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RELEVANT EXPERIENCE – HIGH-RISE BUILDINGS, SPIRES AND TOWERS

A listing of Motioneering selected projects related to Damping System Studies follows:

Project	Location
640 Bourke Street • Tuned sloshing damper concept design	Melbourne, Australia
Celtic – 326 Queen Street • Supplementary damping system concept design	Melbourne, Australia
Collins House (466 Collins) • Tuned sloshing damper design and implementation	Melbourne, Australia
Paragon Apartments • Tuned sloshing damper design and implementation	Melbourne, Australia
Victoria One • Tuned sloshing damper concept design	Melbourne, Australia
97 Franklin Street Tower • Tuned sloshing damper design and implementation	Melbourne, Australia
180 George street • Tuned sloshing damper design and implementation	Sydney, Australia
One Sydney Harbour Towers 1 and 2 • 430 tonne tuned mass damper concept design	Sydney, Australia
Crown Sydney Hotel and Resort • 200 tonne tuned mass damper	Sydney, Australia
Pitt Street Station - Over Station Development Tower • Damping system concept design	Sydney, Australia
Firehouse Hotel (88 Walker) • Preliminary damping system assessment	Sydney, Australia
Baku Tower • One 750 ton tuned mass damper detailed design	Baku, Azerbaijan
Rogers M City Towers 1, 2, 3 & 4 - Garden City • Tuned sloshing damper design for towers 1, 2 & 4. • 705 tonne tuned mass damper for tower 3.	Mississauga, Canada
Tower Hotel (also called the Minolta Tower) • Structural monitoring	Niagara Falls, Canada

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Project	Location
10 York • Tuned sloshing damper feasibility study	Toronto, Canada
37 Yorkville • Tuned sloshing damper concept design	Toronto, Canada
480 University Avenue Toronto • Tuned sloshing damper design and implementation	Toronto, Canada
Casa 2 Condominium • Tuned sloshing damper design and implementation	Toronto, Canada
Massey Tower (197 Yonge Street) • Tuned sloshing damper space optimization	Toronto, Canada
The One (1 Bloor Street West) • Tuned mass damper design	Toronto, Canada
YC Condos (454 Yonge Street) • Tuned sloshing damper concept design	Toronto, Canada
Trump International Hotel & Tower (1133 West Georgia St) • Two 115 tonne tuned sloshing dampers	Vancouver, Canada
One Wall Center • 600 tonne tuned liquid column damper	Vancouver, Canada
Haikou Tower – IFC A • Tuned sloshing damper detailed design and performance analysis	Haikou, China
Qingdao Haitian Hotel • World's first irregular-shaped tuned sloshing dampers	Qingdao, China
Shanghai Tower • 1000 tonne Eddy current damper	Shanghai, China
Luohu Innovative Financial Area Phase I • Tuned sloshing damper - detailed design	Shenzhen, China
Ping An Finance Center • Two tuned mass dampers of 600 tonnes each - implementation assessment	Shenzhen, China
Shenzhen Evergrande Center • 600 tonne tuned mass damper – detailed design and performance analysis	Shenzhen, China
Shenzhen Guozhan Bagualing Project • Tuned sloshing damper implementation assessment	Shenzhen, China
Suzhou IFS / Suzhou Wharf Tower • 800 tonne tuned sloshing damper	Suzhou, China

Project	Location
Suzhou Taihe Yinshan Lake Plot A • Supplementary damping system concept design	Suzhou, China
Suzhou Zhongnan Center • One 660 tonne tuned mass damper detailed design • Two 600 tonne tuned sloshing damper detailed design	Suzhou, China
Tianjin Xiangluo Bay A09 Site • Tuned sloshing damper detailed performance analysis	Tianjin, China
Zhuhai Hengqin IFC Tower • 4-tank bi-directional tuned sloshing damper configuration - detailed performance analysis, detailed design drawing;	Zhuhai, China
Zhuhai Huafa Plaza - Tower 3 • Tuned sloshing damper detailed performance analysis	Zhuhai, China
4 Seasons Mumbai • One 480 ton and one 120 ton tuned sloshing damper	Mumbai, India
King Tower • Tuned sloshing damper concept design	Mumbai, India
World Crest (Prince) Tower • Tuned sloshing damper	Mumbai, India
Petronas Towers Skybridge • Three tuned mass dampers on each of the four legs	Kuala Lumpur, Malaysia
Commercial Bay Office Tower (Downtown Mixed-Use Development) • Tuned sloshing damper design and implementation	Auckland, New Zealand
The Royalton • Supplementary damping system concept design	Manilla, Philippines
Akhmat Tower • Supplementary damping system concept design	Grozny, Russia
Federation Tower Spire • Damping system feasibility study	Moscow, Russia
Kingdom Tower • Implementation assessment	Jeddah, Saudi Arabia
Hyundai Seongsu-Dong • Supplementary damping system concept development and detailed analysis	Seoul, South Korea
NanShan Plaza • Two 500 tonne tuned mass dampers	Taipei, Taiwan

Project	Location
Taipei 101 • 660 ton tower tuned mass damper design build • Two 4.5 tonne pinnacle tuned mass dampers design build	Taipei, Taiwan
Soontareeya Tower • Supplementary damping system concept design	Bangkok, Thailand
Burj Dubai • Tower Damping Concept Design • Spire/pinnacle damping concept design	Dubai, UAE
Burj Dubai Lake Hotel Spire • Tuning and commissioning	Dubai, UAE
DMCC Burj 2020 District - Commercial Tower • Damping system	Dubai, UAE
Downtown Dubai Development Opera District – Plots D1 and D2 • Tuned sloshing damper implementation assessment	Dubai, UAE
Entisar Tower • 1200 tonne tuned mass damper implementation assessment	Dubai, UAE
Princess Tower • 497 tonne tuned sloshing damper design and implementation	Dubai, UAE
SRG Residential Tower - Business Bay • 1850 tonne tuned mass damper implementation assessment	Dubai, UAE
Newfoundland Tower • Tuned sloshing damper	London, UK
Portal West Tower London • Tuned sloshing damper concept design	London, UK
Four Seasons Hotel, One Dalton Street • Tuned sloshing damper design and implementation	Boston, USA
465 North Park Drive • Tuned sloshing damper design and implementation	Chicago, USA
Park Tower, 800 North Michigan Avenue • 300 ton tuned mass damper	Chicago, USA
Chicago Spire • Active mass damper performance design	Chicago, USA
Lake Shore East - Buildings J, K & L • Tuned sloshing damper implementation assessment	Chicago, USA
One Bennett Park (451 East Grand Avenue) • Tuned sloshing damper	Chicago ,USA

Project	Location
NEMA Chicago, 1200 S Indiana Ave • Tuned sloshing damper	Chicago, USA
Signature Tower • 600 tonne tuned mass damper detailed design	Nashville, USA
131 East 47th Street • Tuned sloshing damper detailed performance analysis	New York, USA
180 East 88th Street • Tuned sloshing damper design and implementation	New York, USA
1 Park Row • Tuned sloshing damper concept design	New York, USA
45 Park Place • Tuned sloshing damper design and implementation	New York, USA
MoMA Tower (53 West 53rd) • 450 ton tuned mass damper concept design	New York, USA
Turkevi Center • 400 tonne tuned mass damper	New York, USA
100 East 53rd Street • 420 tonne tuned mass damper	New York, USA
111 Murray • One 570 ton tuned mass damper	New York, USA
111 West 57th Street • 726 tonne tuned mass damper	New York, USA
262 5th Avenue • 450 ton bi-tuned, opposed-pendulum tuned mass damper detailed performance analysis	New York, USA
30 East 31st Street • Supplementary damping system concept design	New York, USA
432 Park Avenue • Two 600 ton tuned mass damper	New York, USA
44 West 66th Street • Tuned sloshing damper design and implementation	New York, USA
45 Broad Street • 400 ton bi-tuned, opposed-pendulum tuned mass damper detailed performance analysis	New York, USA
49 East 34th Street • Supplementary damping system concept design	New York, USA

Project	Location
50 Hudson Blvd • Damper concept design	New York, USA
520 West 41st Avenue • 600 ton bi-tuned, opposed-oendulum tuned mass damper detailed performance analysis	New York, USA
56 Leonard Street • 160 tonne tuned sloshing damper	New York, USA
610 Lexington • Concept and detailed performance design for two 325 ton tuned mass dampers	New York, USA
731 Lexington Avenue (Bloomberg Tower) • 600 tonne tuned mass damper design build	New York, USA
80 South Street Tower Project • Tuned mass damper concept design	New York, USA
9 Dekalb Avenue Tower • Donut shaped tuned sloshing damper performance analysis and detailed design	New York, USA
Barclay Tower (10 Barclay St) • 170 Tonne Tuned Sloshing Damper Design and Implementation	New York, USA
Continuum Project, 41 East 22nd Street New York (AKA Madison Square Park Tower) • Supplementary damping system implementation assessment and concept design	New York, USA
Hudson Yards D (AKA 15 Hudson Yards) • Tuned sloshing damper	New York, USA
Hudson Yards Tower A • 650 ton tuned mass damper detailed performance analysis	New York, USA
Hudson Yards Tower E • 150 ton tuned mass damper detailed performance analysis	New York, USA
One Vanderbilt • 520 ton opposed-pendulum tuned mass damper	New York, USA
215 W 57th Street • Tuned mass damper	New York, USA
Random House Tower (Park Imperial) • 700 tonne tuned liquid column dampers	New York, USA
Saint Stevens (Tower Fifth) • Tuned mass damper concept design	New York, USA

Project	Location
Sutton Place Tower • 800 ton bi-directional tuned mass damper concept design	New York, USA
The Beekman Residences (115 Nassau Street) • Tuned sloshing damper	New York, USA
The Centrale (138 East 50th Street) • 450 ton pendulum tuned mass damper	New York, USA
Trump World Tower • 600 tonne tuned mass damper	New York, USA
W Downtown Hotel & Residences (123 Washington St) • 45 tonne tuned sloshing damper	New York, USA
West 62nd Street & Amsterdam • Tuned sloshing damper	New York, USA
Comcast Center • 1,300 ton tuned liquid column damper	Philadelphia, USA
The Comcast Technology Center (1800 Arch Street) • Bi-directional tuned sloshing damper	Philadelphia, USA
Walnut Street Tower • Tuned sloshing damper	Philadelphia, USA
181 Fremont Street • Supplementary damping system concept design	San Francisco, USA

AIR TRAFFIC CONTROL TOWERS

Project	Location
McCarran International Airport Air Traffic Control Tower • 60 ton tuned mass damper	Las Vegas, USA
Calgary Air Traffic Control Tower • 50 tonne tuned mass damper	Calgary, Canada
Toronto Pearson Airport Apron Control Tower - Terminal 1 • Tuned mass damper design & implementation	Toronto, Canada
Mexico City International Airport (NAICM) • Peer review	Mexico City, Mexico
Muscat Air Control Tower • Tuned mass damper design	Muscat, Oman

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RELEVANT EXPERIENCE – BRIDGES AND LONGSPAN FLOORS

A listing of Motioneering selected projects related to Damping System Studies follows:

Project	Location
Red Hill Creek Bridge • Five 2 tonnes tuned mass dampers	Hamilton, canada
Hunt Club Pedestrian Bridge, Ottawa Airport Parkway • Two 750 kg tuned mass dampers	Ottawa, Canada
Complexe les Ailes - Passerelle (Bridge) • One 1 tonne tuned mass damper	Montreal, Canada
Burgoyne Bridge • Damping solution – pickets	St. Catharines, Canada
Beanfield Centre - Pedestrian Bridge • One 400 kg tuned mass damper	Toronto, Canada
Pearson-East Pedestrian Bridge • Six viscous damping devices	Toronto, Canada
Port Lands Pedestrian Bridges • Tuned mass dampers (multiple)	Toronto, Canada
Apple Store Pacific Centre • Tuned mass dampers (500 kg and 1 tonne)	Vancouver, Canada
Shenzhen Western Corridor Bridge • Seven 5-1/2 tonne tuned mass dampers	Deep Bay, Hong Kong, China
Qiantan Four Square City Pedestrian Bridge • Tuned mass dampers (multiple)	Shanghai, China
Lusail Footbridge Vibrations • Monitoring of cable vibration mitigation devices	Lusail, Qatar
Atlanta Botanical Gardens Pedestrian Bridge • Design of distributed tendon dampers	Atlanta, USA
I-74 Bridge • Damping solution design	Davenport, USA
Bagley Avenue Pedestrain Bridge (Ambassador Gateway) • Vertical and lateral tuned mass dampers (multiple)	Detroit, USA
ARIA Resort and Casino - Ballroom Floor • Vibration assessment and tuned mass damper concept design	Las Vegas, USA

Bellagio and Spring Mountain Pedestrian Bridge • Twelve tuned mass dampers (multiple sizes)	Las Vegas, USA
MGM Mirage City Center Block B & C Pedestrian Bridges • Tuned mass damper design	Las Vegas, USA
Palms Casino Resort Rain Night Club Renovation – Floor Vibration • Tuned mass damper	Las Vegas, USA
Spring Mountain Road & Las Vegas Boulevard Pedestrian Bridges • Damping system design (3 bridges)	Las Vegas, USA
Treasure Island/Venetian Pedestrian Bridge • Six 1.5 tonne tuned mass dampers	Las Vegas, USA
1175 Vanguard West Campus Building 35 bridge • Four 2 ton tuned mass dampers	Malvern, USA
Martin Olav Sabo Pedestrian Bridge • Impact dampers on cables	Minneapolis, USA
Cumberland River Pedestrian bridge • Three tuned mass dampers	Nashville, USA
Madison Square Garden • Five tuned mass dampers	New York, USA
Oakley C. Collins Memorial Bridge (Ironton-Russell Bridge) • Design of tuned mass dampers and stay cable dampers	Ohio/Kentucky, USA
State Road 414 Bridge Extension Over US 441 • Four tuned mass dampers	Orlando, USA
Grand Canyon Skywalk • Three 1.2 tonne tuned mass dampers	Peach Springs, USA
Seattle-Tacoma (Sea-Tac) International Airport Bridge • Two 8.8 ton tuned mass dampers	Seattle, USA
Kennedy Center Pedestrian Bridge • Tuned mass damper concept design	Washington, USA

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RELEVANT EXPERIENCE – UNIQUE STRUCTURES

A listing of Motioneering selected projects related to Damping System Studies follows:

Project	Location
Tsukuba Isolation Platform	Quebec, Canada
Wind Turbines for Urban areas	Canada
Sakhalin 1 - Drilling Rig, Sakhalin Island • 100 tonne tuned mass mamper for seismic damping	Sakhalin Island, Russia
Expo 2020 Mobility Pavilion - Fins • Supplementary damping system concept design	Dubai, UAE
British Airways i360 Tower	Brighton, UK
US Air Force Memorial • Ball-in-box impact dampers performance verfication	Arlington, USA
Spire of Dublin • 1250 kg tuned mass damper & 800 kg tuned mass damper	Dublin, Ireland
Studio Museum of Harlem • Tuned mass damper concept development	New York, USA
Hudson Yards Art Sculpture - The Vessel • Tuned mass damper consultation	New York, USA
Grand Canyon Skywalk • Three 1.2 tonne tuned mass dampers	Peach Springs, USA