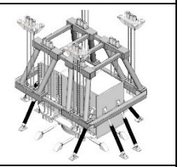
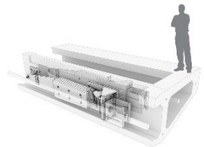
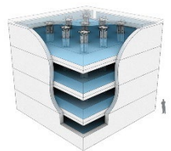
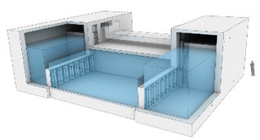
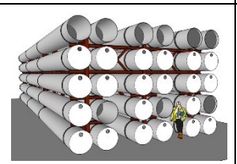
Types of Mass Damping Solutions

There are many options to consider. Each system has specific benefits and drawbacks that are important to weigh in the context of the particular project.
The following is a summary that can be used as a good reference when considering various options:

TYPE OF SYSTEM (& CONFIGURATION)		PERFORMANCE	SPACE ENVELOPE	MAIN ADVANTAGES	DISTINGUISHING FEATURES
Tuned Mass Damper	**Simple Pendulum** 	Can achieve up to 6% total damping, and dynamic response reductions exceeding 50%	Usually requires more vertical space compared to other TMDs	• High multidirectional damping performance; • Smooth & quiet operation; • Reliable over a wide range of return periods; • Proven performance for many projects..	• Elegant appearance; • Fewer parts lead to simplicity and lower cost;
	Compound (Dual) Pendulum 		About half of the vertical space compared to a simple pendulum	• High multidirectional damping performance; • Smooth & quiet operation; • Reliable over a wide range of return periods; • Proven performance for many projects.	• More compact than simple pendulum;
	Opposed Pendulum 		Typically smaller vertical and horizontal footprint than other types of TMDs.	• High multi-directional damping performance; • Unique configuration achieves smallest footprint; • Smooth & quiet operation; • Reliable over a wide range of return periods; • Proven performance for many projects.	• Unique configuration achieves smallest footprint;
	Spring-mass systems 		Can be easily adapted to fit in small spaces (within girders for floors & bridges)	• Reliable over a wide range of loading scenarios; • Proven performance for many projects;	• Good for “small” TMDs for bridges and floors; • Not practical for building TMDs; • Many versatile configurations available;
Tuned Sloshing Damper 		Can efficiently achieve up to 4% total damping, and dynamic response reductions exceeding 30%	• Lower density of mass typically leads to higher volume of space (compared to equivalent TMD) • Typically rectangular or square tanks, but other shapes can also be made to work	• Good multi-directional damping performance in one system; • Silent operation; • Reliable over a wide range of return periods; • Water can be used for Fire Suppression Storage Water	• Lower capital costs than comparable mechanical TMD
Tuned Liquid Column Damper 		Can efficiently achieve up to 4% total damping per direction, and dynamic response reductions exceeding 30%	• Often requires more space overall than a TMD or TSD. • Typically rectangular tanks.	• Silent operation; • Reliable over a wide range of return periods; • Water can be used for Fire Suppression Storage Water	• Single directional performance per tank
Hummingbird Damper 		Can efficiently achieve up to 4% total damping per direction, and dynamic response reductions exceeding 30%	Modular configuration allows for placement in multiple smaller spaces	• Highly efficient use of damping mass (100% effective); • Silent operation; • Reliable over a wide range of return periods; • Water can be used for Fire Suppression Storage Water; • Modular and prefabricated construction	• Single directional performance per cylinder • Modular, prefabricated construction facilitates rapid installation;
Other types of Damping Systems		• Motioneering has the expertise to assess the feasibility and implement other types of damping solutions. • Some other systems, such as distributed damping element, also require additional modeling and iterative analysis by the structural and wind engineering teams. This is due to their modifications of the stiffness characteristics and loading distribution within the primary structural system.			