



WASHINGTON STATE  
DEPARTMENT OF TRANSPORTATION (WSDOT)

# BREAKTHROUGH IN MITIGATING MARINE PILE DRIVING NOISE

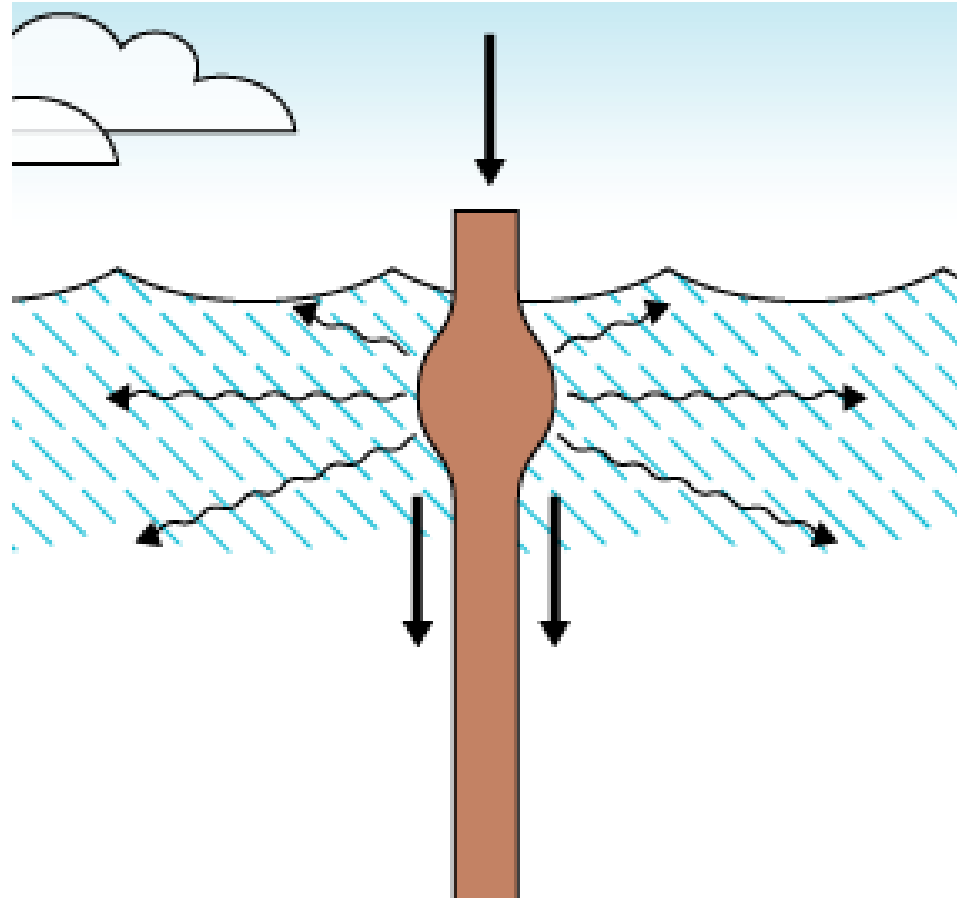
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# REVIEW OF CURRENT NOISE MITIGATION TECHNIQUES



# NOISE GENERATION

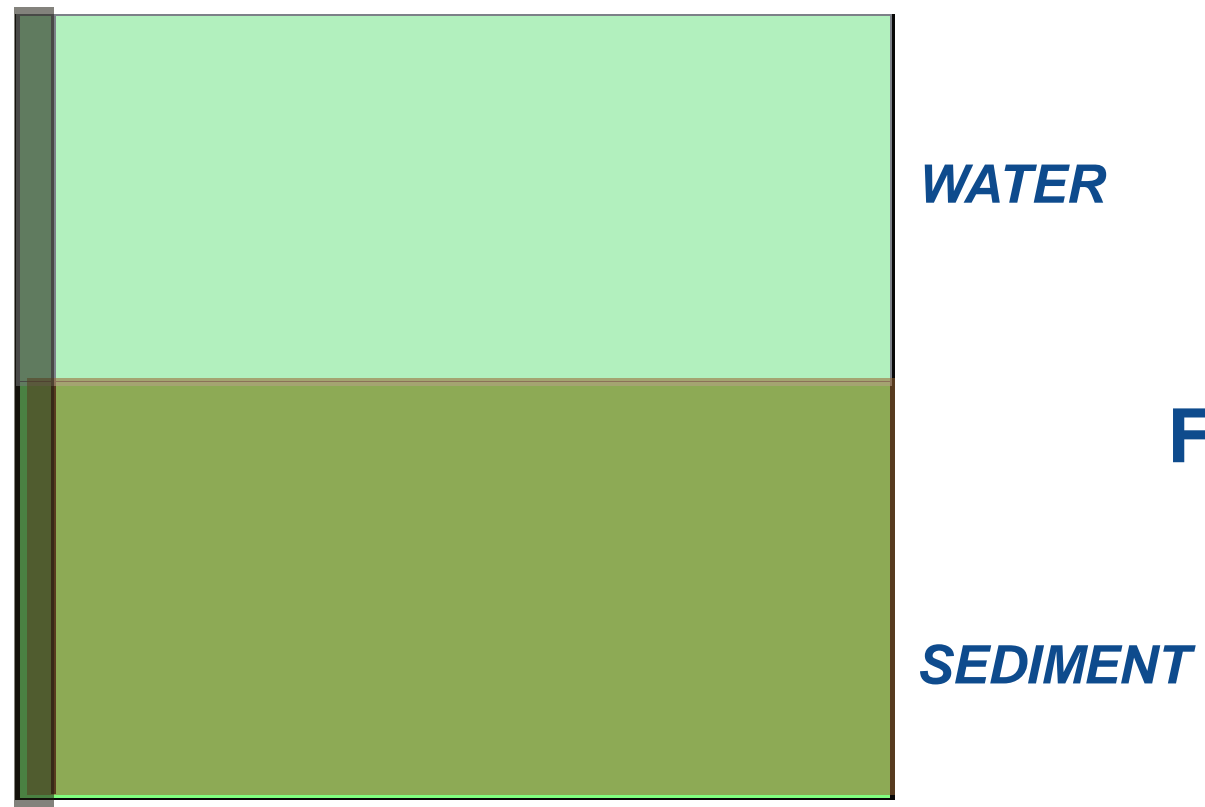


Pile expands radially after impact

Moving bulge disturbs the water and sediment as it propagates down the pile

# NO ATTENUATION - FEM

*Pile*



**AXISYMMETRIC ACOUSTIC  
FINITE ELEMENT SIMULATION**





# CURRENT APPROACHES



**BUBBLE CURTAIN**



**COFFERDAM**



**SLEEVE / BARRIER**

***EXPENSIVE, TIME-CONSUMING, INEFFECTIVE***



# BUBBLE CURTAIN



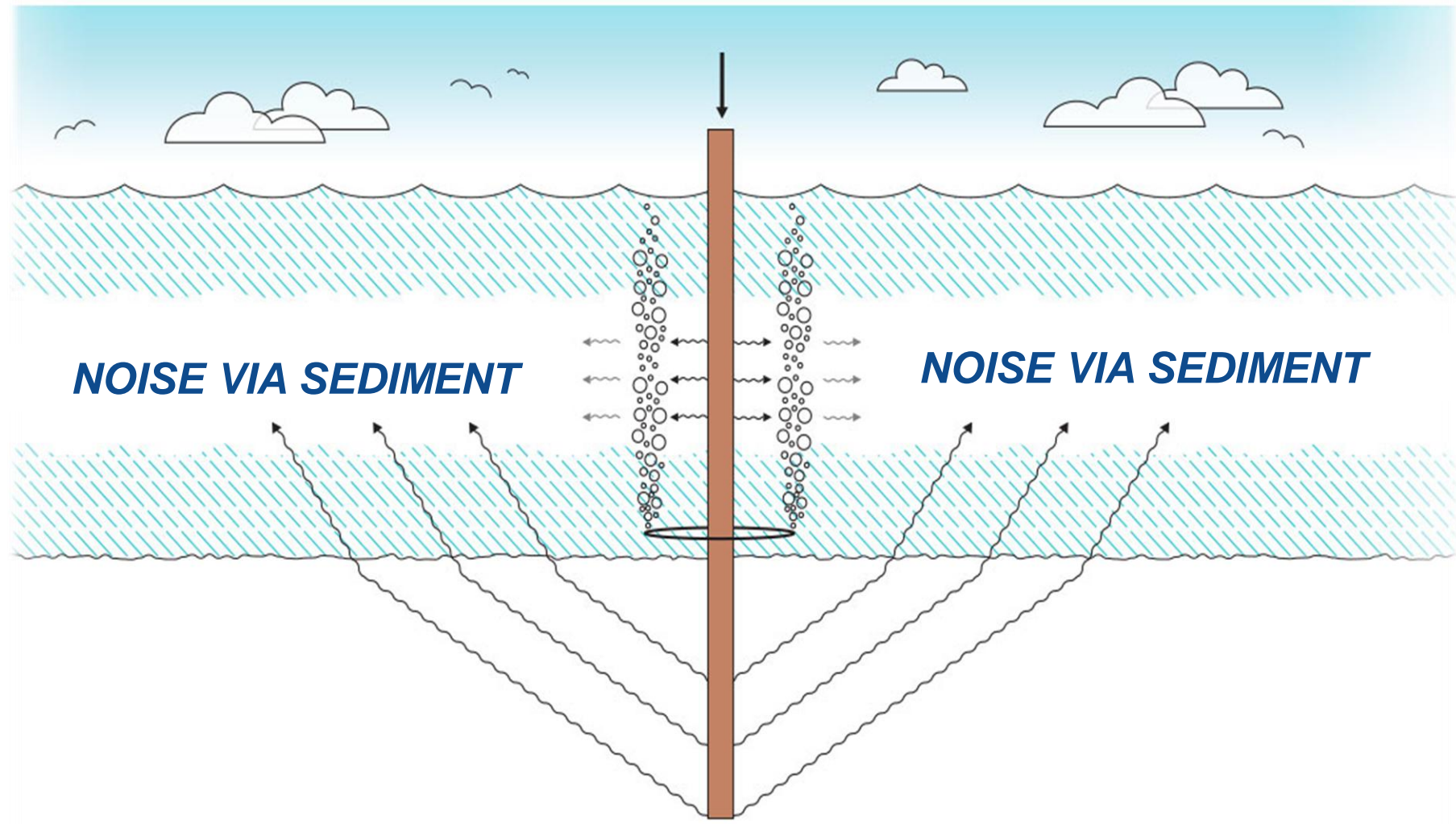
VIDEO COURTESY OF JOE CALLAGHAN, GEOENGINEERS, INC.

## CHALLENGES

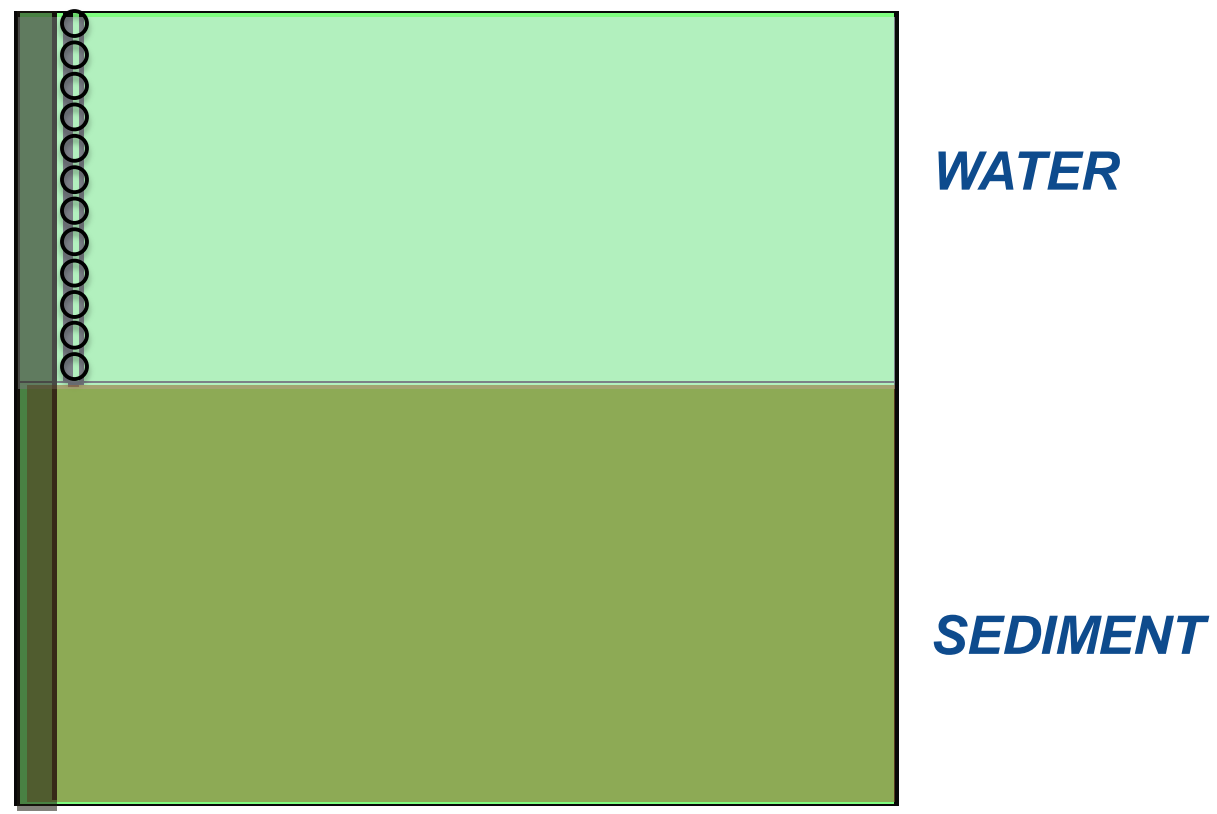
- Only marginally effective
- Impacted by current and placement
- Burdensome and time consuming



# INEFFECTIVE, WHY?



# BUBBLE CURTAINS - FEM



**NOISE ENTERS WATER  
FROM SEDIMENT LAYER**





# WHAT HAVE WE LEARNED?

## CURRENT METHODS:

- Do not address noise from sediment
- Yield < 10 dB under the very best conditions
- Expensive and cumbersome

***BUBBLE CURTAIN IS NOT A RELIABLE  
ATTENUATION METHOD***



# W MECHANICAL ENGINEERING

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UNIVERSITY of WASHINGTON



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