MULTITECH
DAMPER SOLUTIONS

# The Magic World of Dampers

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*www.multitech-fr.com* *contact@multitech-vibration-control.com*





## *Gilles Oudin*

is the President and founder of Multitech.
Multitech is operating on a worldwide basis to design and manufacture different types of anti-vibration dampers to solve any issue regarding vibration of structures especially slender structures.

## *Guillaume Oudin*

Director of the laboratory

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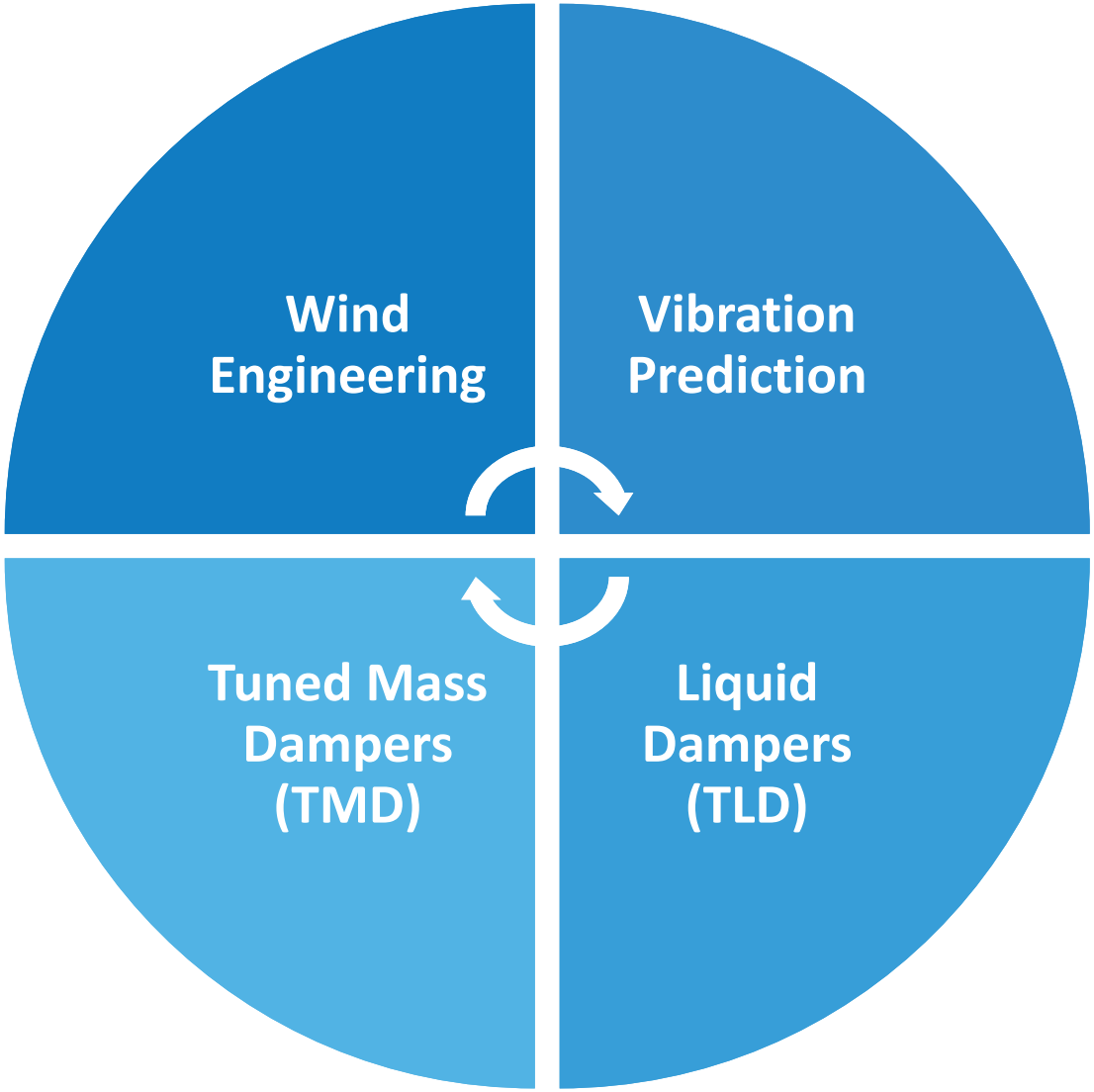
## DAMPERS ARE MAINLY USED FOR SLENDER STRUCTURES SUCH AS :

- Steel Stack
- Concrete Stack
- Distillation tower
- Flagpole
- Gsm/Telecom mast
- Wind turbine
- Solar tower
- skyscryper




# MAIN STEPS TO DESIGN A DAMPER

Every damper study starts with wind engineering and vibration predictions.

There is no perfect Code but by having a wide knowledge all of International Codes , such as CICIND, Eurocode, ASME, Chinese Code ,BS etc and by taking the good part of each, a damper designer can find a solution to any problems.

In our field mainly TLD and TMD are the most common

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# DIFFERENT GROUPS OF DAMPERS

## Friction Damper

- the friction between a moving mass and the structure dissipate energy by friction. Used only for small structures

## Impact Damper

- such as a heavy chain moving in a circular container at stack top. Used only for small structures

## Rolling Damper

- A ball is moving is a spherical container. The difference between the radius of the mass and the radius of the container give the frequency. Used long time ago for small structure.

## Tuned Mass Damper

- there is a moving mass that is tuned at the proper frequency; between the mass and the structure devices are install to absorb the energy by different means: dashpots, cable coils, tank of silicon oil, Eddy Current, etc..Can be used for any type of structure of any size.

# DIFFERENT GROUPS OF DAMPERS

## Column liquid damper

- A tube with a horizontal section and two vertical branches is filled with liquid. Restriction in the cross section or vane help to adjust the damping. Used mainly for building not for stacks and chimneys.

## Tuned Sloshing Damper

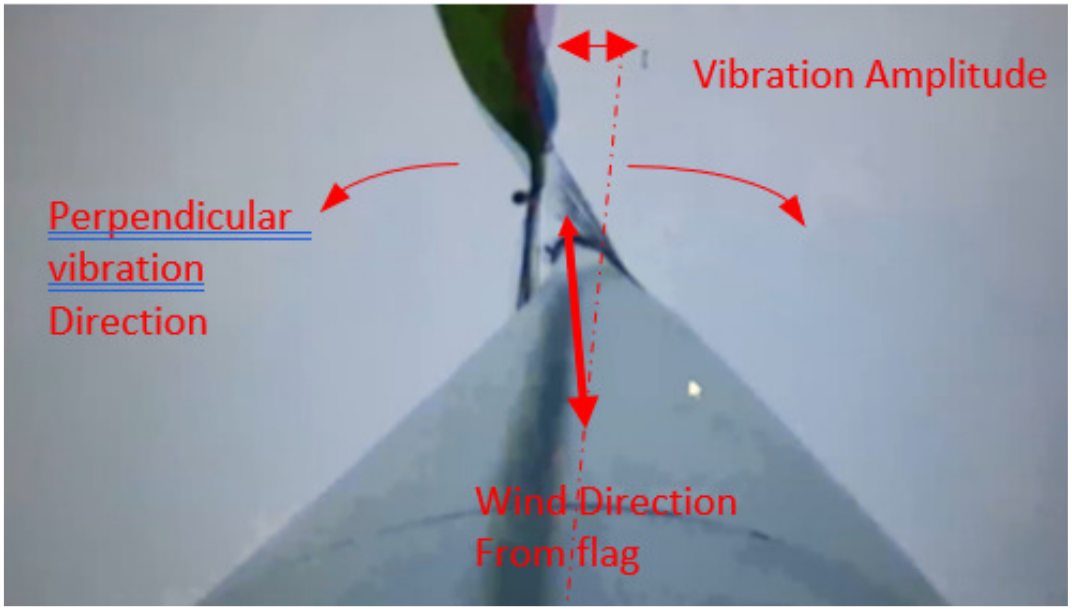
- basically, the energy is absorbed by the wave that broke on the partition wall and ty the perforated cells. This type of damper can be used from 0.20 Hz (with reasonable size) till more than 2.50 Hz. Can be used for very large structure in steel till very tiny one. To save cost this type of damper can be mistuned.

## Pads

- below base for tiny structures

# TRADITIONAL USES OF DAMPERS

to avoid cross wind vibration of structures




This is a perfect illustration of cross wind vibration. The flag shows the wind direction while we clearly show that the vibration is perpendicular to the wind. The amplitude of the movement is directly connected to the damping. By increasing the structural damping by a damper, the vibration will stop.

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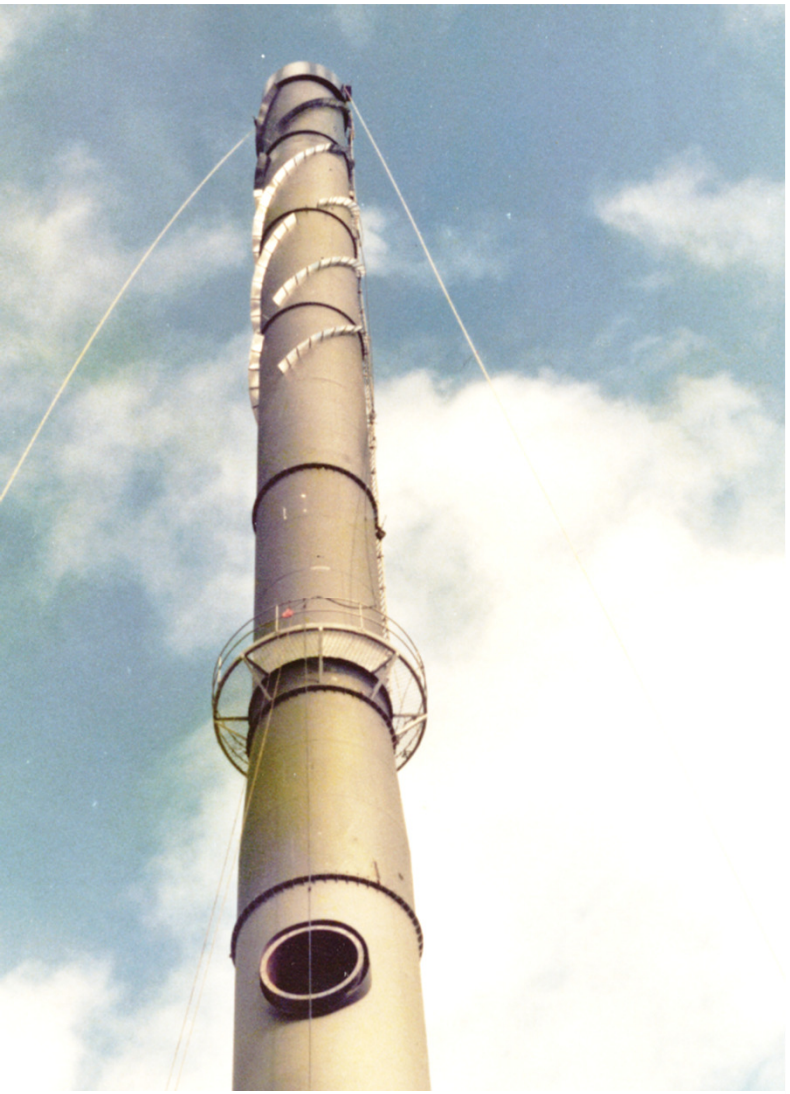
# DAMPERS CAN BE ALSO USED TO **AVOID INTERFERENCE VIBRATION**

The steel stack even with helical strakes strongly move upstream and downs stream long the line of the two stacks. By adding a damper this phenomenon of vibration has been stopped.



Vibration stack with helical strake temporary stabilized with cables

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# DAMPERS CAN BE ALSO USED TO **AVOID VIBRATION OF STACK** WITH HELICAL STRAKES

Helical stake is an old fashion solution to stabilize stacks. They are efficient when the Scruton Sc number is big. According to Eurocode 1991-4, this solution can be used when the Sc is larger than 8.
They can solve only cross wind, but they cannot solve interference vibration.
The only solution when Sc < 8 is to use a damper.

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# DAMPERS CAN BE ALSO USED TO **INCREASE HEIGHT OF EXISTING STRUCTURE**

This stack of 28 m with helical strake (3 rows of blades) was extended till 35 m without changing the foundation and the original stack. Helical strakes have a huge disadvantage as the shape coefficient cf or μs is between 1.20 to 1.40 instead of 0,60-0,65 for a smooth stack, Since the stakes are installed in general at the top third the total wind load is around 1.50 times more important than the smooth stack. Helical strakes on stack always increase the structure weight and are not economical. Thanks to a damper the extension from 28 m to 35 m has been achieved.

We also can increase the structure height by adding a damper even if no helical strakes just by playing with the dynamical factors

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# DAMPERS CAN BE ALSO USED TO **REDUCE ALONG WIND LOAD AND SAVE MATERIAL**

In most of the international Codes the along wind load can be reduced by increasing the damping. See CsCd factor in Eurocode of gust factor in ASME or R factor in GB 50009 in Chinese Code.

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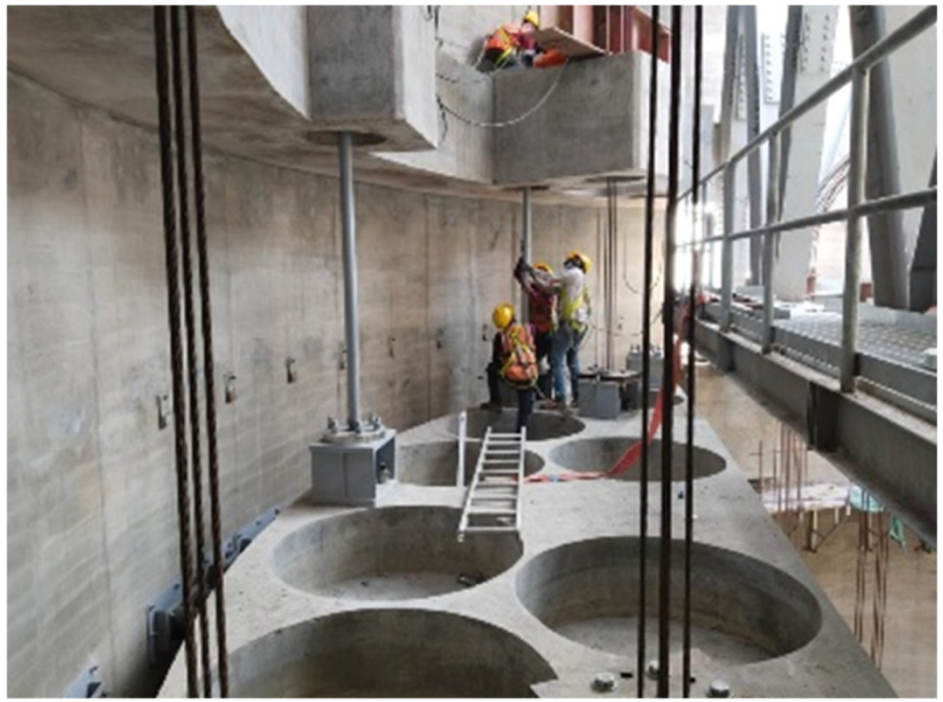
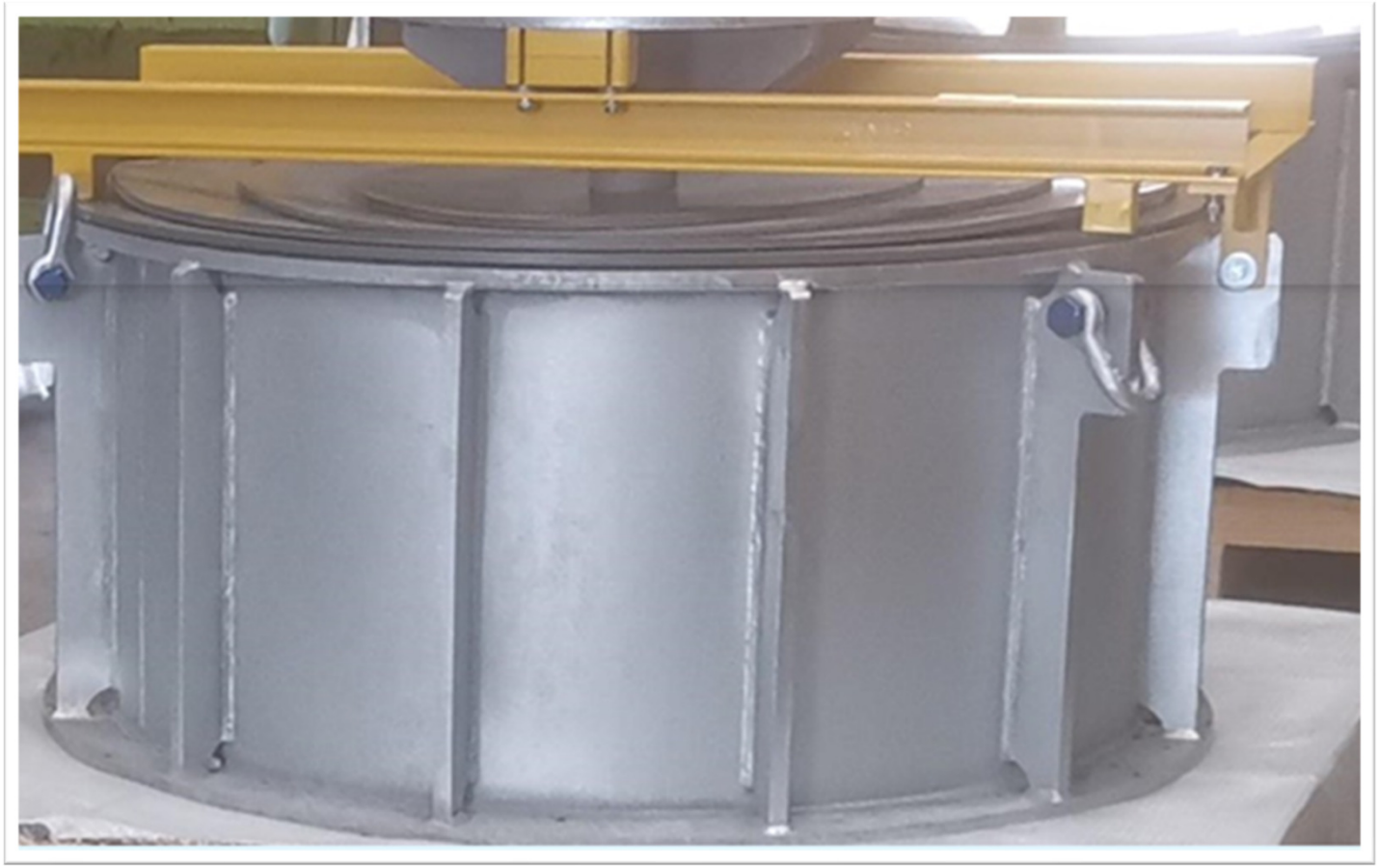


(Photos Courtesy of Ferbeck International)

# LIFTING THE 140 T MOVING MASS TILL FINAL ELEVATION AT AROUND 270 M



(Photos Courtesy of Ferbeck International)

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**MOVING MASS READY TO INCORPORATE 8 DAMPER UNITS.**

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The damper on this 275 m (860 feets) concrete stack in a hurricane area with 80 m/s design wind speed was a little bit useful for eventual vibrations. With this extreme high wind speed the main role of the damper was to reduce the along wind loads of around 18%. With a final foundation of 64 m , 6.50 m thick at the max, and 340 piles of 1 m and 70 m deep , a wind shield of 32 m a saving of 18% means huge material saving.

**The savings are so important that the damper is FOR FREE!!!**

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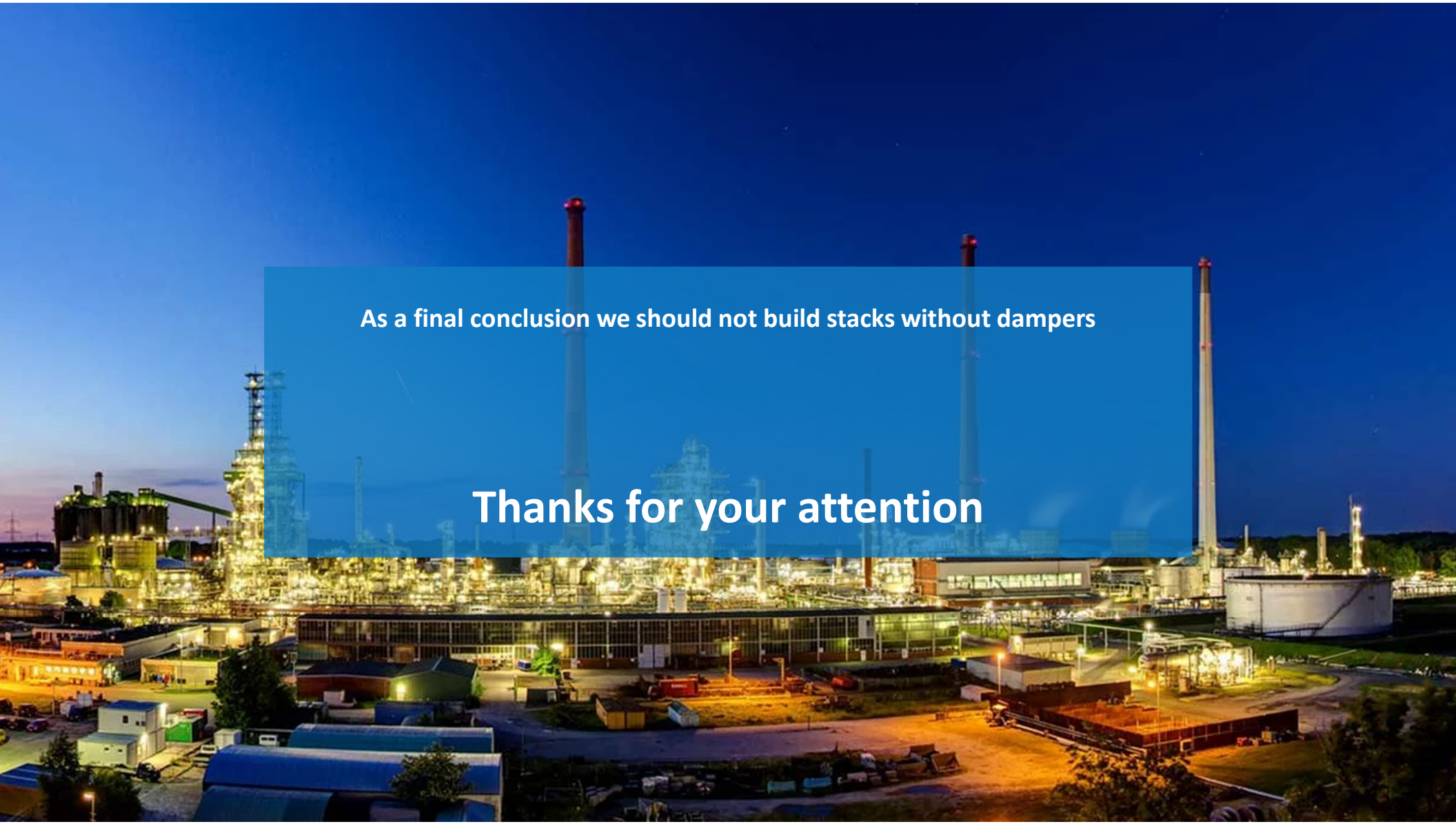
Damper can be used for many other aspects than for cross wind vibration. Dampers allow material saving of minimum 15% for large concrete stacks and till 35% for steel stacks.
Dampers are cheap, basically a damper weight represent 5% of the Modal Mass and the modal mass is around 20% of the Total Mass of the stack.

It means that with **0.05 x 0.20=1%** of the stack mass **we can save 15 to 35%** of the material.
. Dampers needs to be studied and checked by laboratory measurement which ensure the security for the clients that often can also save money on the Insurance Contact: a safe structure has less risk for the insurance company.

Due to the huge material saving dampers are Environment friendly because less material means much less $CO_2$ emission.

**Dampers are a MAGIC SYSTEM that allow huge saving.**


As a final conclusion we should not build stacks without dampers
Thanks for your attention