TRILLIUM TOWER

UNIVERSITY OF TORONTO

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S-FRAME SOFTWARE

Stantec

rjc Creative Thinking Practical Results

CASTCONNEX

IBI

AE Associated Engineering

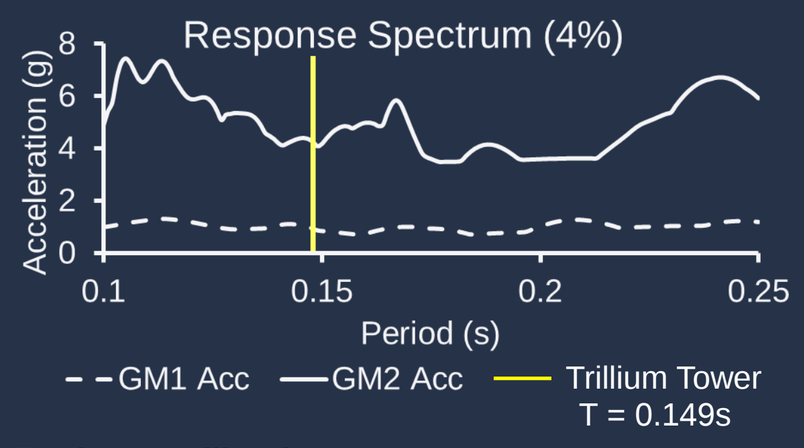
Altair

Design

- Asymmetrical structure with stiff L-shaped base
- Closed tube structure with exterior bracing
- Bracing schemes and column sections chosen for optimal centre of rigidity and period
- Floor plans provide continuous torsional load paths
- Detailed connections to prevent local failure & increase connection fixity to match model
- In-house Python program which creates and models permutations of parameters such as column section and bracing schemes in SAP2000. Over 15,000 towers modelled and analyzed
- Python script for centre of rigidity calculations
- Response spectra used to determine optimal period

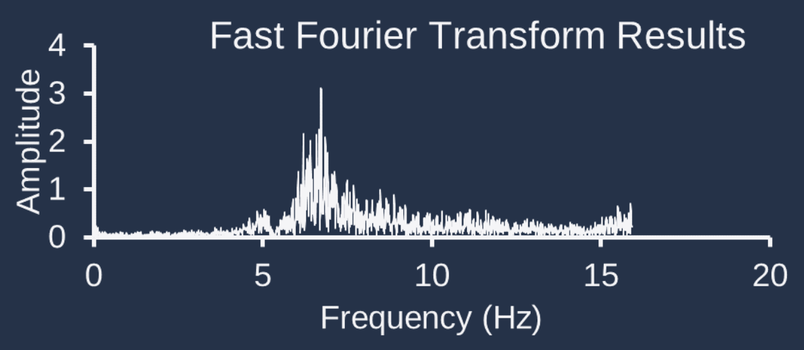
Analysis

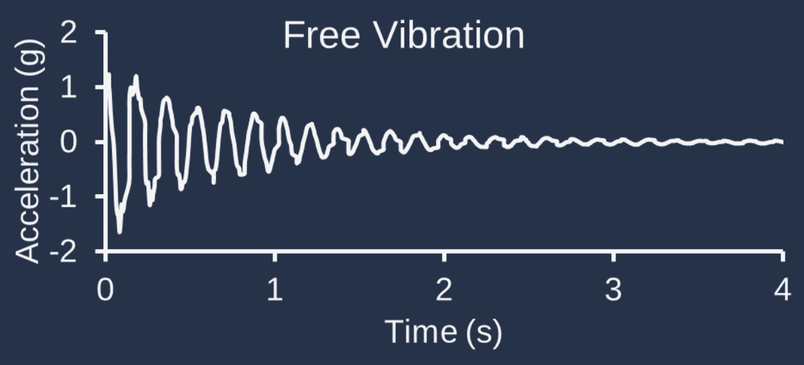
- SAP2000 Modal Time History Analysis
  - Fixed connections
  - Constant Damping
  - Linear behaviour, confirmed by checking maximum member stresses
- Response Spectrum Analysis:
  - 4% damping ratio obtained from free vibration
  - CQC used as modes are closely spaced and interact heavily
  - Using 5 modes, 98% mass participation



Testing + Calibration

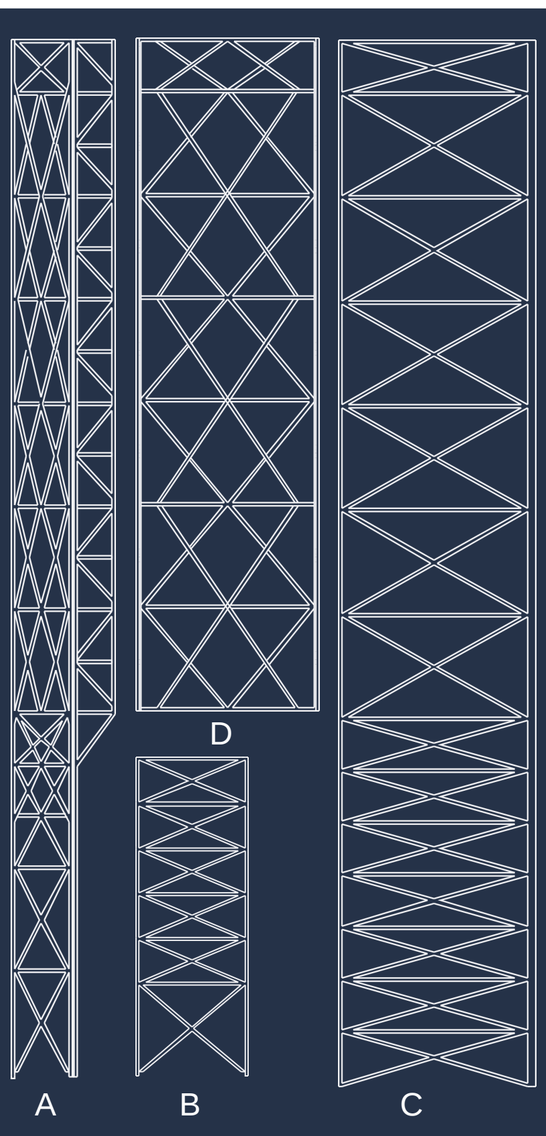
- White Noise Test
  - FFT to obtain fundamental frequency
  - Adjust Young's Modulus of Balsa in SAP2000 to match period of constructed tower
- Free Vibration Test
  - Damping ratio, obtained from log decrement of exponential decay in test, used to calibrate SAP2000 model and response spectra

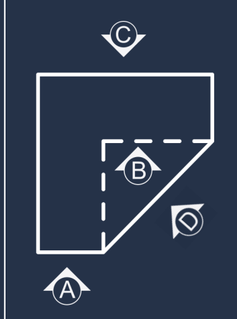




Ground Motion	Peak Roof Disp. (in)	Peak Roof Acc. (g)
GM1	0.234	1.19
GM2	1.05	4.86

Score	Value
FAR	+$613,962
FABC	-$131,268
FASC	-$109,000
FABI	**+$373,695**



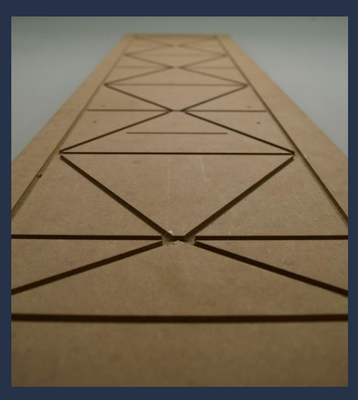


Construction

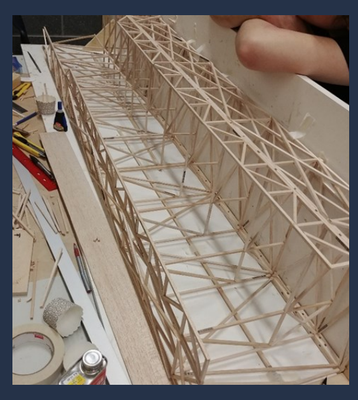
- 3D Revit model used to avoid construction conflicts
- Faces created in jig to allow for accurate positioning
- Faces then joined together using floor beams
- Balsa sorted by stiffness with strongest pieces used in critical members

Architecture

1. Wave-inspired façade: evokes San Diego coastline
2. Roof-top garden: creates green collective space to reduce environmental footprint
3. Glass cladding: blends and adapts to surroundings



JIG



TOWER IN CONSTRUCTION