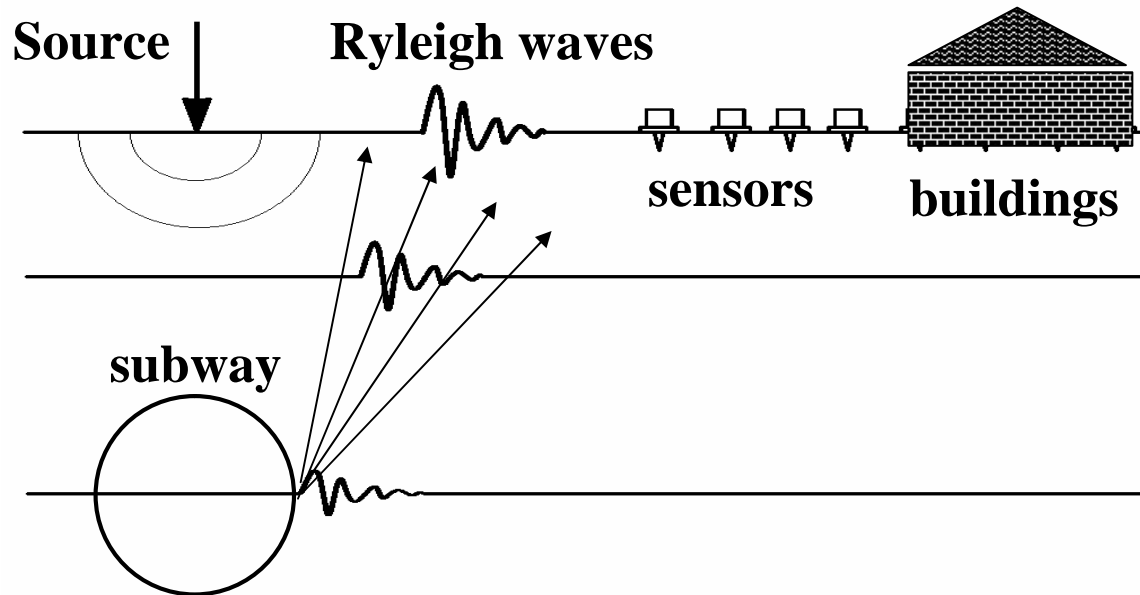
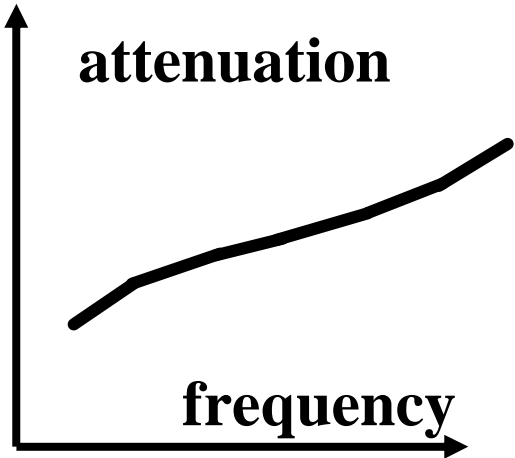


Engineering Problems

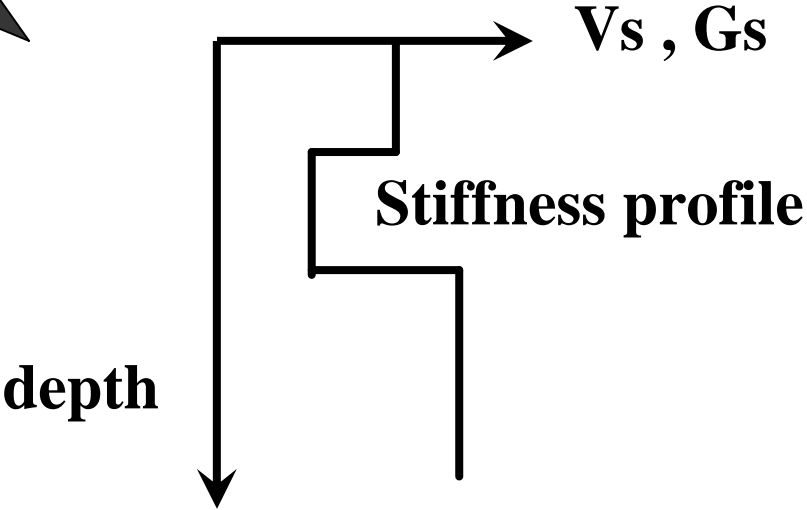
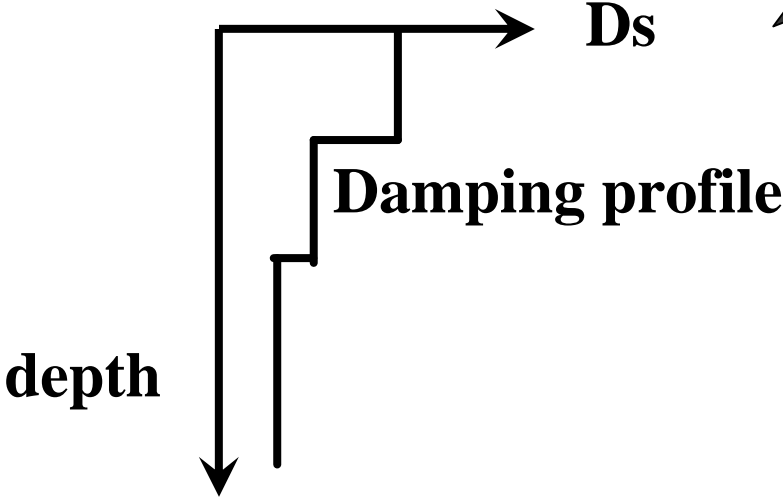
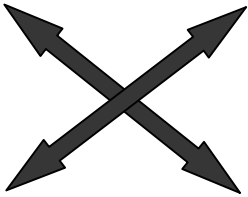
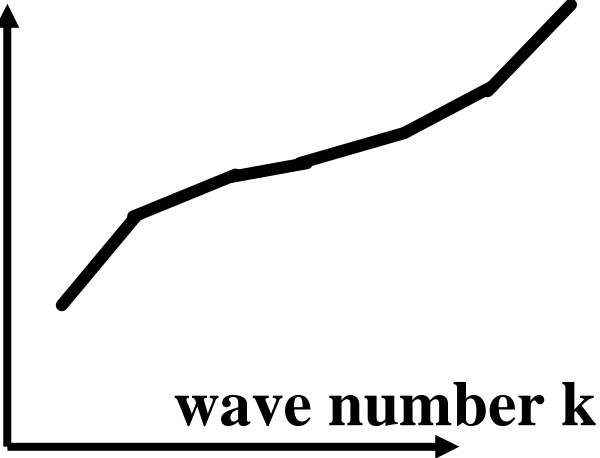


Train, tram, traffic, workings, explosions, subway, industrial machines

Dynamic Properties of Soils

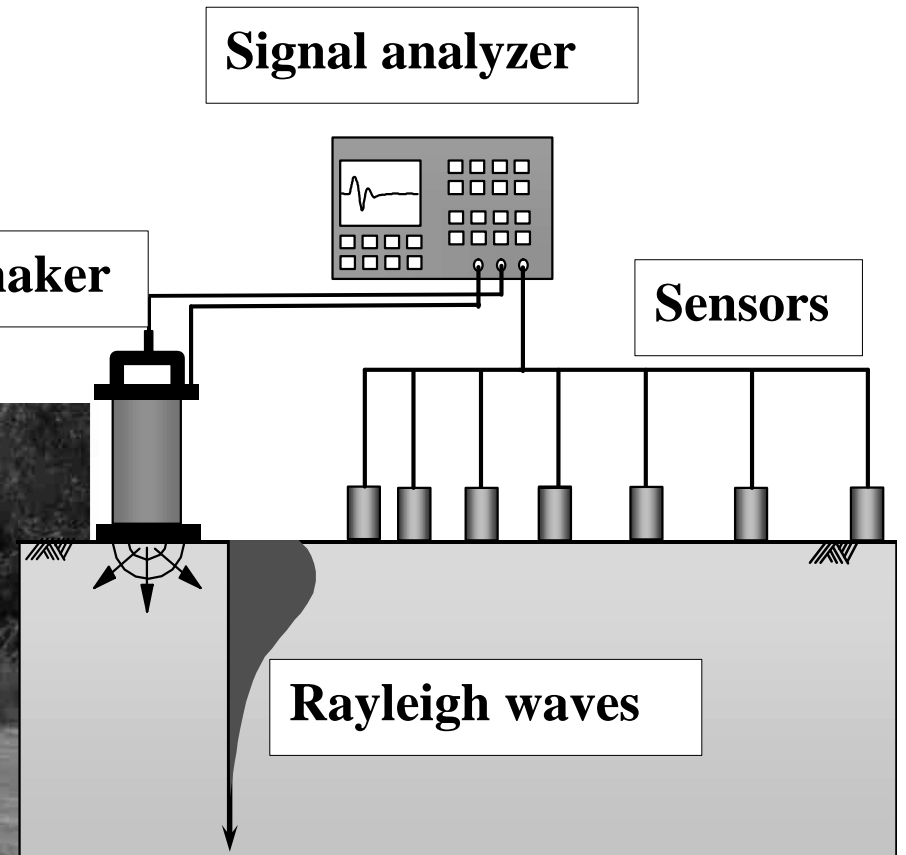


frequency ω



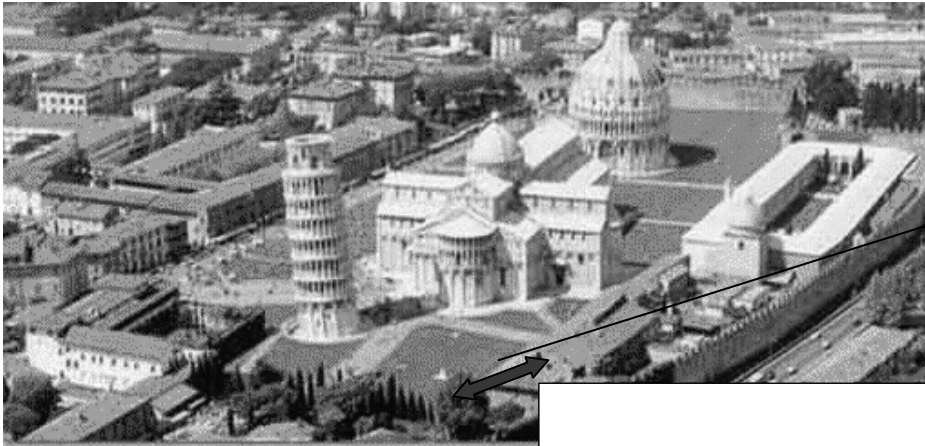
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Multichannel SASW: Experimental Setup



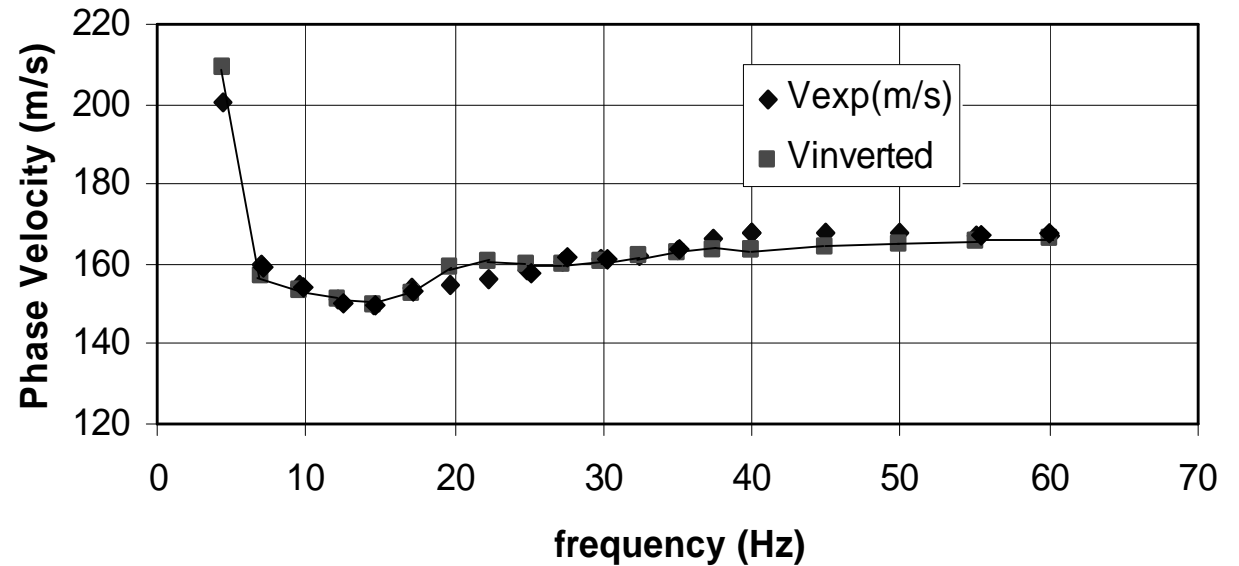
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Application to the Site of the Leaning Tower of Pisa



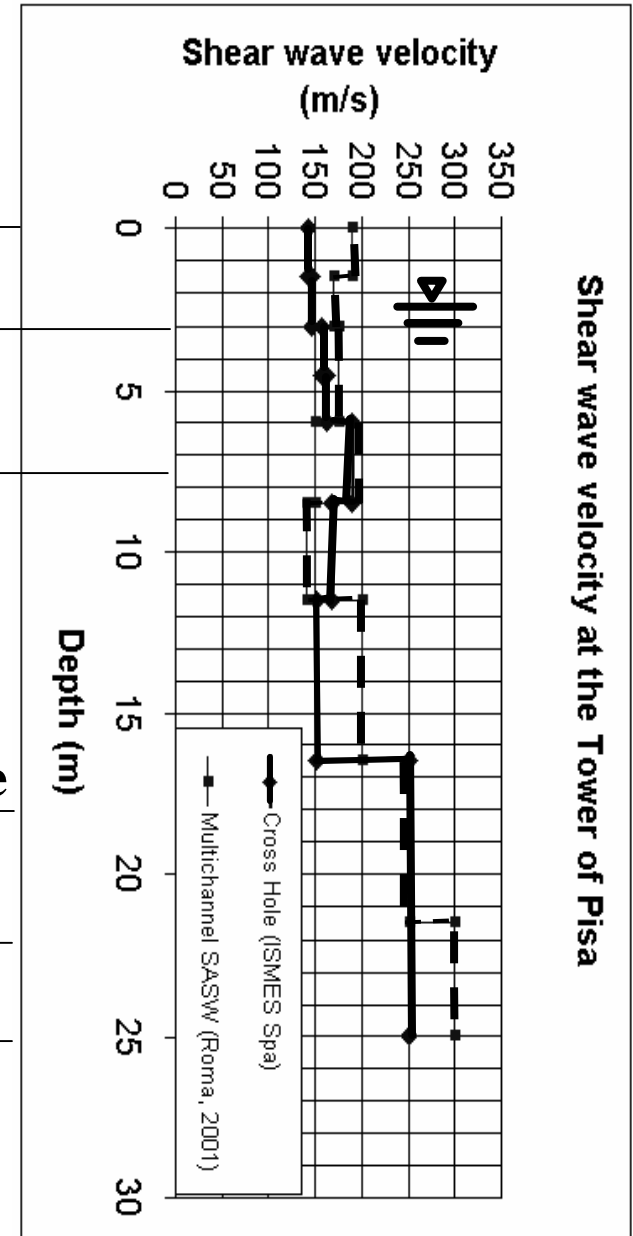
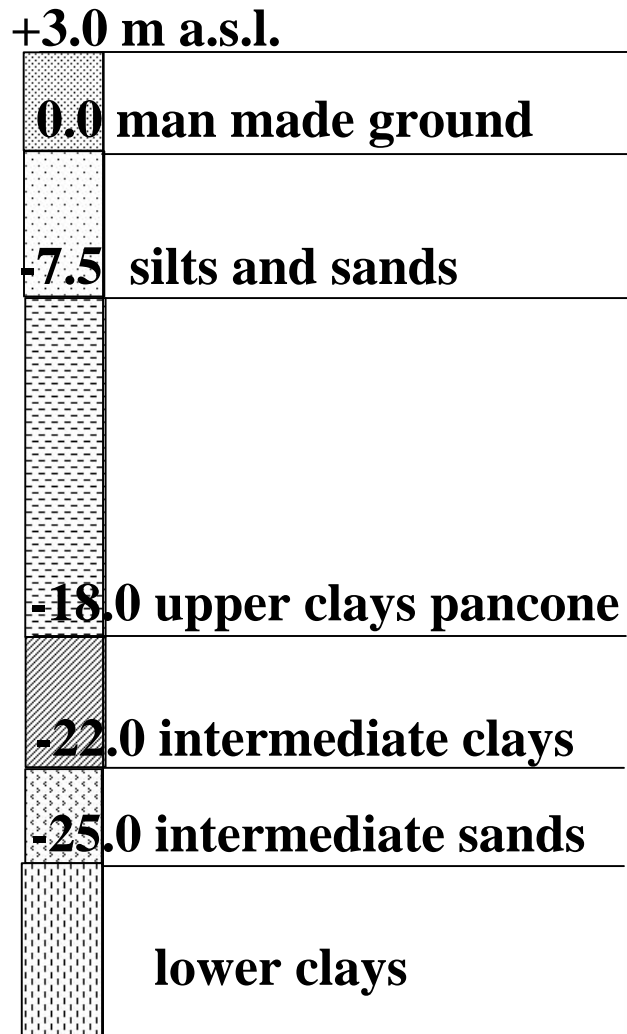
receivers array

Dispersion Relation in Pisa



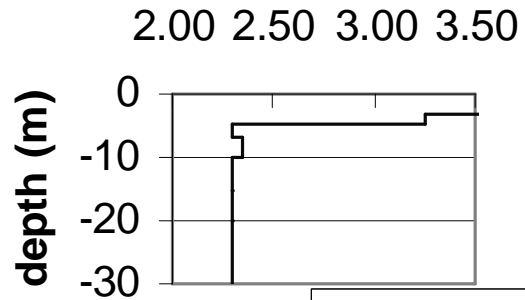
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Leaning Tower of Pisa



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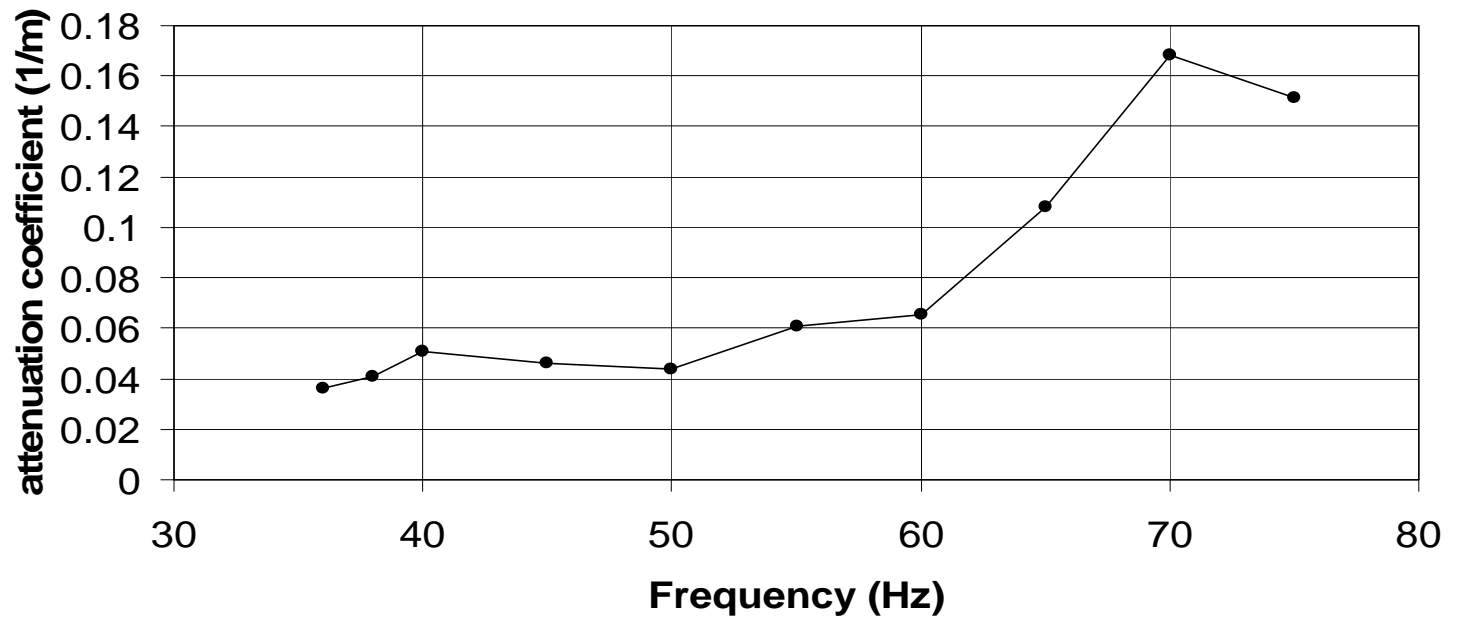
**Shear Damping Ratio
Ds (%) (Site Pisa
Tower)**



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Leaning Tower of Pisa

Experimental Attenuation Curve at Leaning Tower of Pisa



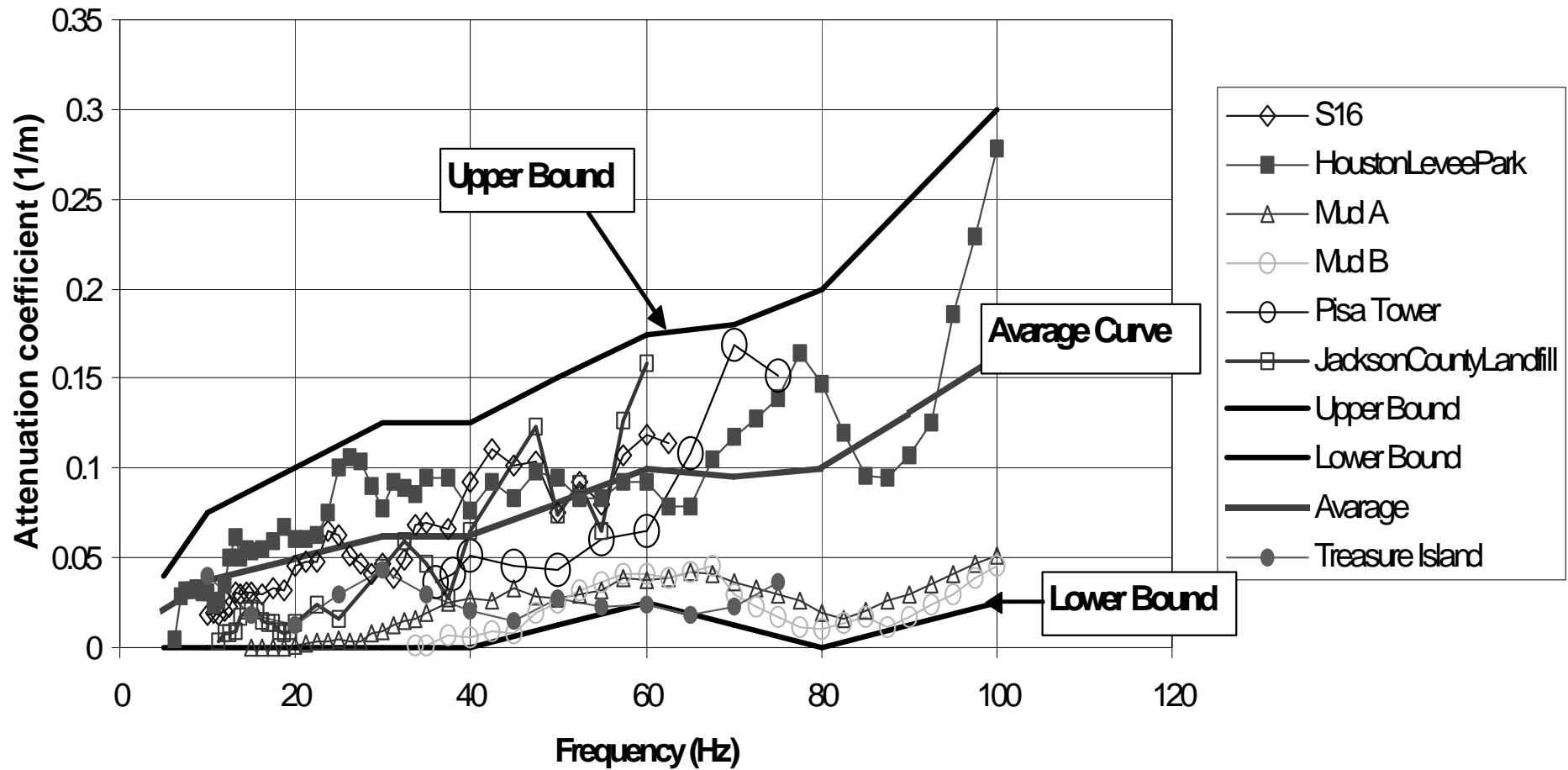
Investigated Sites

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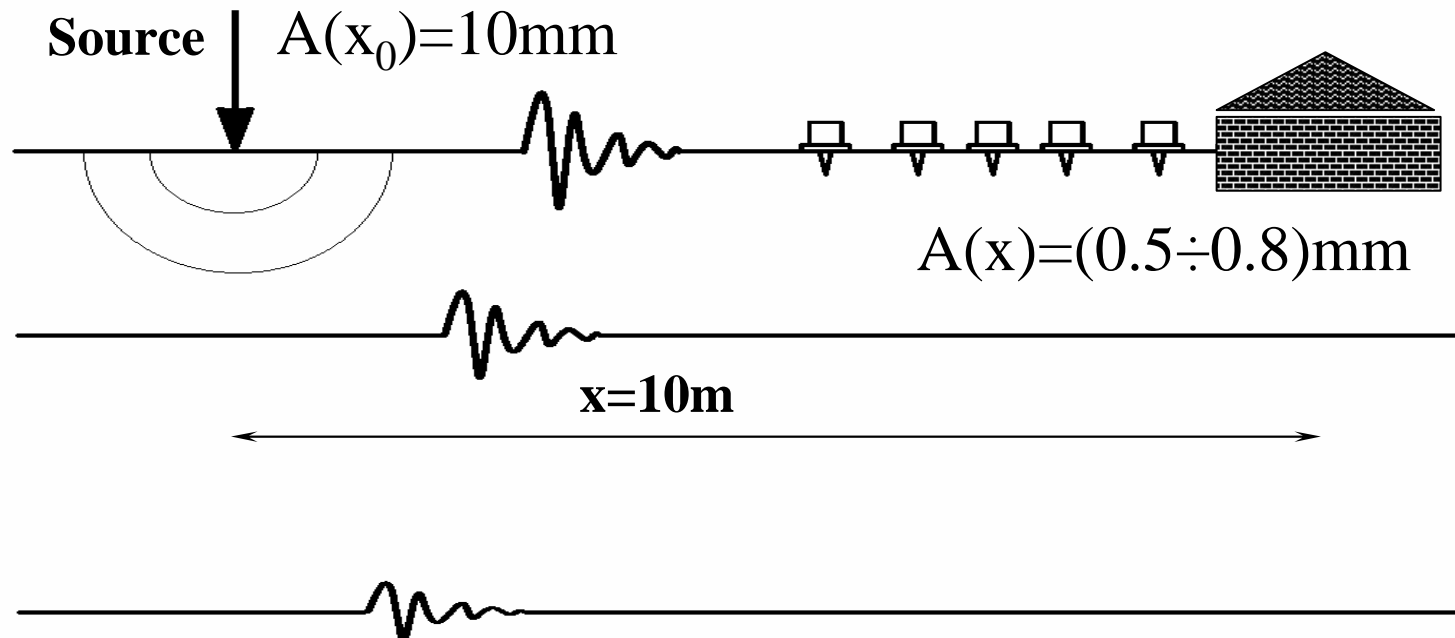
Site	Location Description	Zw (m)	V _{s30} (m/s)	D _{s1} (%)	EC8
S16	(Memphis) Cracked superficial layer of clay	3.5	314	5.0	B
Houston Levee Park	(Memphis) Superficial layer of clayey silt over layer of sand over a halfspace of stiff clay	5	289	4.6	B
Mud A	(Memphis) Loose sedimentary layers of silt and sand	5	198	1.2	C
Mud B	(Memphis) Loose sedimentary layers of silt and sand	8	200	1.5	C
Pisa Tower	(Pisa) layers of man-made ground, silt, sand and clay	3	206	4.35	B
Jackson County Landfill	(Amagon) Very stiff superficial layer of clay over medium to dense sand	n.a.	210	3.75	B
Treasure Island	(S.Francisco) Loose fine-to-medium sand on soft clay (bay mud)	1.5	160	0.6	C

Attenuation Coefficient α

Energy absorption Curves for Rayleigh Waves



Utility of Attenuation Coefficient a



$$A(x) = A(x_0) \cdot (x_0/x)^{0.5} \cdot e^{-a(x-x_0)}$$

$$f = (5\div 50)\text{Hz}$$



$$a = (0.025\div 0.075) \cdot 1/\text{m}$$

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Conclusions

- (1) Attenuation of vibrations propagating on the free surface**
- (2) Rayleigh Waves as a powerful means for Soil Characterization at very small strain level**
- (3) Results at several sites**
- (4) Upper Bound, Lower Bound, Average trend**
- (5) Application to Earthquake Engineering and Soil-Structure Dynamic Interaction in presence of vibrations**