

Optimization that Resonates

A Case Study on Pump Station Challenges Focused on O&M

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March 21, 2019

Understanding common causes of pump vibration addresses issues during start-up & operation

AGENDA



Review

common causes



Identify

root cause through testing



Solve

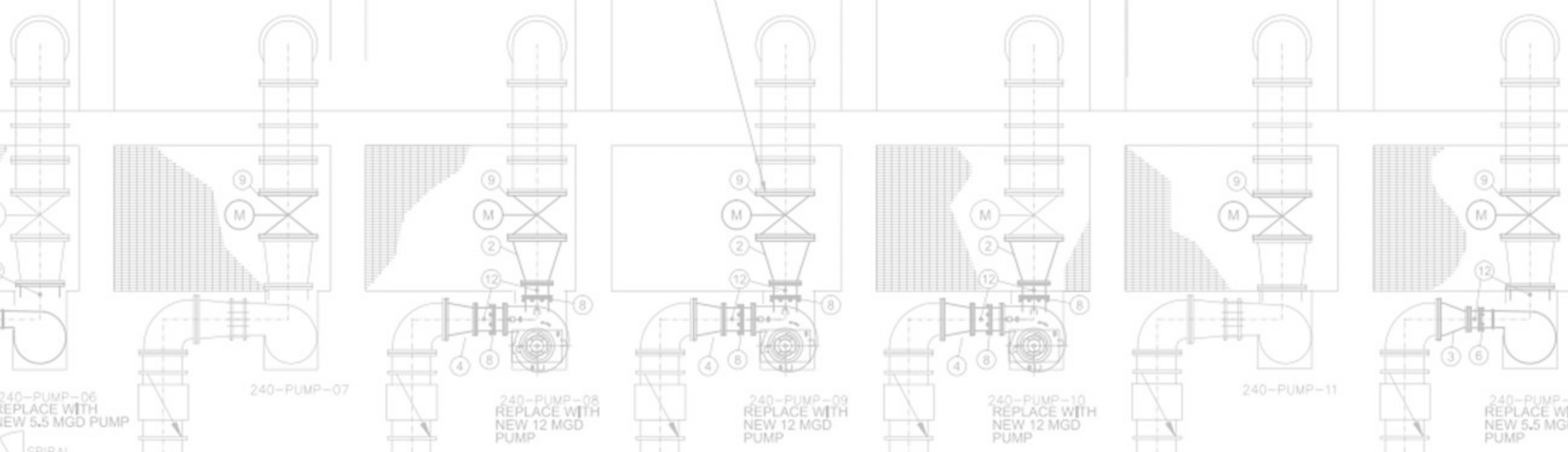
the challenge



Pump vibration

can be caused by both *mechanical* & *hydraulic* issues

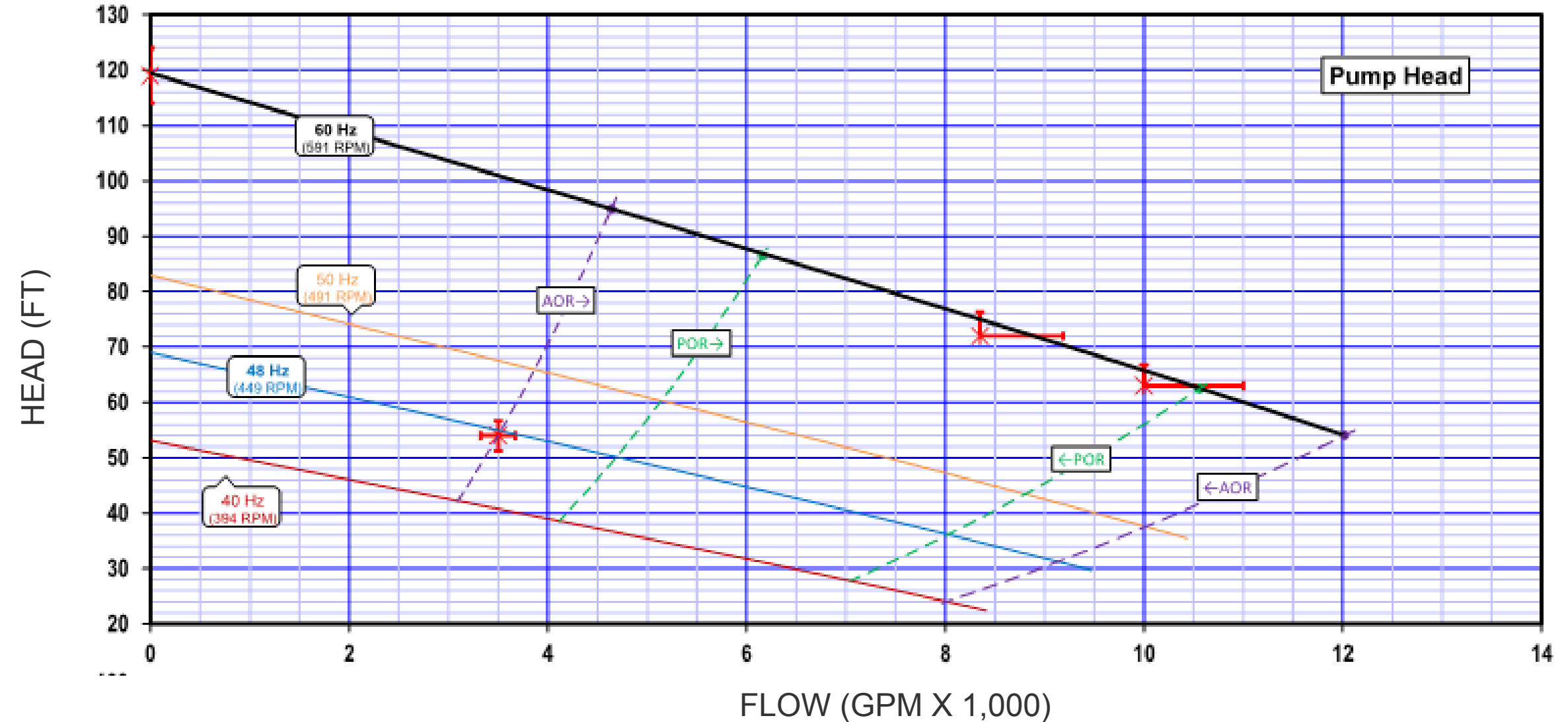
- Operation outside of **preferred operating range (POR)**
- Poor intake conditions
- Insufficient pump support / installation
- Inadequate pipe support
- Inadequate motor support
- Resonance



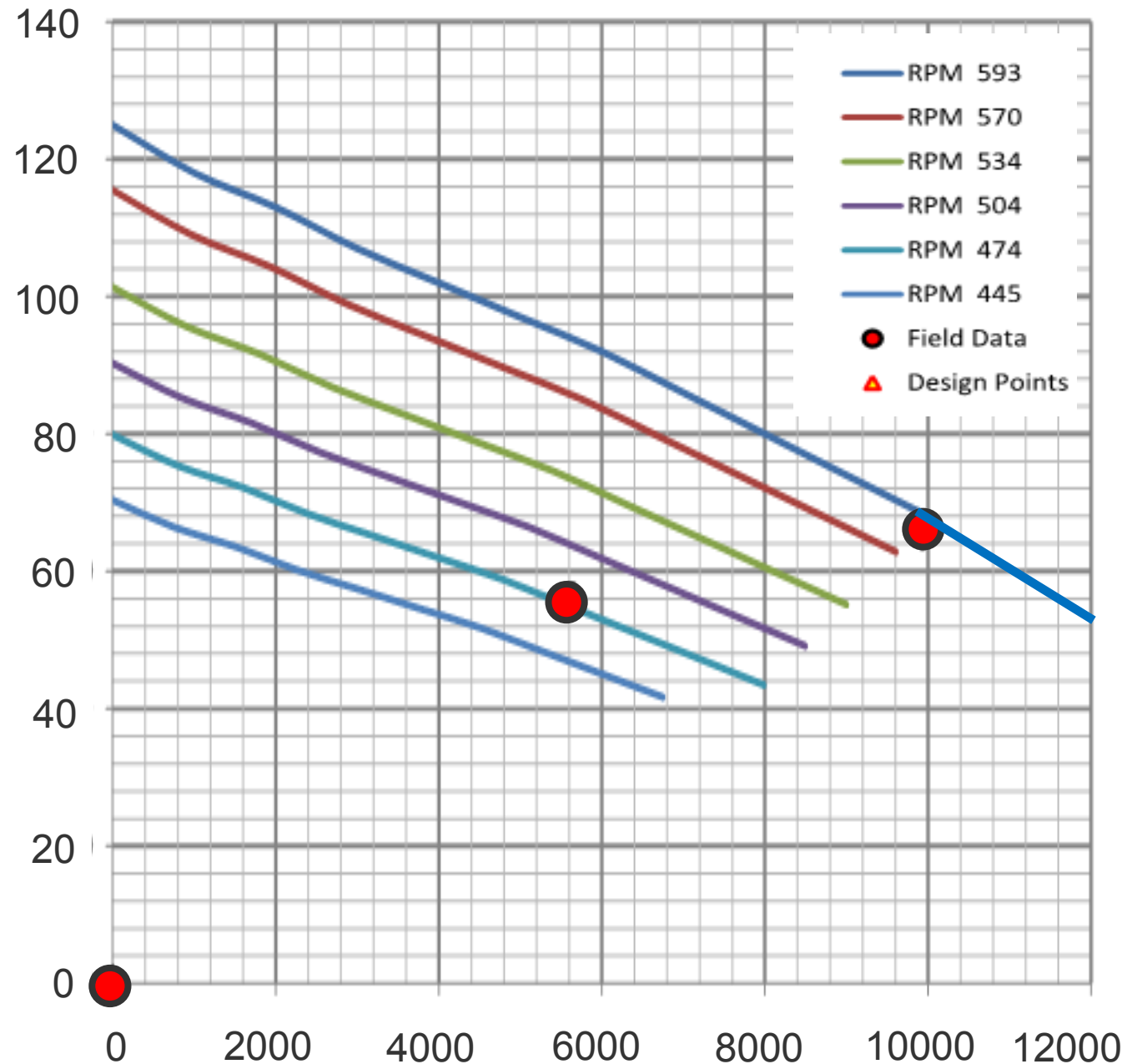
In a recent raw wastewater influent pump station start-up, vibration & resonance issues were documented

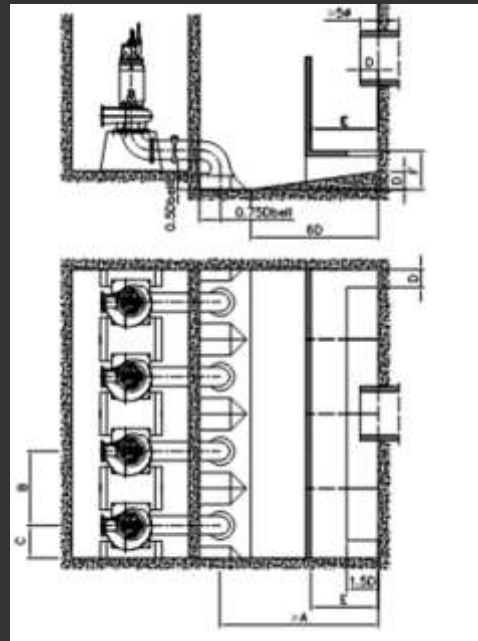
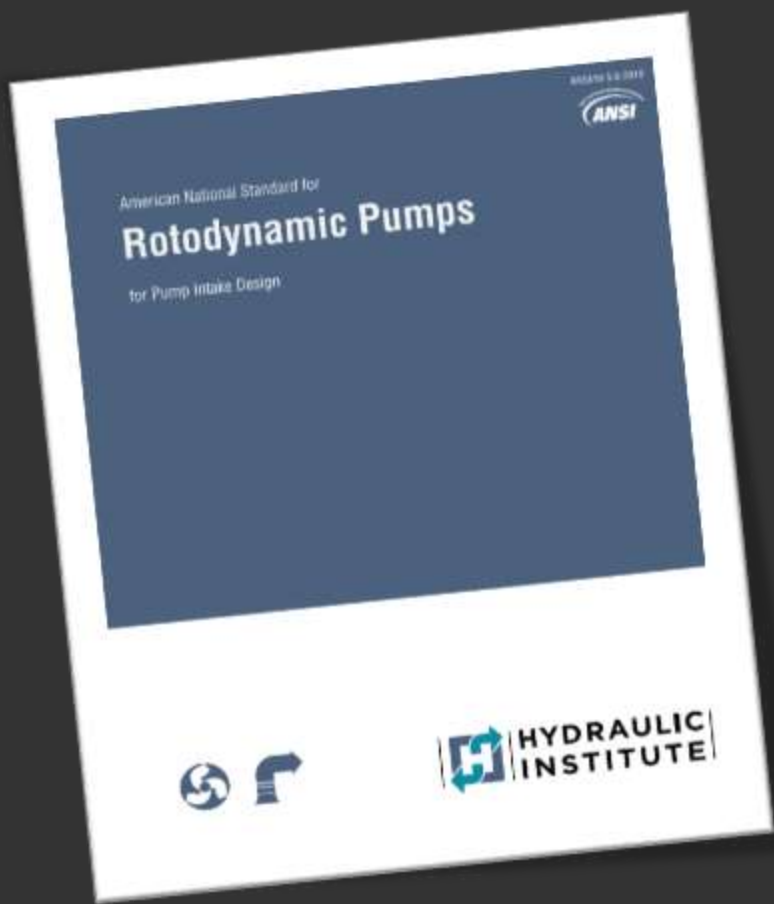
- 60 MGD influent pump station
- Wet pit / dry pit
- 5 vertical solids handling pumps
- 3 – 250 HP
- 2 – 125 HP

Vibration **increases** as you move away from the Preferred Operating Range (POR)



Field testing can determine if the pump is operating within the POR





1
Insufficient submergence

2
Debris in wetwell

3
Vortex formation

4
Intake not conforming to HI (9.8)

Improper intake design or poor intake conditions can lead to **pump vibration**

Inspection of volute
rules out other
potential causes



Verify **adequate
pump support**
during installation.



Inadequate pipe support results in nozzle loading

• **Isolate** the pump from the piping system

Reduce rigidity of the system



American National Standard for
**Rotodynamic
Pumps**
for Pump Piping



6 Campus Drive
First Floor North
Parsippany, New Jersey
07054-4406
www.Pumps.org

Inadequate motor support is becoming a common issue



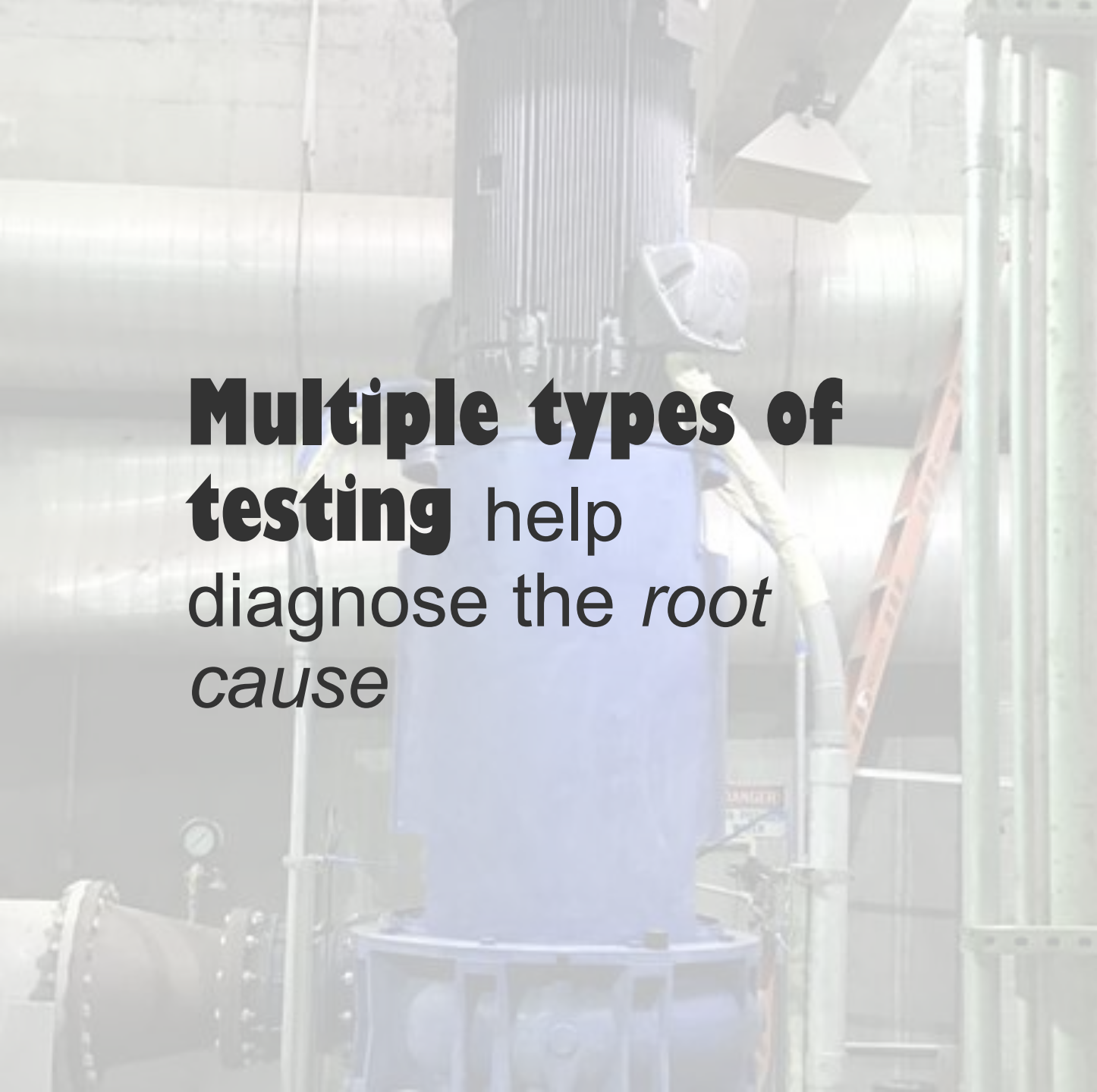
BEFORE

AFTER

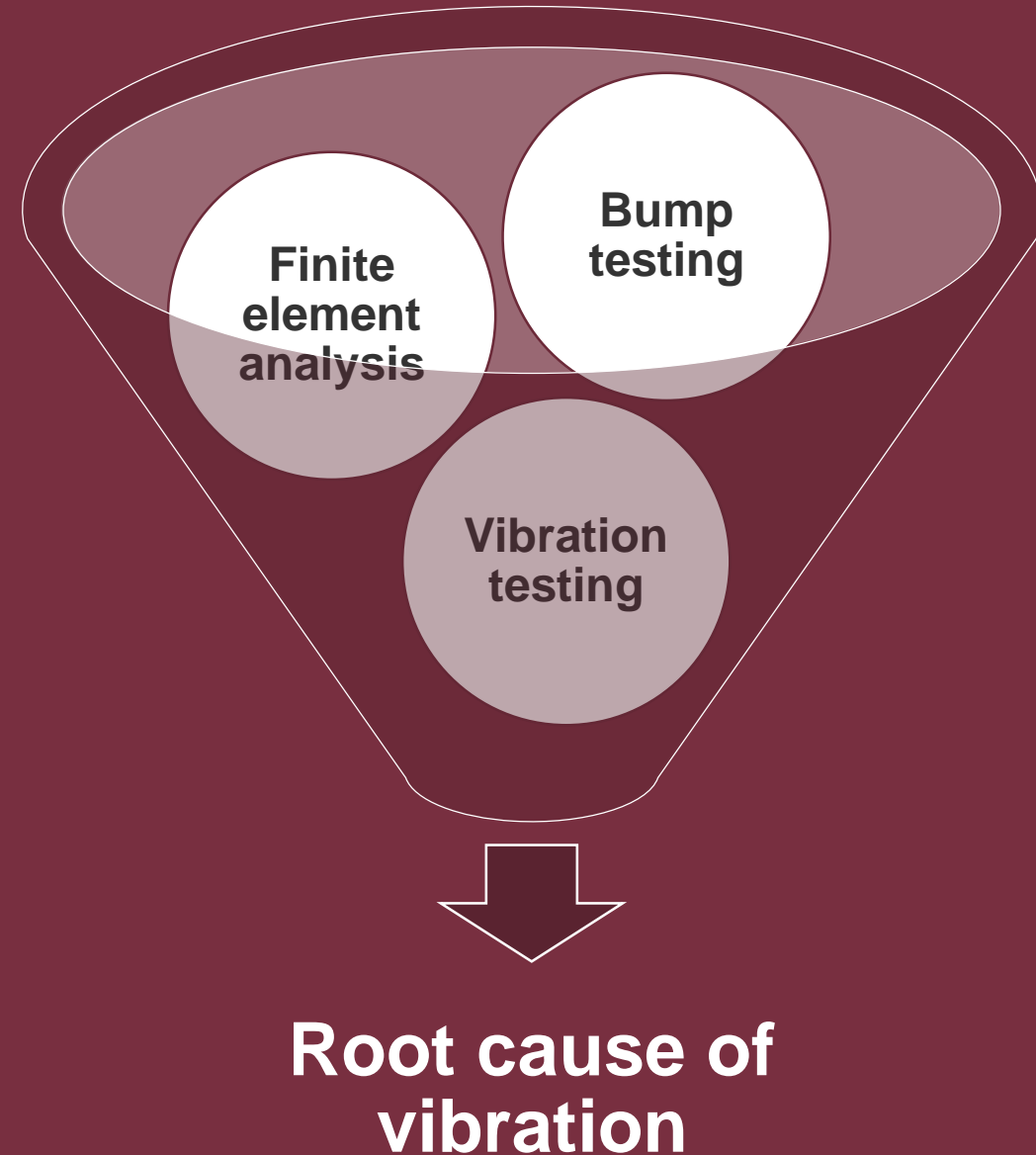


Resonance occurs when pump operation frequency matches that of the pump structure

- One speed
- Modification to move natural frequency
- Speed limiting / exclusion of speed



Multiple types of testing help diagnose the *root cause*



Bump testing can be used to identify the natural frequency of a pump structure



Finite element analysis can be used to predict the natural frequency of a pump

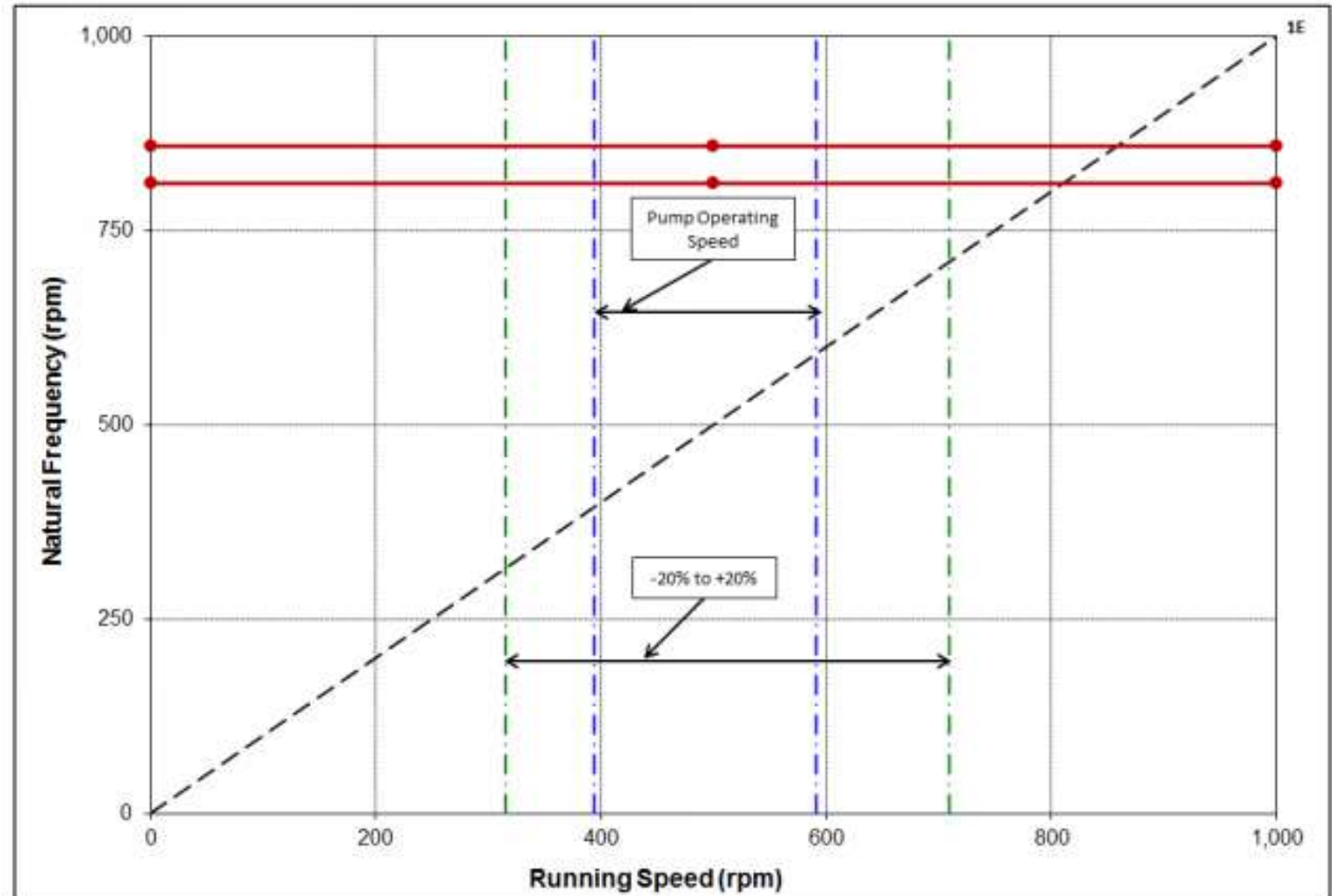


Require analysis performed by a qualified firm

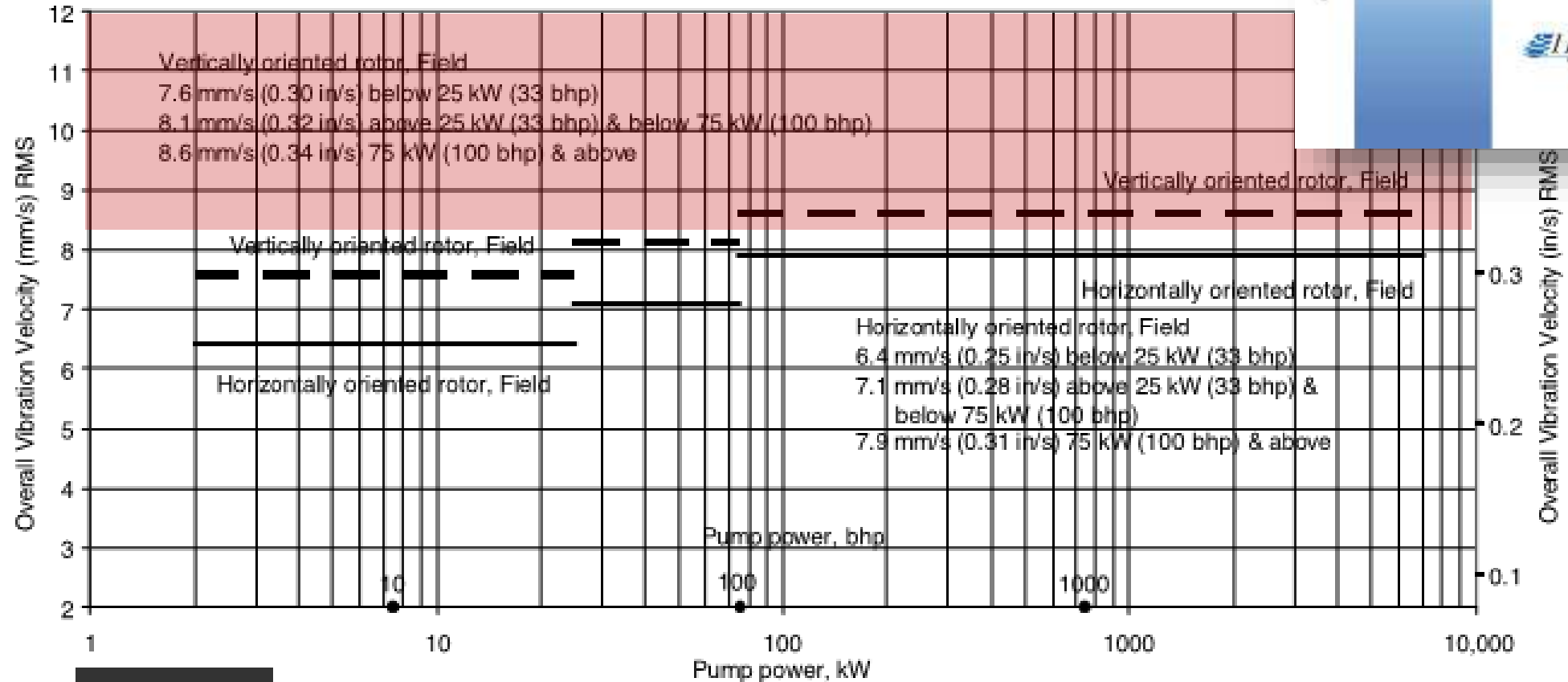
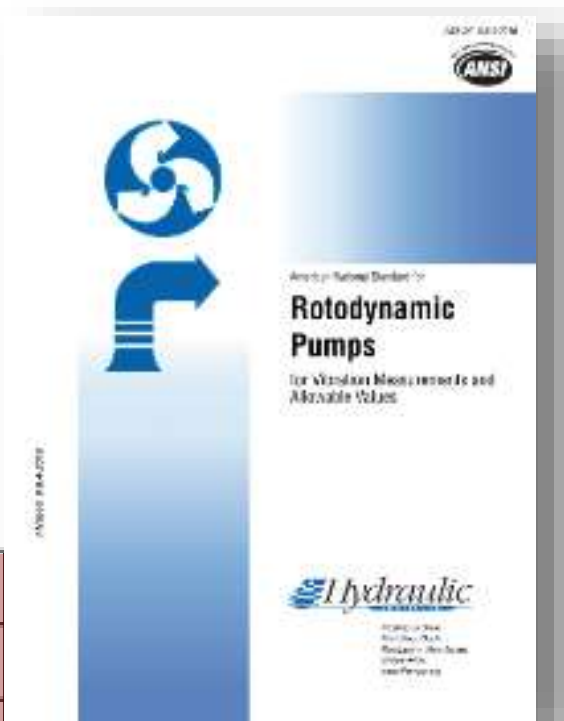


Invest upfront to avoid issues during construction

Require a speed separation margin



Vibration testing in the field confirms HI requirements are met

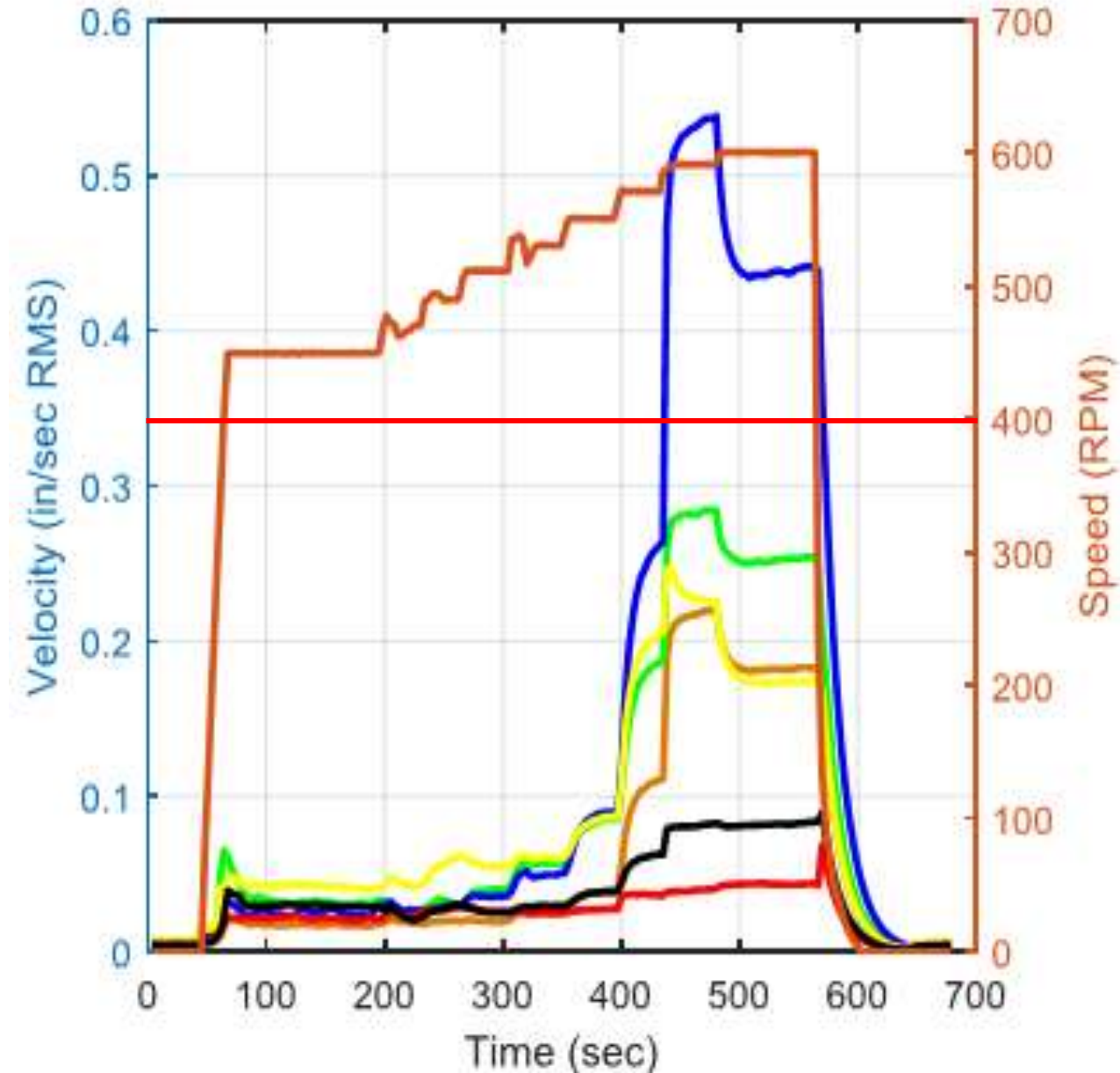





Vibration testing in the field measures three key parameters

1. Pump speed
2. Discharge pressure
3. Operating vibration

Vibration readings
are converted into
charts to show pump
RPM & velocity



A large industrial motor is mounted on a metal stand in a factory. The motor is blue and has a large cylindrical top section. The stand is also blue and has a lower section with a platform. The background shows industrial pipes and structures.

How were these
issues ultimately
resolved?

FOUR RESOLUTION OPTIONS

1. **Stiffening** of the motor stand
2. **Improving** anchorage from the motor stand to pump
3. **Upgrading** to motor lower bearing housing

Testing requirements should be tailored to the specific project

Third party vibration testing can protect the Owner's best interests

Factory testing



Hydrostatic &
performance

Field testing



Performance &
vibration

**Finite element
analysis**

Identification of
pump issues early
on provides



Less maintenance



Prolonged equipment life



More efficient operation

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Questions?

THANK YOU

