

INTRODUCTION



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Question # 01: Write a detail note on Tuned Mass Damper (TMD).

➤ What is Tuned Mass Damper (TMD):

Tuned mass damper (also called vibration absorbers or vibration dampers) is a device mounted to a specific location in a structure, so as to reduce the amplitude of vibration to an acceptable level whenever a strong lateral force such as an earthquake or high winds hit.

Consequently, discomfort, damage, or outright structural failure caused by vibration in the structure will be prevented. This article presents different aspects of tuned mass damper and its applications.

➤ Types of Tuned Mass Damper (TMD):

• **Horizontal Tuned Mass Damper (TMD):**

It is normally found in slender buildings, communication towers, spires and the like. Horizontal tuned mass damper (TMD) as shown in Fig. 1 composed of viscodampers and leaf springs or pendulum suspensions. It eats horizontal and torsional excitations.

• **Vertical Tuned Mass Damper (TMD):**

It is usually applied in long span horizontal structures such as bridges, floors and walkways. Vertical tuned mass damper (TMD) as shown in Fig. 2 is a combination of coil springs and Viscodampers and it declines vertical vibrations.

Both types have similar functions, though there might be slight differences in terms of mechanism.

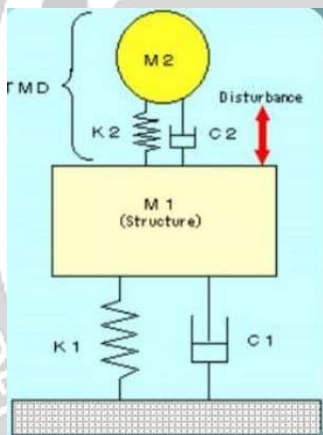


Fig. 1

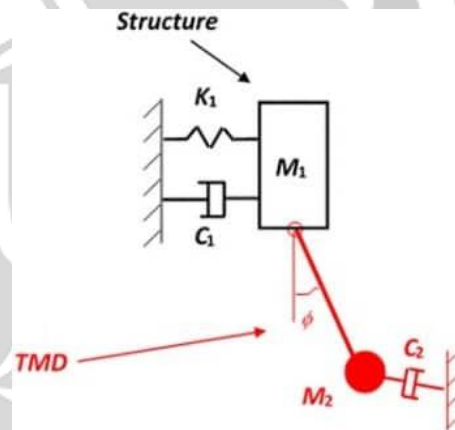


Fig. 2

➤ Applications of Tuned Mass Dampers

Tuned mass dampers are mainly used in the following applications:

- Tall and slender free-standing structures (bridges, pylons of bridges, chimneys, TV towers) which tend to be excited dangerously in one of their mode shapes by wind,
- Stairs, spectator stands, pedestrian bridges excited by marching or jumping people. These vibrations are usually not dangerous for the structure itself, but may become very unpleasant for the people,
- Steel structures like factory floors excited in one of their natural frequencies by machines, such as screens, centrifuges, fans etc.,
- Ships excited in one of their natural frequencies by the main engines or even by ship motion.

Tuned Mass Dampers may be already part of the structure's original design or may be designed and installed later.

➤ Example of Tuned Mass Damper Application

Taipei structure has TMD of weight 730 tonnes and has the largest diameter in the world. Tuned Mass Damper of Burj Al Arab and Emirate Tower.

Question # 02: Write advantages and disadvantages Of Base Isolation?

➤ Advantages of Base Isolation:

- Widely held misconception that seismic isolation is expensive.
- Structural Damage is restricted when the structure is built on a suitable seismic isolating system.
- Secondary damage as a result of falling furniture would be restricted. In other words, the level of safety is increased significantly when using base isolation system rather than conventional systems.
- Base isolation can be retrofitted to suitable existing structures but too many variables to give meaningful indication of cost.
- Base isolation allows for a reduction in structural elements of the building with less ductile detailing needed.
- Crawl spaces or basements can have multiple benefits e.g. in siting services, additional income from a carpark, flexibility for future development.
- Protection of the integrity of the internal structures e.g. stairs, internal walls, and partitions.
- Building is safer for occupants and contents are protected.
- Continuity of operations is much more likely.
- Widely held misconception that seismic isolation is expensive.
- When viewed against the savings it can in some cases result in a slightly lower construction cost overall.
- Building can remain serviceable throughout construction.
- Does not involve major intrusion upon existing superstructure.
- Isolates Building from ground motion
- Lesser seismic loads, hence lesser damage to the structure.
- Minimal repair of superstructure.

➤ Disadvantages of Base Isolation:

- Cannot be applied partially to structures unlike other retrofitting.
- Challenging to implement in an efficient manner.
- Allowance for building displacements.
- Inefficient for high rise buildings.
- Not suitable for buildings rested on soft soil.
- Coupled foundations allow motion of some modes of the structure to include a participating soil mass which increases inertia for these modes, and would also allow energy to radiate back into the soil. A Base Isolated building is decoupled from the soil by the isolators. The lower support stiffness of the isolators makes the building more susceptible to wind induced motion.

The End