Some amplifying features e.g. in an area where wind will obviously funnel or within 5m of a building corner/parapet	Within 2.5m of a building corner/ parapet or on a roof

* design wind pressure for cladding face loads provided by project consultants

Score	
1-5	Standard Design Process
6-7	Check with design manager, additional modeling or testing may be required
8-12	Check with design manager, additional modeling or testing may be required

FAÇADE WIND NOISE RISK MATRIX

MATERIALS RISK (LOW → HIGH)	DEVELOPMENT INDEX (LOW → HIGH): INDUSTRIAL/ LOW RISE COMMERCIAL AND OFFICE Manufacturing, Utility, Warehousing	MEDIUM COMMERCIAL OCCUPANCY Multilevel Carparks	MULTISTORY MEDIUM OCCUPANCY Universities, Schools and Office Buildings	MULTISTORY HIGH OCCUPANCY LIVING Hotels, Hospitals and Apartment Buildings
• Timber louvres • Fabrics	LOW	MEDIUM	MEDIUM	MEDIUM
• Aero foil louvres • Perforated metal with large irregular holes	LOW	MEDIUM	MEDIUM	HIGH
• Sharp edge louvres • Cable structures	LOW	MEDIUM	HIGH	EXTREME
• Peforated metall with regular small holes • Balustrades with balusters • Architectural feature Façades	MEDIUM	HIGH	HIGH	EXTREME

EXPLANATION OF RISK RANKING	
LOW	This is not likely to generate noise.
MEDIUM	Consideration should be given to noise generation and mitigation during the design process. Consult with Insol if necessary.
HIGH	Wind generated noise that causes occupant discomfort is likely. Consult Insol regarding risk mitigation.
EXTREME	Wind generated noise that causes occupant discomfort is likely. Consult Insol regarding mitigation.


INSOL
Architectural
Facade Treatments
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CASE STUDIES

CASE STUDY

AUCKLAND INTERNATIONAL AIRPORT TRANSPORT HUB

CLIENT
AIAL

ARCHITECT
Peddlethorpe

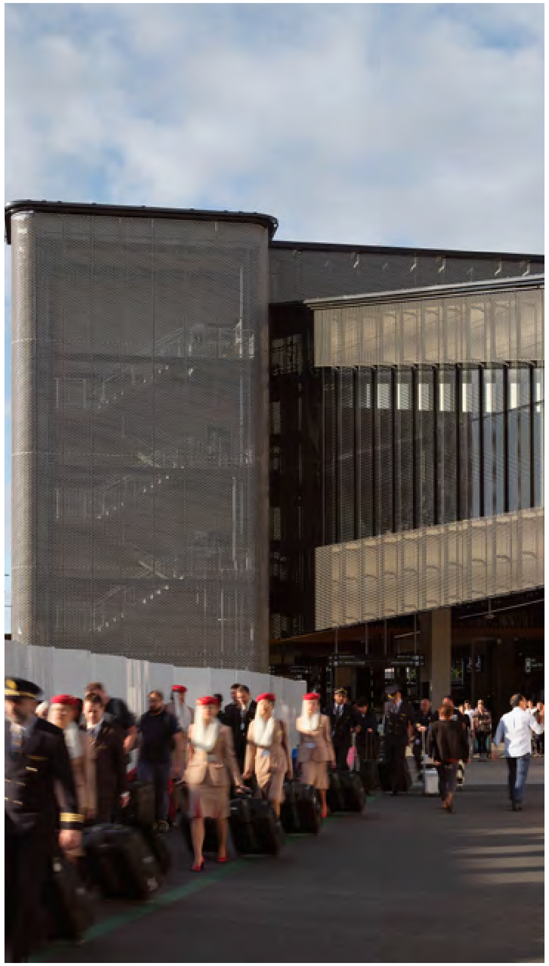
LOCATION
Auckland, NZ

THE SITUATION
The Auckland International Airport Transport Hub is arguably the busiest in the country. With over 10,000 vehicle movements per day and tens of thousands of passengers walking past, any issues of noise from the perforated Façade would create a significant and embarrassing problem for this gateway to the world.

Located next to the International Terminal, adjacent to gateway hotels and providing a sheltered walkway to the domestic terminal, the Transport Terminal is a high throughput facility in a high wind zone with over 8500m of perforated screening. The potential for wind-induced noise and vortex-induced oscillation posed a risk which could play out under the gaze (and within earshot) of enough connected travellers to pose a significant problem for the Airport, making wind-tunnel testing critical.

TESTING RESULTS & RECOMMENDATIONS
The initial perforated pattern specified performed poorly in both acoustics and deflections. By testing subsequent patterns using an interactive process, we were able to modify the pattern to a point whereby it would produce no noise while maintaining the architectural intent.
Multiple variations of the pattern were needed to reach that point, each being subjected to increasing wind speeds at different angles, the 1:1 mock-up being rotated by 15 degrees on the turntable between each test. The client was able to view the panel under full wind load and understand how it would look and perform in the eyes of concerned travelers passing by.

CONCLUSION
By incrementally changing the pattern we were able to preserve the original vision for the Transport Hub. No noise was generated by the adapted pattern even in wind speeds exceeding the daily average at the Airport, or at an expected (and unexpected) gust level.
Furthermore, we were able to prove the fixings would be able to hold fast against vibrations and expected wind loadings, maintaining the structural integrity of the Façade.



CASE STUDY

SHELLY BEACH ROAD APARTMENTS

CLIENT
GN Construction

ARCHITECT
PB&A

LOCATION
Auckland, NZ

THE SITUATION
Sitting atop an elevated position in St. Mary's Bay, XXXII is a boutique apartment complex with views of downtown Auckland and the Waitakere Ranges.
Occupant privacy and thermal gain is provided by 42 Azimuth Sliding Screens, each panel using 40x3mm flat bars and a 60x6 angle perimeter. The screens are able to be manipulated into the optimal position by occupants.
As the screens are not for weather tightness or security, it was easy to foresee a situation whereby they would not be secured into position, by method of dead-man latch. The question then becomes one of which dead-man latch. There was nothing available with test reports showing the latch was robust and durable enough to cope and hold under pressure from wind gusts, requiring a bespoke latch.
With no test data available, we needed to make sure it met our demands for risk mitigation and tested it to failure.

TESTING RESULTS & RECOMMENDATIONS
A full 1:1 scale mock-up was manufactured and then placed on the turntable in front of the wind tunnel. This mock-up was rotated to simulate the varying angle of wind direction, with all angles tested at every speed increment to find the angle at which the most load was placed on the latch by the wind.
The next step was to increase the speed until the latch failed. The first tests had the latch failing when the wind tunnel was running at 15m/s (54km/h). That would be enough for significant issues to likely occur multiple times per year. Further modifications to the latch were made and the testing regime was repeated until we again reached the point of failure.

CONCLUSION
For sliding screens to be used in medium density apartments and/or buildings or multiple storeys, there is significant risk from wind-induced damage (noting the potential for wind noise is also a concern). The currently available latches are unable to offer the safety required and require significant modification to meet anything approaching an acceptable level.
For prudent risk mitigation, we'd recommend the use of wind tunnel testing for similar projects or speaking with us about our now tried and tested design that we know already works.

CASE STUDY

SCAMMONDEN BRIDGE, UK

CLIENT
National Highways Limited

ARCHITECT
Windtech

LOCATION
West Yorkshire, UK

THE SITUATION

When it opened in 1970, the seven mile stretch of the M62 motorway that connects parts of the Pennines in West Yorkshire was hailed as the "most exciting section of motorway construction yet undertaken in Britain".

Sitting 37 metres (120 ft) above the motorway is the Scammeonden Bridge. At 120m (410 ft) long, it was the longest concrete arch bridge in England. The bridge had only a waist high fence on each side and, sadly, in more recent years had become well known as a place where people went to end their lives.

This led to safety improvements in 2020. As part of the GBP1 million upgrade plan, an inwardly curved 2.4m (8ft) high ant-climb fence was installed. However, the high winds which plagued the bridge from the moment it was opened continued to cause problems.

The infill elements of the parapet were immediately susceptible to vortex induced oscillation (VIO) and the fluctuating lift and drag forces caused structural vibrations. The result was a deterioration of sections of the new anti-climb fence, to the point where they were deemed beyond repair in under 3 years since being commissioned.

TESTING RESULTS & RECOMMENDATIONS

A remedial solution was designed to help reduce the wind induced excitation on the fencing and barrier, however because of the issues with the initial design, the client needed to test the remedial before this was applied on site. To establish the effectiveness, a full 1:1 scale mock up was built and tested extensively using Insol wind tunnel.

This mock-up was rotated to simulate the varying angle of wind direction, and subjected to extreme wind speeds up to 49m/s for extended periods of time. Further modifications were made to the test mock up to cancel out any instances of vibration which still occurred, and a second round of testing with a final mock up proved a 100% effective result.

CONCLUSION

The result is a design which is 100% effective and will ensure the parapet structure meets the design life criteria requirements, along with increasing pedestrian comfort.

WINDLAB™

BY INSOL

Invercargill

34 Onslow Street
Invercargill 9812
03 216 3287
enquiries@insol.co.nz

Auckland

7 Waokauri Place
Auckland 2022
09 276 9735
enquiries@insol.co.nz