STUDY ON REDUCTION OF VIBRATION CONTROL DEVICES FOR AKASHI-KAIKYO BRIDGE

Susumu Fukunaga

- Honshu-Shikoku Bridge Expressway Co., Ltd.

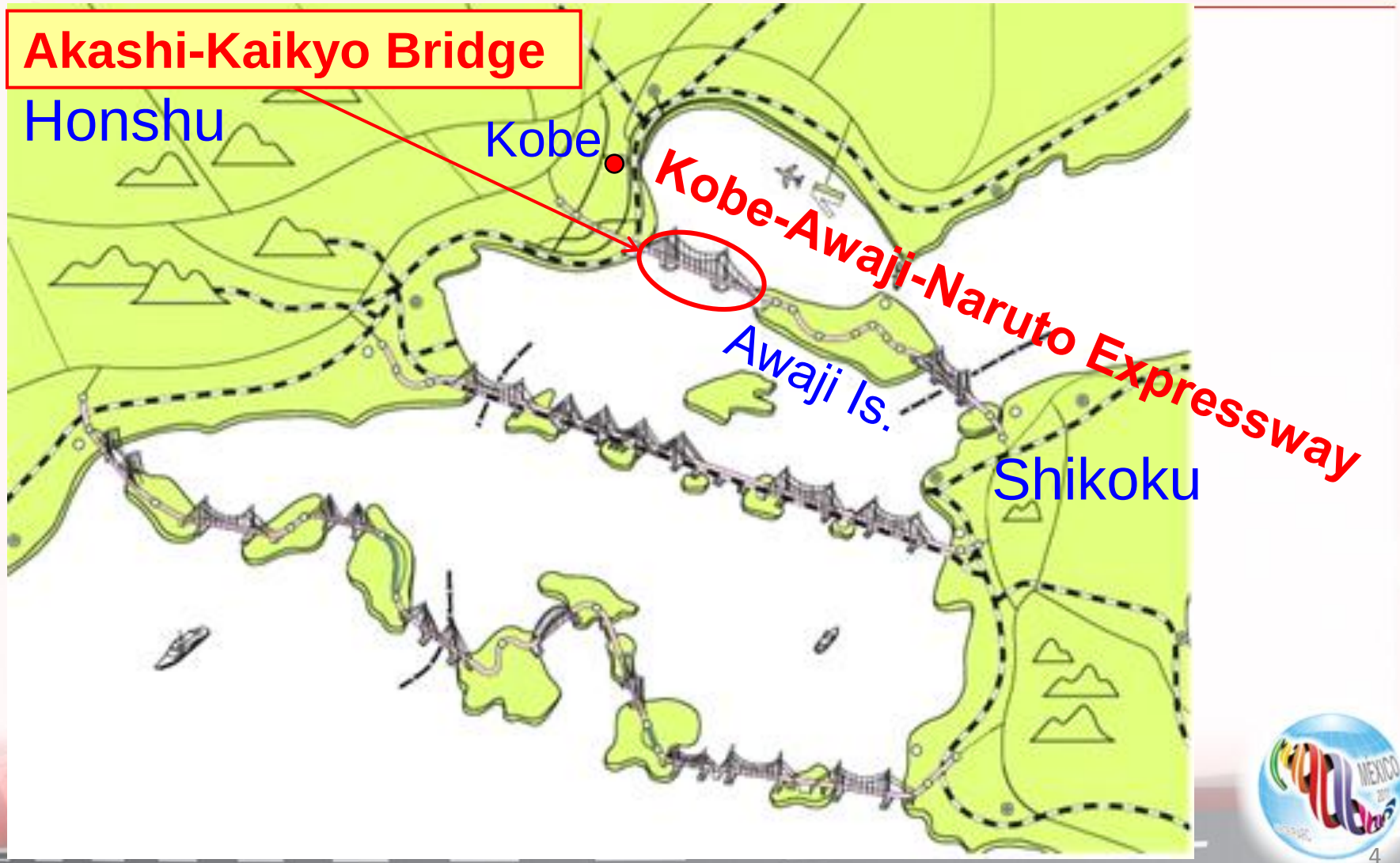
- Long-span Bridge Engineering Center,
  Wind and Earthquake Engineering Division
- susumu-fukunaga@jb-honshi.co.jp

Contents

1. Honshu-Shikoku Bridges
2. Akashi-Kaikyo Bridge
3. Wind-Resistant Design of the Tower
4. Structural Health Monitoring of the Tower
5. Study on Cost Reduction of Vibration Control Devices

Honshu-Shikoku Bridges

Honshu-Shikoku Bridges

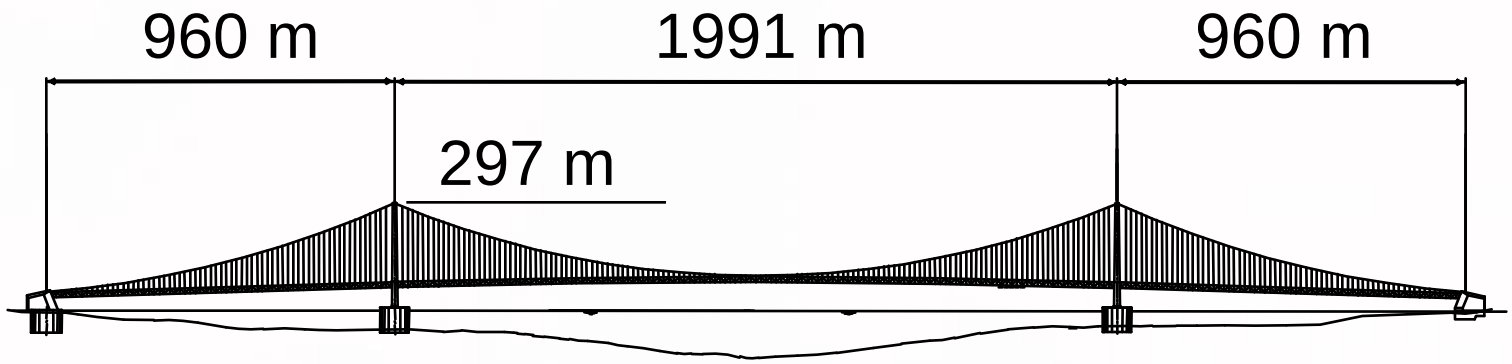


Akashi-Kaikyo Bridge

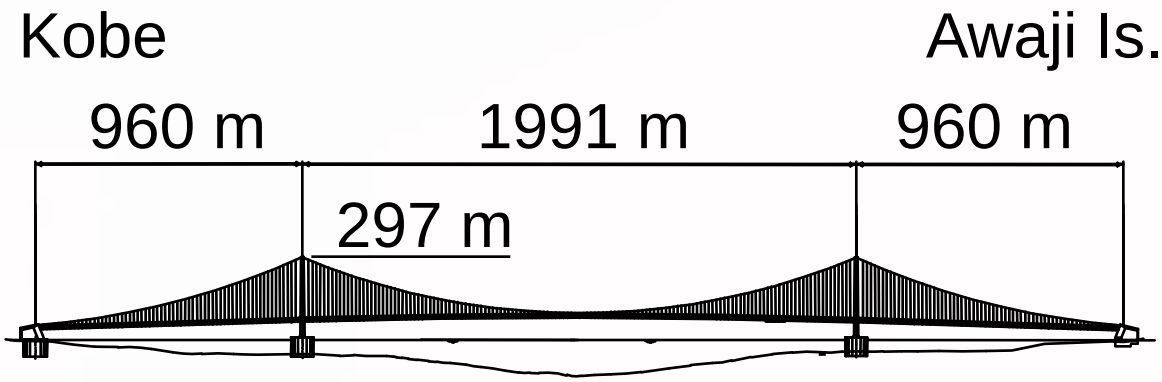
Akashi-Kaikyo Bridge

Kobe

Awaji Is.



Tower of Akashi-Kaikyo Bridge

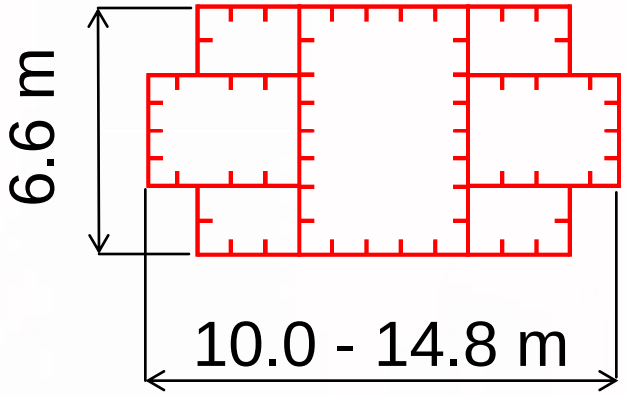


Very tall

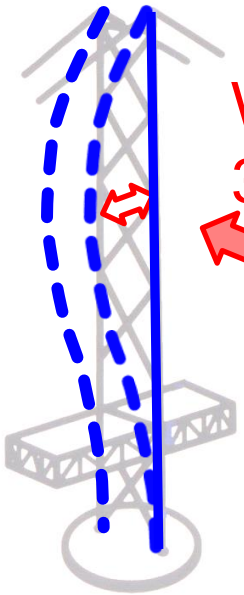
Anticipation of vibration

Wind tunnel test for Tower

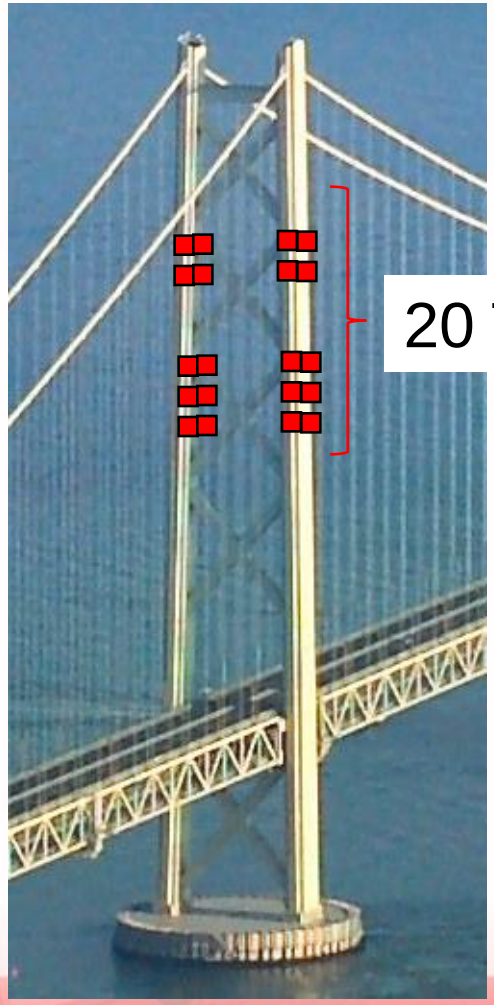
Tower shaft

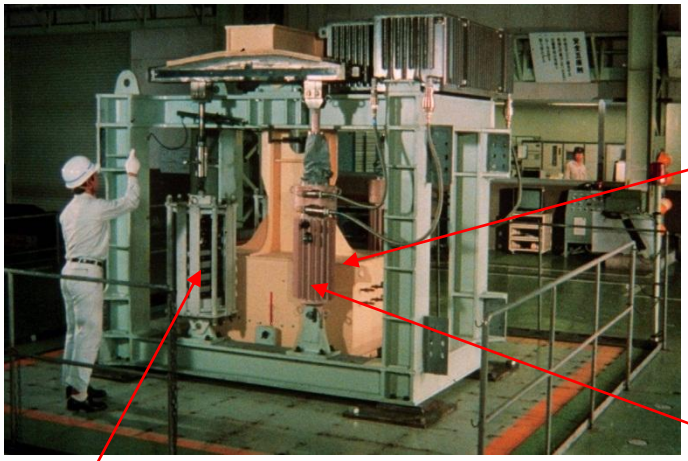


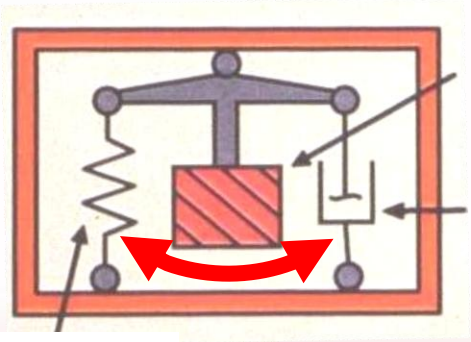
Cruciform
Cross-section



Tuned Mass Damper

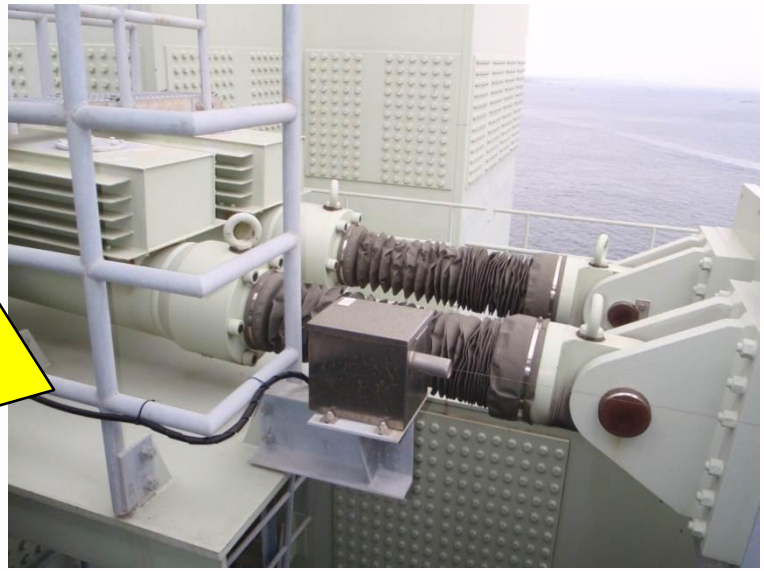






Additional Damper

Tower

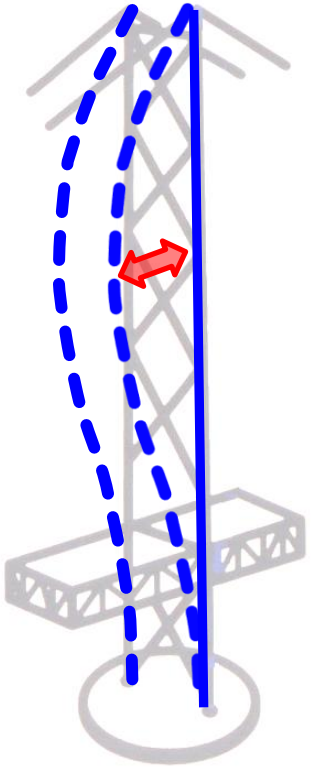


Side span girder

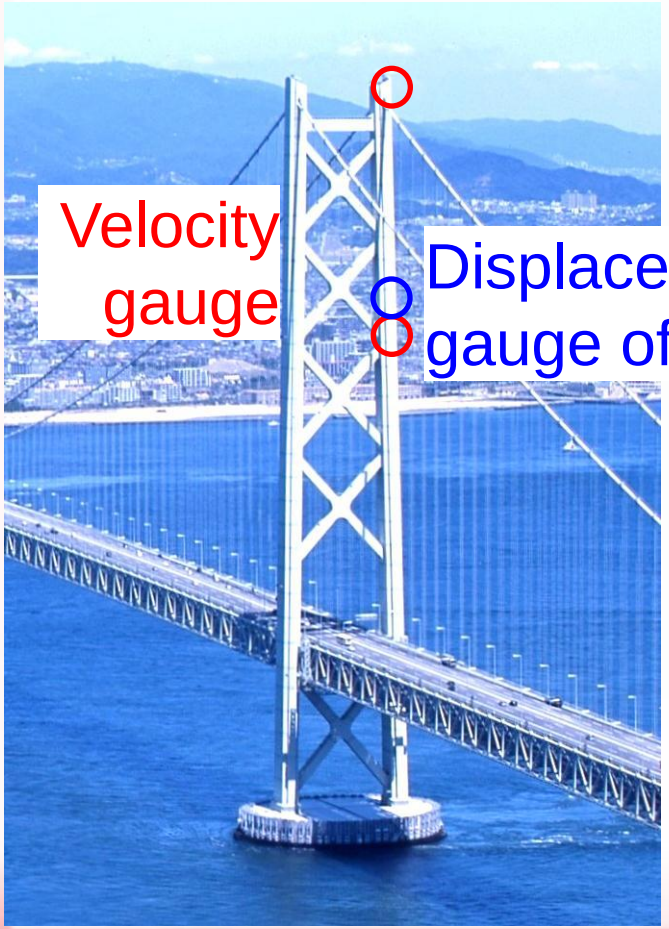
Oil Damper

Vibration displacement of the tower

	Displacement
No damper	95 cm
TMD + Additional damper	10 cm
Allowable value	30 cm

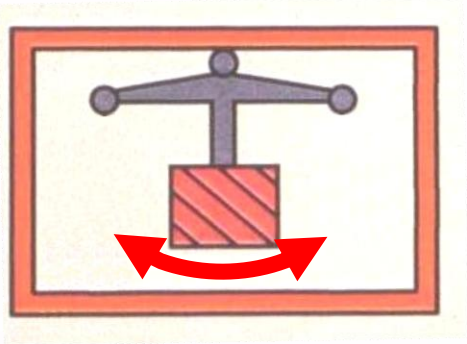


Structural Health Monitoring of Tower



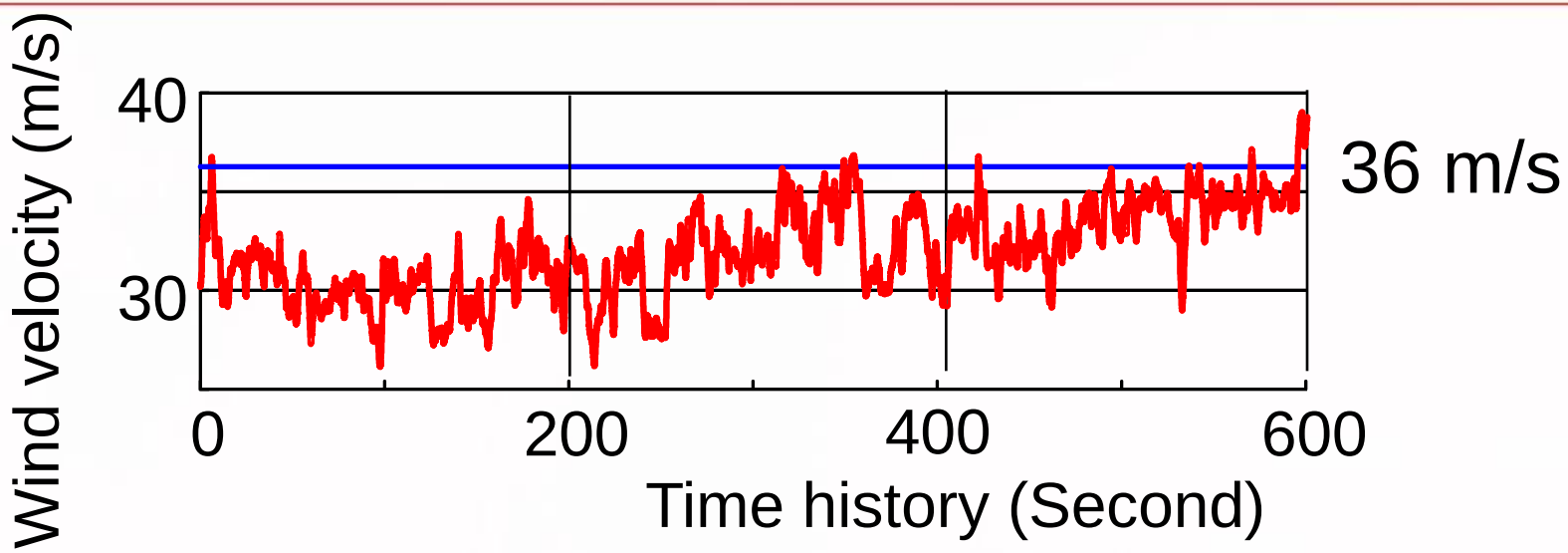
Verification of validity of wind-resistant design

TMD



Swing Displacement of Pendulum

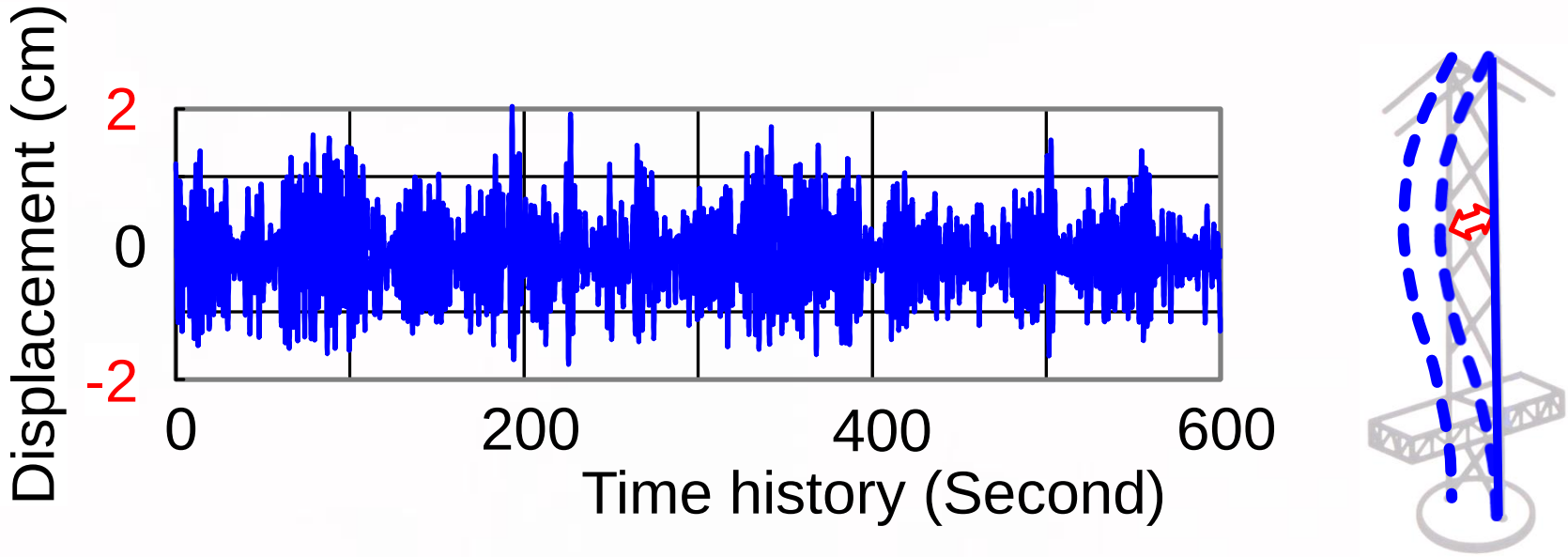
Observed Strong Wind



Wind direction : nearly transverse direction

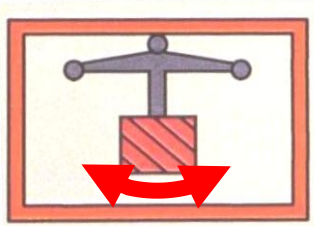
There was a possibility of vibration of towers

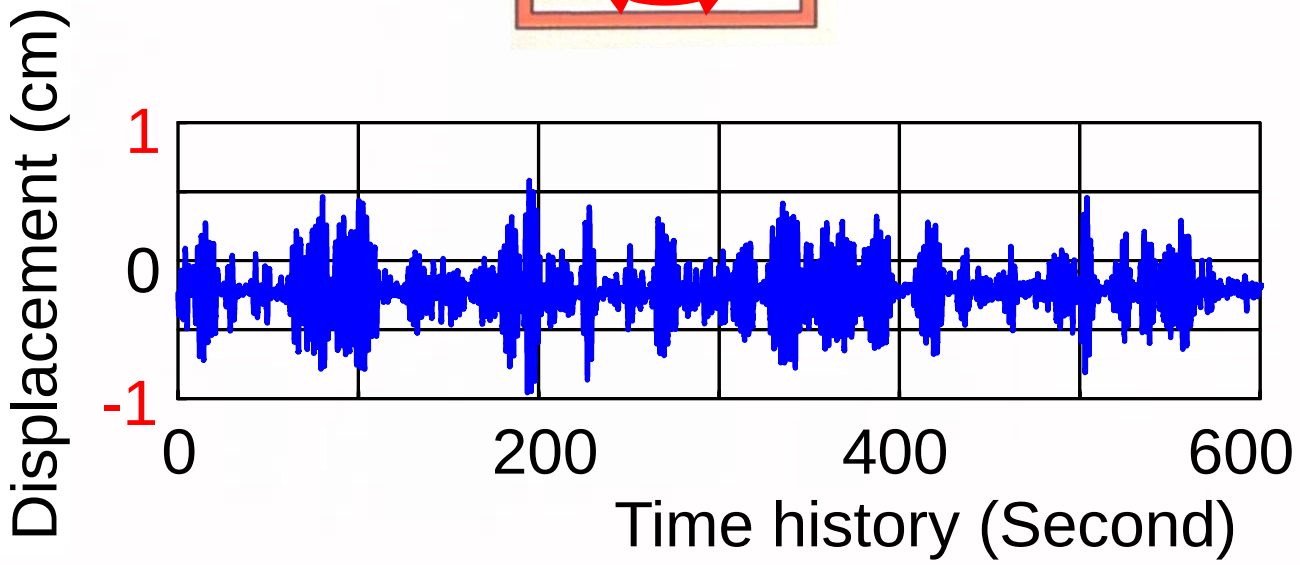
Observed Vibration of Tower



Observe 2 cm < Design value 10 cm

Observed Displacement of Pendulum of TMD





Results of structural health monitoring

- Strong wind which could vibrate towers was observed.

- Vibration displacement of the tower was very small.

There is a possibility of reduction of vibration control measures.

Maintenance problems of vibration control devcies

- Many vibration control devices have to be maintained.

  40 TMDs and 8 additional dampers

- Mantenance interval is every 5 years.
- Maintenance cost is expensive.

Reduction of maintenance cost of vibration control devices has been requested.

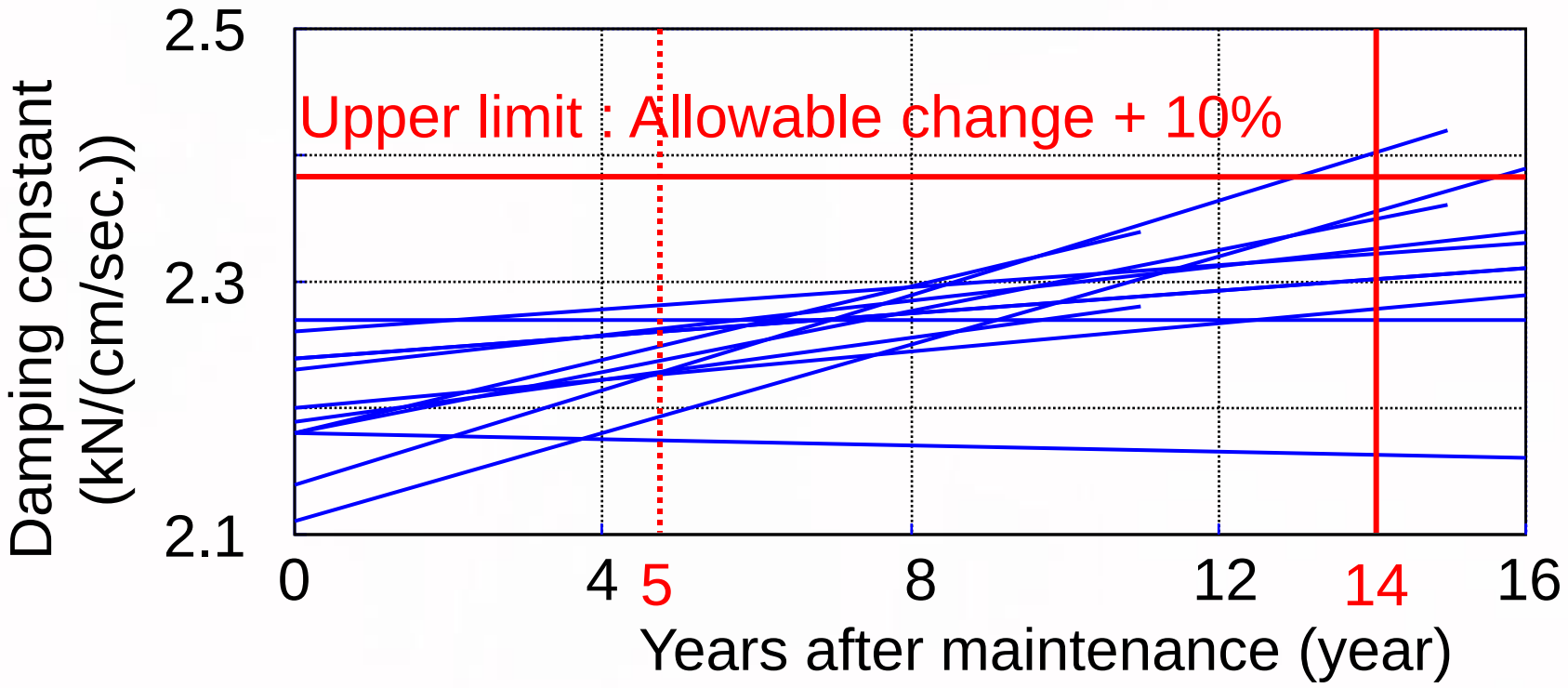
Study on cost reduction of vibration control devices

1. Re-evaluation of damping performance of tower

Actual damping	>	Design damping	⇨	Reduction of vibration control devices

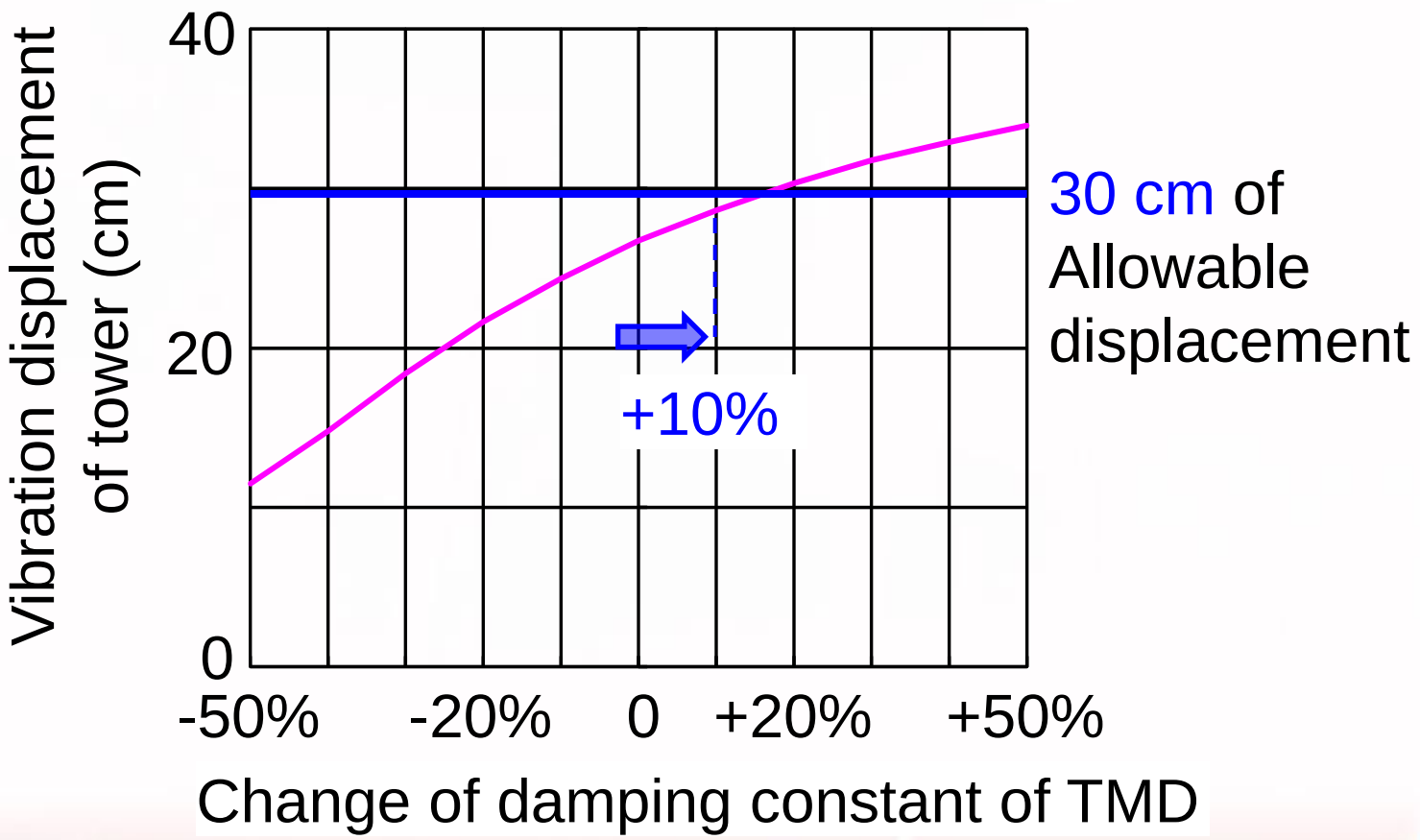
2. Re-evaluation of allowable displacement of tower
3. Re-evaluation of allowable change of damping of vibration control devices.

Change of damping constant of TMD

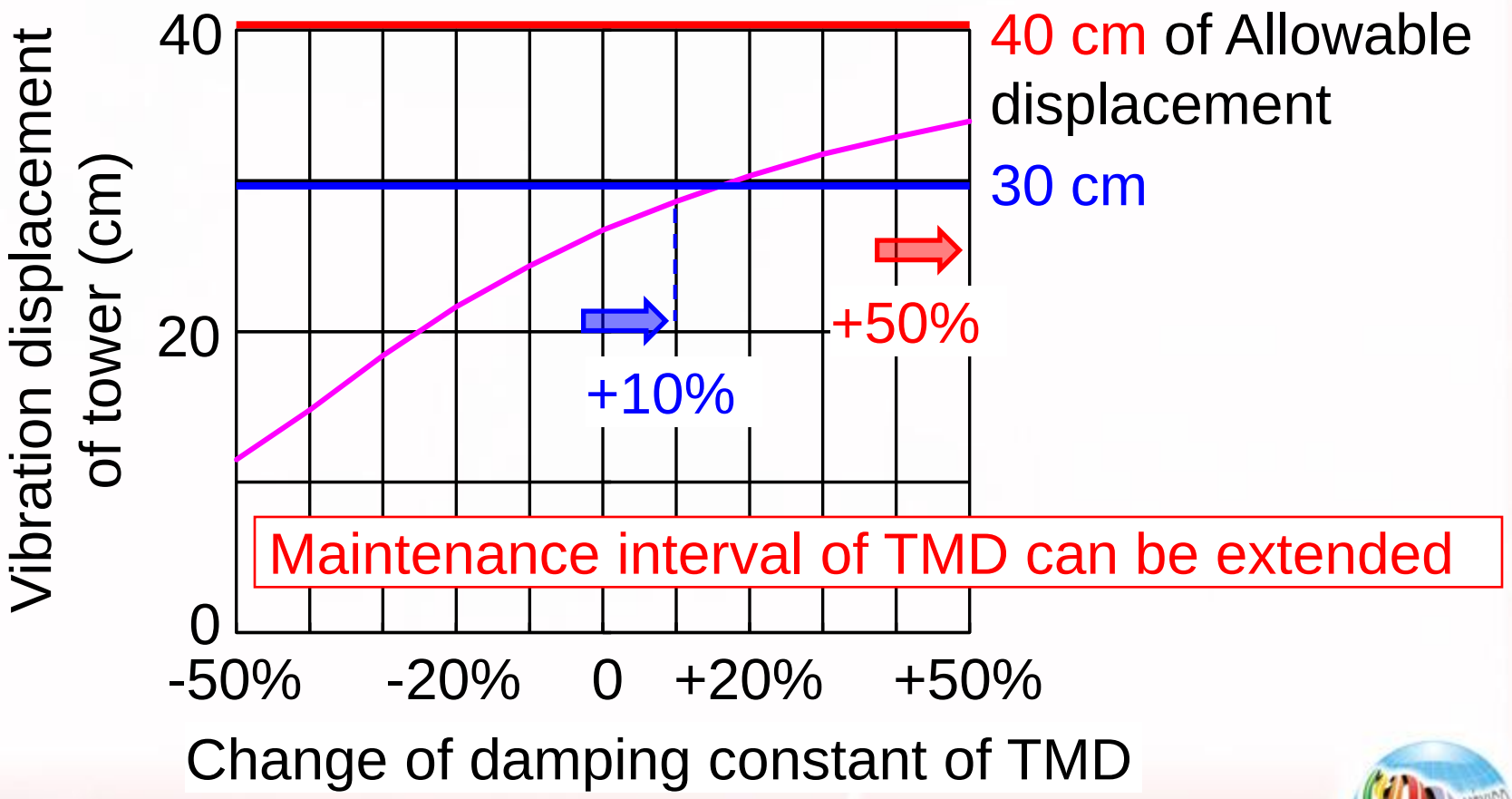


Maintenance interval : 5 years ⇨ 14 years

Relation of change of damping constant of TMD and vibration displacement of tower



Relation of change of damping constant of TMD and vibration displacement of tower



Conclusion

- Maintenance cost of vibration control devices have been larger problem.
- Study on reduction of maintenance cost of vibration control devices.
- Maintenance interval of vibration control devices can be extended.
- After the studies, reduction of maintenance cost of vibration control devices will be possible.

Thank you very much for your attentions