BRASIL PARK TOWER

Balneario Camboriu, SC

PRELIMINARY RESULTS SUMMARY OF STRUCTURAL WIND TUNNEL TESTING

Project # 2505783
November 13, 2025

Redefining possible.

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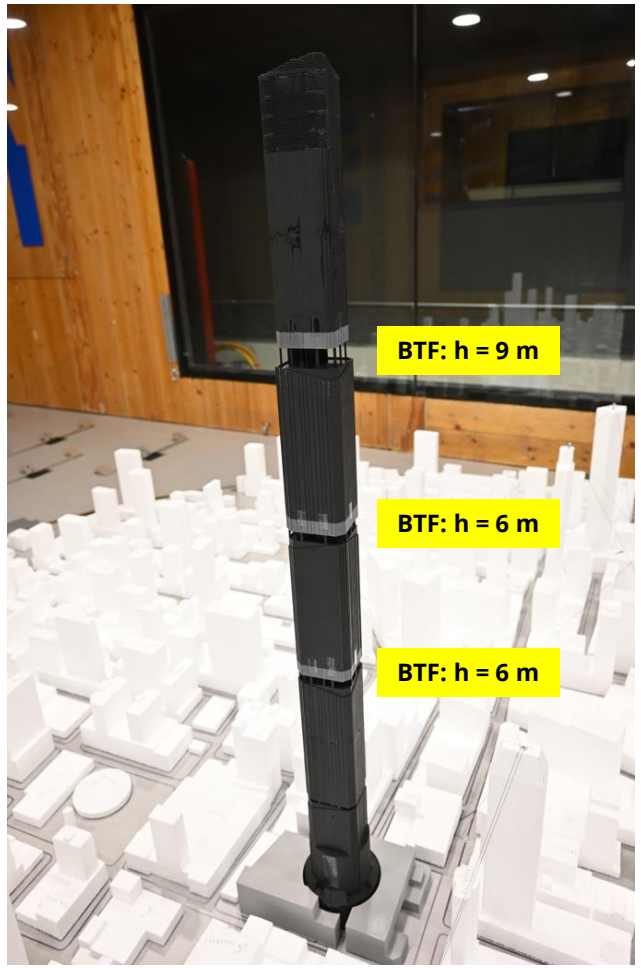
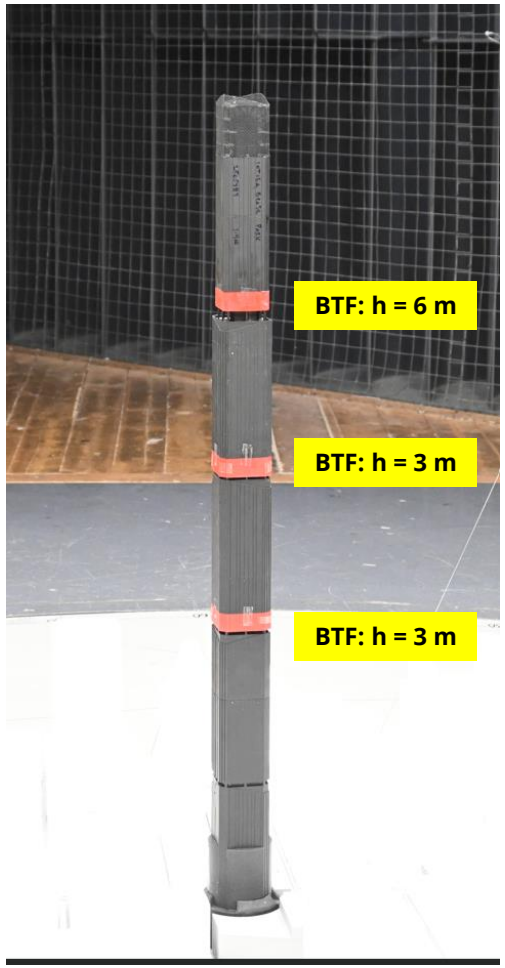
Building Configurations Tested: Configuration 1



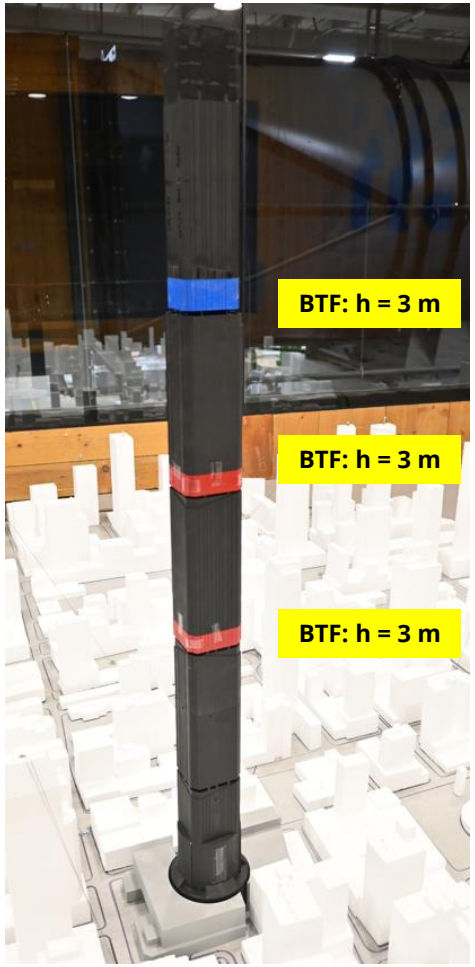
BTF = Blowthrough Floor

Building Configurations Tested: Configuration 2



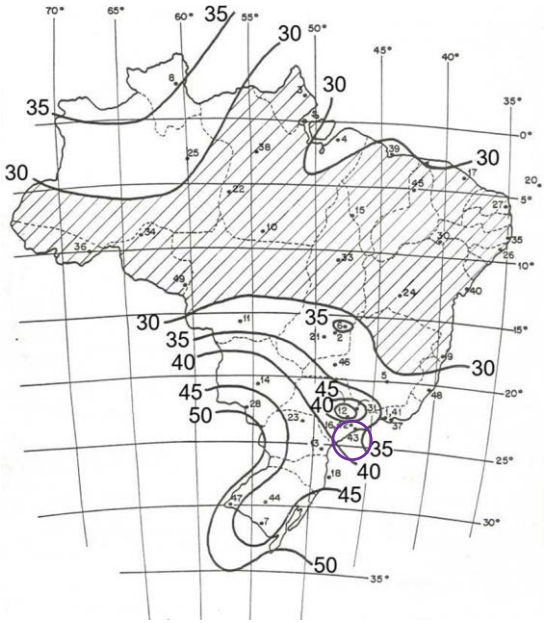
BTF = Blowthrough Floor

Building Configurations Tested: Configuration 3

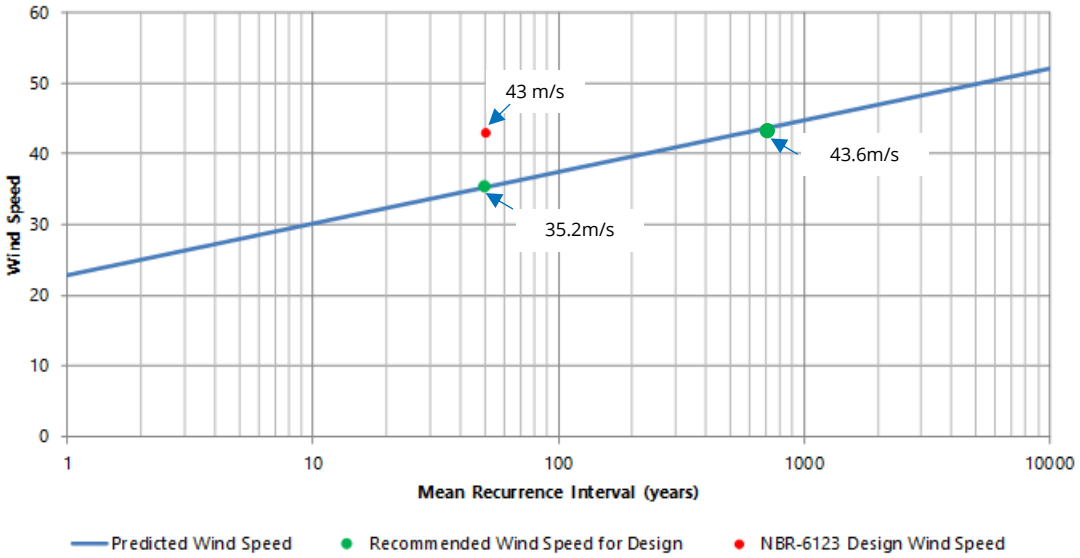


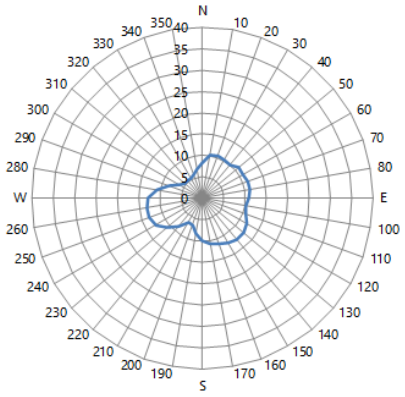
BTF = Blowthrough Floor

Wind Climate Model Used in the Analysis

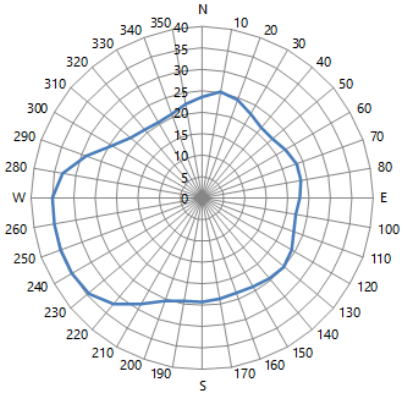


NBR-6123 Map of Design Wind Speeds



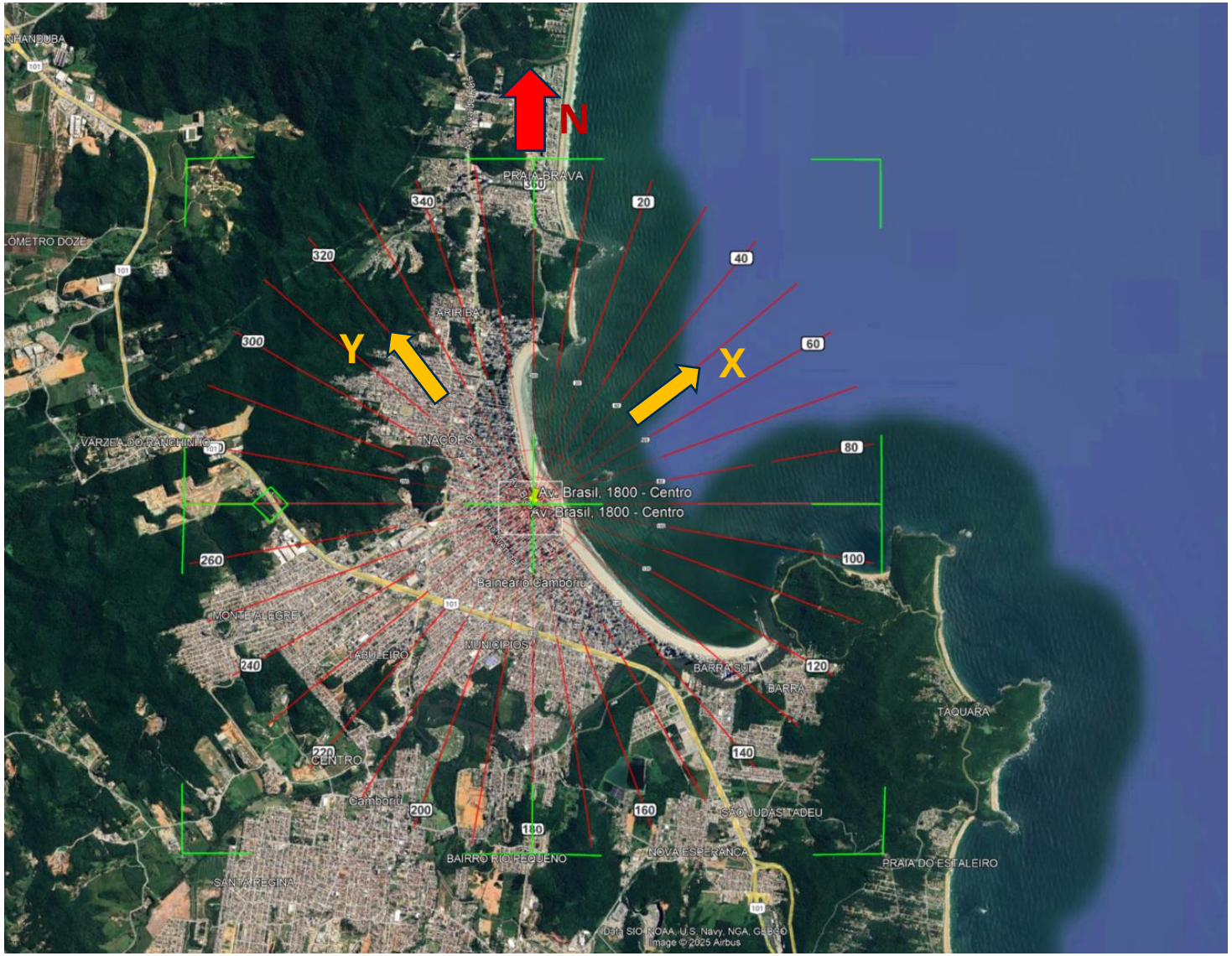


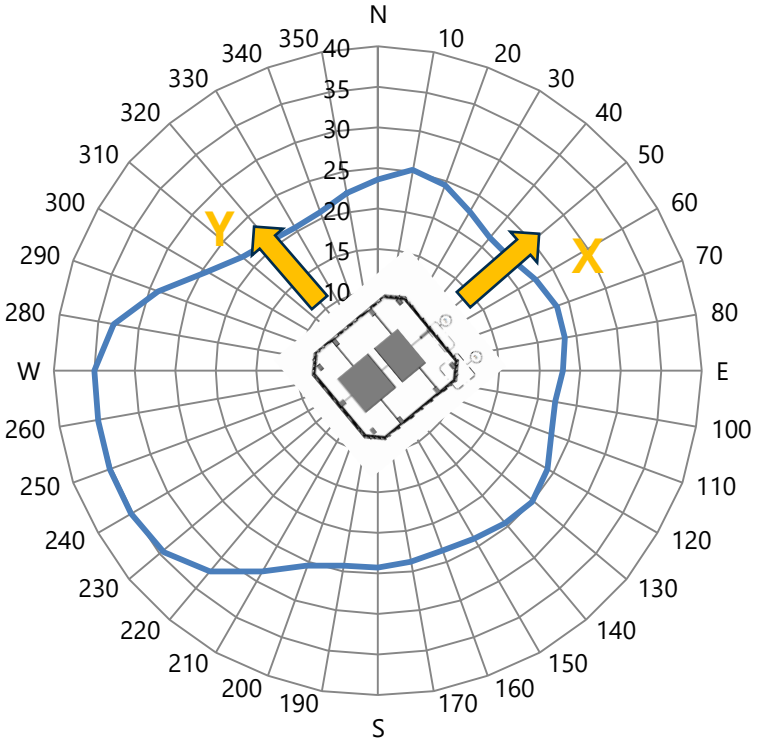
Common Winds



Design Winds

Site and Building Orientation Relative to Wind Directionality





Design Winds

Key Findings from the Analysis

- Due to long sway periods (13-16 sec range) and high slenderness ratio (16.5), vortex shedding is occurring at low wind speeds (bi-weekly or monthly return period wind events!!). Similar behavior has been observed on similar slender buildings in New York City with high slenderness ratio.

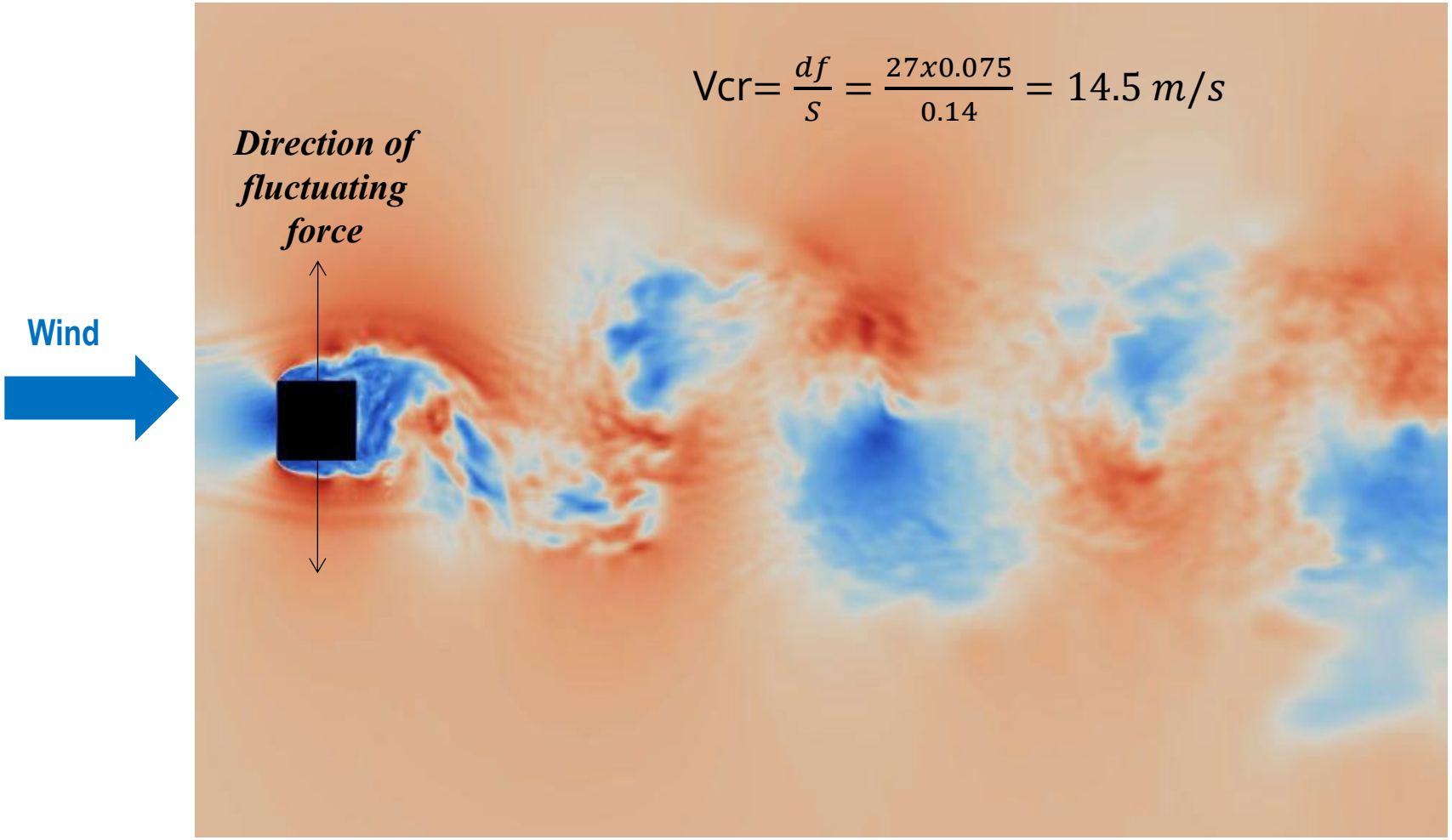
- 50-year and 700-year wind loads are governed by along-wind responses. This is also related to the fact that vortex shedding and strong across-wind responses occur at low wind speeds due to the tower's long sway periods and high slenderness ratio.

- Chamfered corners, blow-through floors, and porous crown at the top of the tower have proven to be very effective in reducing wind loads and accelerations of the tower.

- Wind tunnel predicted base overturning moments are 20-30% than the values calculated by code prescriptive analytical procedure.

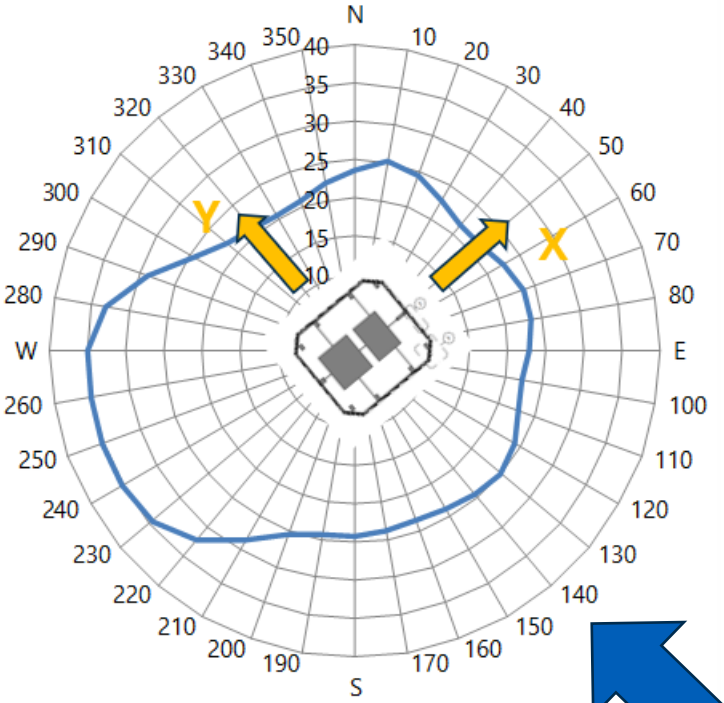
- Predicted accelerations at low return period winds are at levels that can be manageable through the implementation of TMD that can generate a total damping of 3-4%.

Illustration of Vortex Shedding in a Square Section



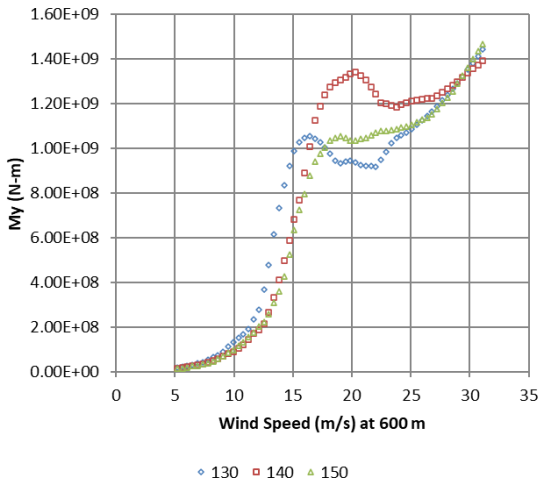
$$Vcr = \frac{df}{S} = \frac{27x0.075}{0.14} = 14.5\ m/s$$

Illustration of Vortex-Shedding Effects at Low Wind Speeds

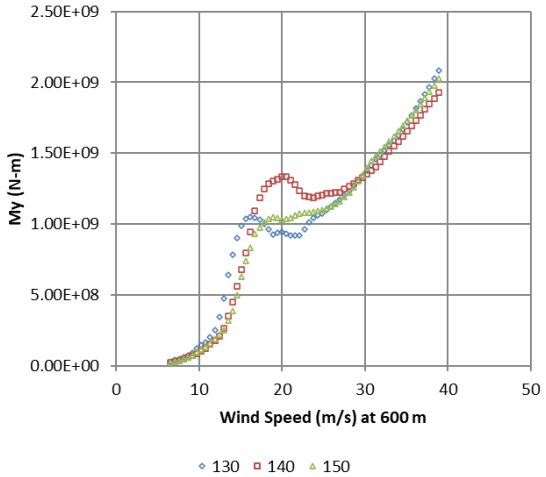


Wind

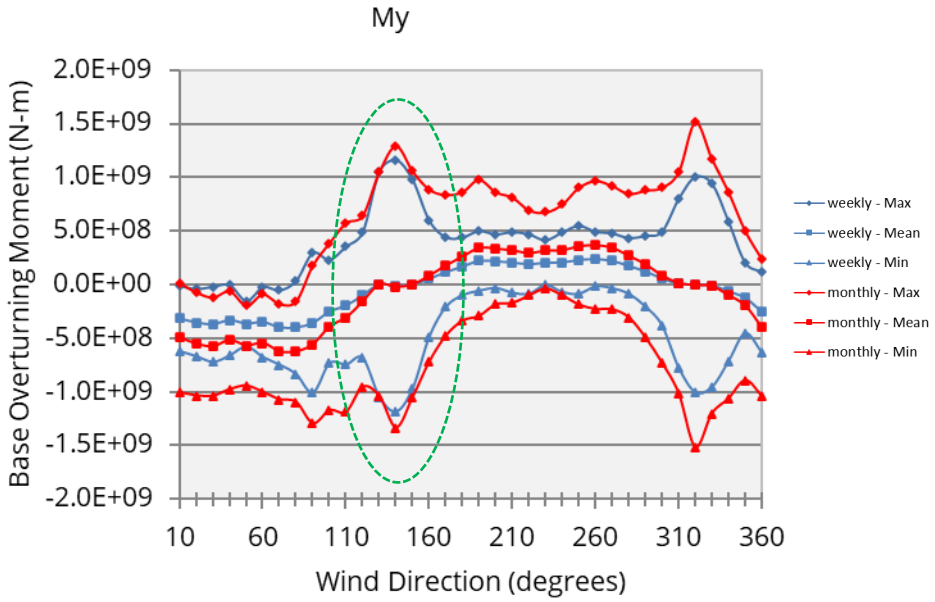
Weekly



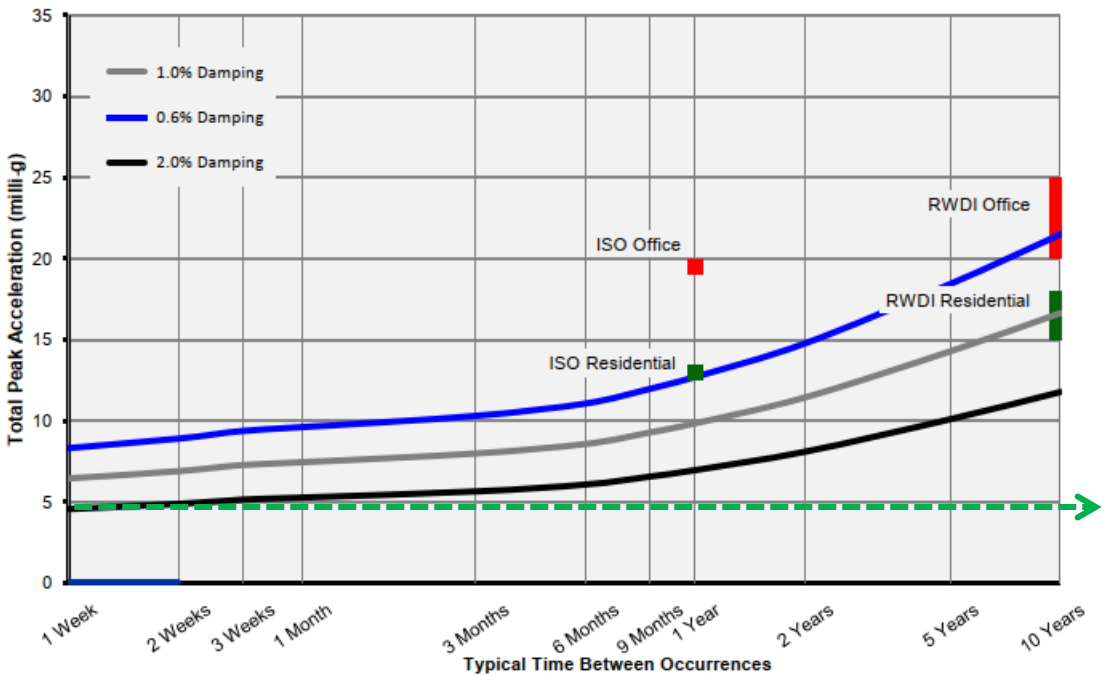
Monthly



Across-wind Response



Acceleration Results for Configuration 1



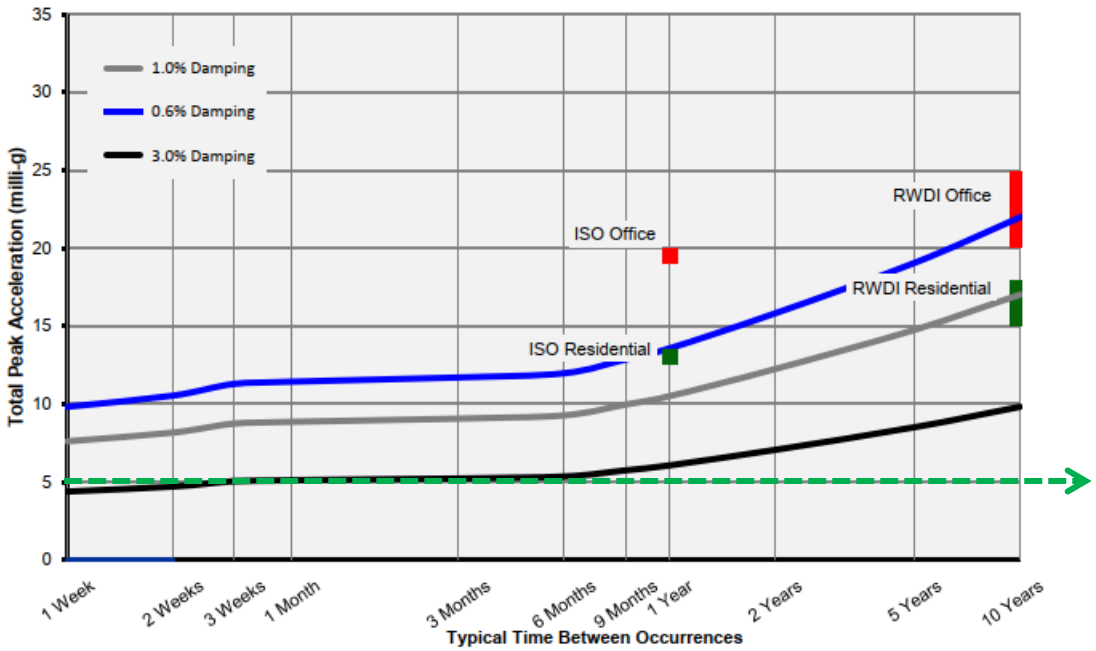
Motion Perception Threshold

Return Period	Peak Accelerations[2] (milli-g) Total - [X, Y and torsional components]		
	1.0% Damping	0.6% Damping	2.0% Damping
1 Week	6.4 - [6.4, 4.6, 0.16]	8.3 - [8.2, 5.9, 0.21]	4.6 - [4.5, 3.2, 0.12]
1 Month	7.4 - [7.4, 5.7, 0.30]	9.6 - [9.5, 7.3, 0.39]	5.3 - [5.2, 4.0, 0.21]
1 Year	9.8 - [8.5, 9.8, 0.65]	13 - [11, 13, 0.84]	7.0 - [6.0, 6.9, 0.46]

Notes

1. Periods of 14.92, 13.34, and 2.36 seconds were used along with the indicated damping ratios.
2. Accelerations are predicted at Structural Level '113' (384.2 m above Structural Level '1')

Acceleration Results for Configuration 2



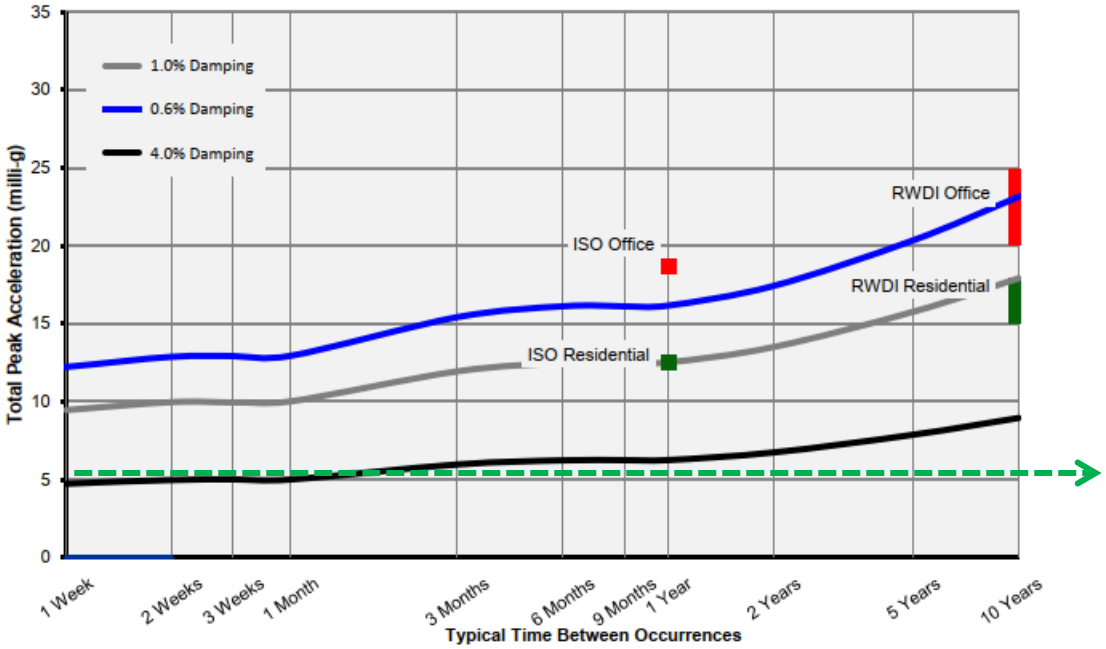
Motion Perception Threshold

Return Period	Peak Accelerations[2] (milli-g) Total - [X, Y and torsional components]		
	1.0% Damping	0.6% Damping	3.0% Damping
1 Week	7.6 - [7.6, 5.3, 0.16]	9.8 - [9.8, 6.8, 0.20]	4.4 - [4.4, 3.1, 0.091]
1 Month	8.9 - [8.8, 6.3, 0.30]	11 - [11, 8.1, 0.39]	5.1 - [5.1, 3.6, 0.18]
1 Year	11 - [9.3, 10, 0.68]	14 - [12, 13, 0.88]	6.1 - [5.4, 5.9, 0.39]

Notes

1. Periods of 14.92, 13.34, and 2.36 seconds were used along with the indicated damping ratios.

Acceleration Results for Configuration 3



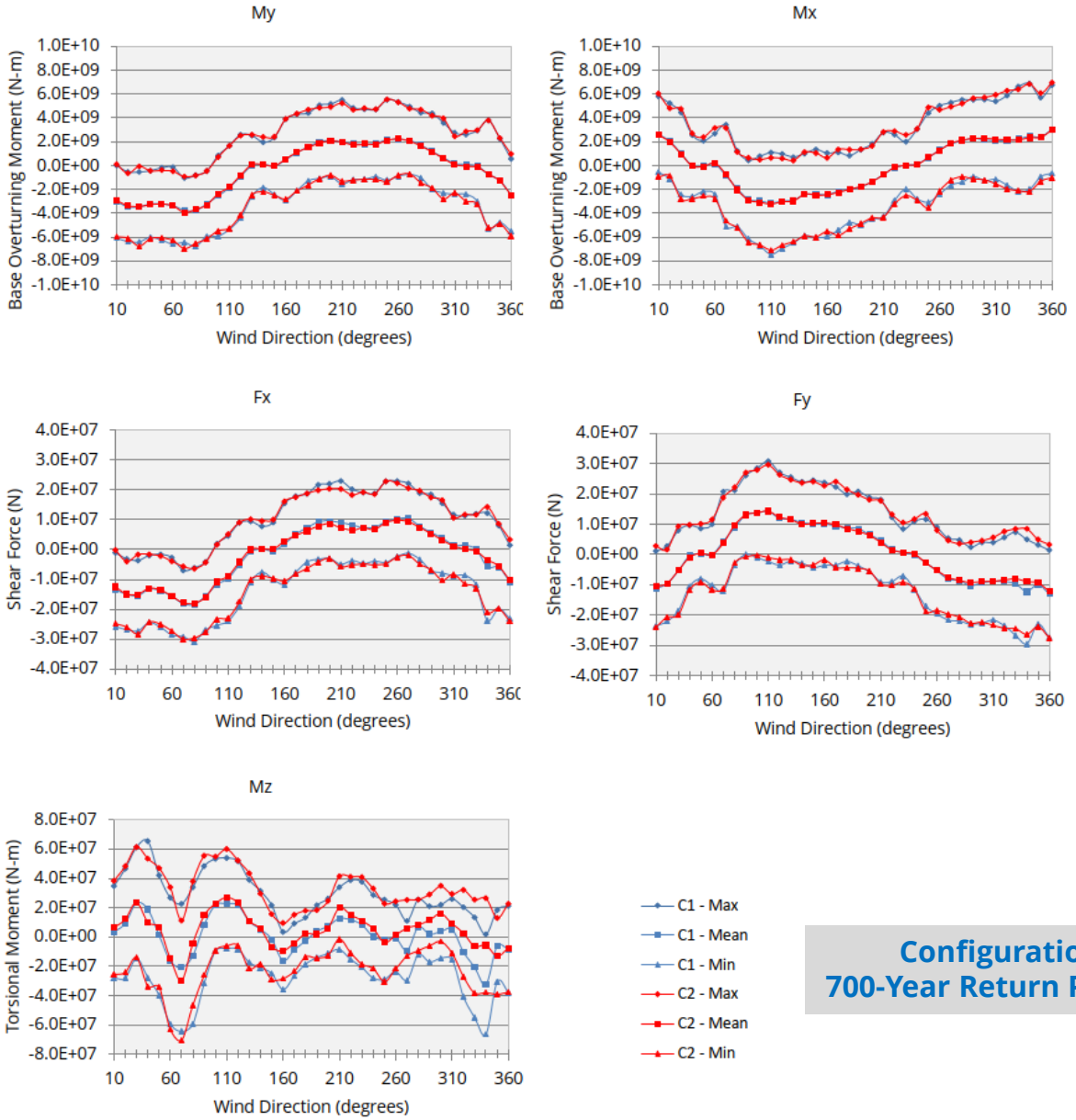
Motion Perception Threshold

Return Period	Peak Accelerations[2] (milli-g) Total - [X, Y and torsional components]		
	1.0% Damping	0.6% Damping	4.0% Damping
1 Week	9.5 - [9.3, 6.5, 0.18]	12 - [12, 8.4, 0.23]	4.7 - [4.6, 3.2, 0.091]
1 Month	10 - [10, 7.7, 0.33]	13 - [13, 9.9, 0.43]	5.0 - [5.0, 3.8, 0.17]
1 Year	13 - [13, 12, 0.68]	16 - [16, 15, 0.87]	6.3 - [6.3, 5.8, 0.34]

Notes

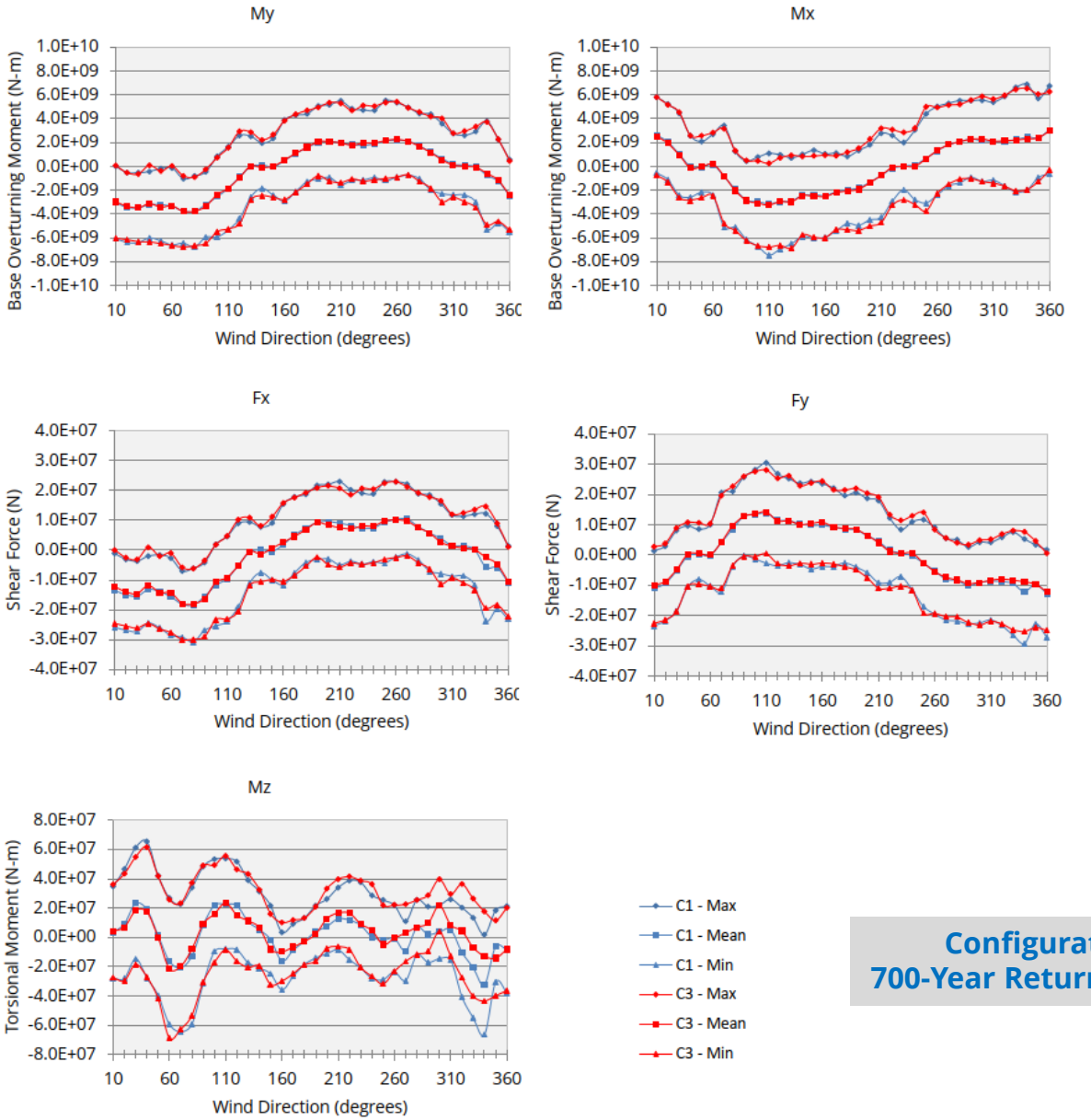
1. Periods of 13.92, 12.34, and 2.36 seconds were used along with the indicated damping ratios.

Illustration of Along-Wind Response at High Wind Speeds



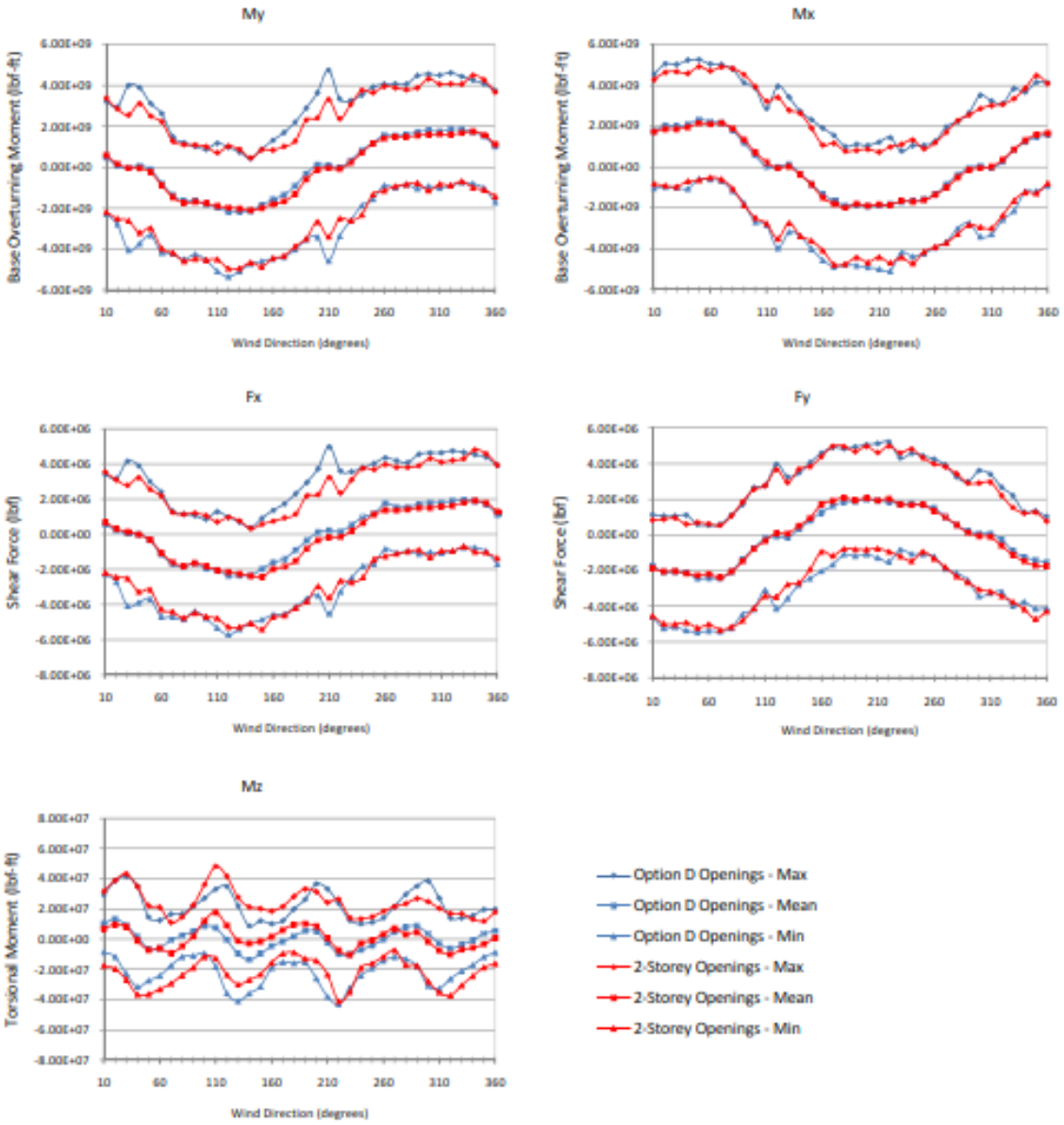
Configuration 1 & 2
700-Year Return Period Winds

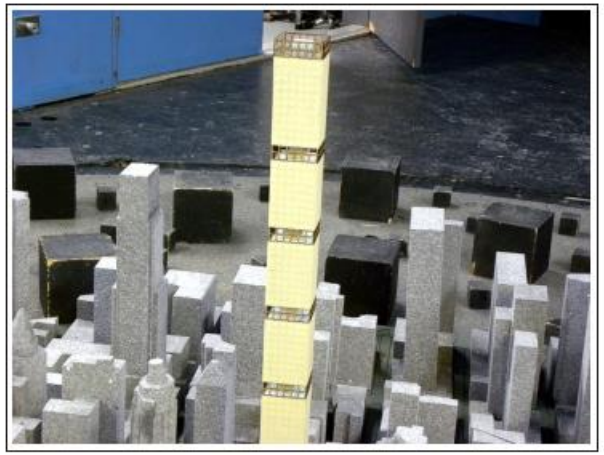
Illustration of Along-Wind Response at High Wind Speeds

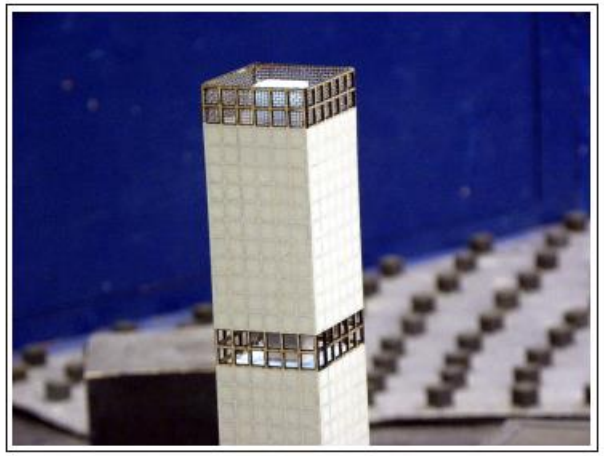


Configuration 1 & 3
700-Year Return Period Winds

432 Park Avenue: Along-Wind Responses at 50-Year Wind Speeds







Wind Tunnel Study Model
Two Storey Full Openings

Figure: 1c

RWDI

Summary of Predicted Peak Overall Structural Loads (ULS Properties)

Summary of Predicted Peak Overall Structural Wind Loads - 700 Year Return Period (ULS Properties)					
Configuration	My (N-m)	Mx (N-m)	Mz (N-m)	Fx (N)	Fy (N)
C1 - (9|6|6)	5.49E+09	5.63E+09	5.34E+07	2.30E+07	2.27E+07
C2 - (6|3|3)	5.45E+09	5.57E+09	5.65E+07	2.25E+07	2.21E+07
C3 - (3|3|3)	5.41E+09	5.31E+09	5.32E+07	2.24E+07	2.10E+07
RATIO	My	Mx	Mz	Fx	Fy
C1/C2	1.01	1.01	0.95	1.02	1.03
C1/C3	1.01	1.06	1.00	1.03	1.08
C2/C3	1.01	1.05	1.06	1.00	1.05

Summary of Predicted Peak Overall Structural Wind Loads - 50 Year Return Period (ULS Properties)					
Configuration	My (N-m)	Mx (N-m)	Mz (N-m)	Fx (N)	Fy (N)
C1 - (9|6|6)	3.45E+09	3.53E+09	3.28E+07	1.49E+07	1.43E+07
C2 - (6|3|3)	3.40E+09	3.53E+09	3.17E+07	1.42E+07	1.41E+07
C3 - (3|3|3)	3.45E+09	3.45E+09	3.01E+07	1.47E+07	1.37E+07
RATIO	My	Mx	Mz	Fx	Fy
C1/C2	1.01	1.00	1.03	1.05	1.02
C1/C3	1.00	1.02	1.09	1.01	1.04
C2/C3	0.99	1.02	1.05	0.97	1.03

Summary of Predicted Peak Overall Structural Loads (SLS Properties)

Summary of Predicted Peak Overall Structural Wind Loads - 50 Year Return Period (SLS Properties)					
Configuration	My (N-m)	Mx (N-m)	Mz (N-m)	Fx (N)	Fy (N)
C1 - (9|6|6)	3.68E+09	3.79E+09	3.32E+07	1.56E+07	1.52E+07
C2 - (6|3|3)	3.62E+09	3.85E+09	3.48E+07	1.50E+07	1.52E+07
C3 - (3|3|3)	3.68E+09	3.77E+09	3.24E+07	1.55E+07	1.48E+07
RATIO	My	Mx	Mz	Fx	Fy
C1/C2	1.02	0.99	0.95	1.04	1.00
C1/C3	1.00	1.01	1.03	1.00	1.03
C2/C3	0.98	1.02	1.07	0.96	1.02

Conclusions

- Aerodynamic shaping recommended at the concept design stage, i.e., chamfered corners, blow-through floors, and porous crown at the top of the tower have proven to be very effective in reducing both wind loads and accelerations of the tower.
- Due to long sway periods (13-16 sec range) and high slenderness ratio (16.5), vortex shedding is occurring at low return period winds (bi-weekly or monthly return period). Similar behavior has been observed on similar slender buildings in New York City with a high slenderness ratio.
- Wind tunnel predicted base overturning moments are 20-30% than the values calculated by code prescriptive analytical procedure.
- The ULS base overturning moments predicted for Configurations 1, 2 and 3 are within a 6% variation.
- The SLS base overturning moments predicted for Configurations 1, 2 and 3 are within a 2% variation.
- Predicted accelerations at low return period winds for all three configurations are at levels that can be managed through the implementation of a TMD that can generate a total damping of 3-4%.

Questions & Discussion on Next Steps