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Note on sheet pile driveability with vibratory methods

Fine-grained materials

GES's experience of installation of sheet pile into cohesive strata using rig-mounted vibratory hammers varies from the current routine driveability recommendations. The variance could be based on many practical aspects such as rig crowd force, bespoke tuning of plant hydraulics and many other potential variables.

In GES's experience, the sheet pile length is the most significant variable in fine-grained strata. GES's experience of sheet pile driving using rig-mounted vibratory hammers into cohesive strata (typically **Irish Boulder CLAYS)** is summarised in Table 1 below:

SPT Range	Undrained shear strength range (kN/m^2)	Sheet pile length range (m)		
		0-6	6-12	12+
0-8*	0-40	Easy	Easy	Easy becoming moderate with increasing depth at upper range
8-15	40-75	Easy	Moderate at upper range	Difficult at upper range, beyond 15m consider pre-auger
15-30	75-150	Moderate at upper range	Difficult at upper range	Refusal beyond 12m without pre-auger, difficult with pre-auger beyond 15m, post-auger may be required
30-50	150-250	Difficult	Refusal without pre-auger. Difficult with pre-auger.	Impacting recommended
50+	250+	Pre-auger required. Difficult / impacting may be required	Impacting recommended	Impacting recommended

Notes:

Easy – piles driving within bounds of hammer capacity, pile advancing at a rate greater than 0.1m/s**

Moderate – piles driving close to bounds of hammer capacity, pile advancing at a rate up to 0.05m/s**

Difficult – piles driving at hammer capacity typically, pile advancing at a rate of up to 0.01m/s**
(generally achievable with leader rig crowd force, not achievable with excavated-mounted hammers)

Refusal – pile resistance in excess of hammer capacity, pile advancing at a rate less than 0.01m/s**

Where *difficult* driving is encountered the vibration attenuation coefficient will increase but will be much less than soft ground

*** The suitability of sheet piles in very soft and soft ground should be considered by a specialist geotechnical or temporary works engineer**

****Driving rates are averaged over 1m depth of driving**

Table 1 - Summary of GES experience of sheet pile installation using vibratory methods

Coarse-grained materials

GES's experience of installation of sheet pile into coarse-grained strata using rig-mounted vibratory hammers varies from current routine driveability recommendations. The variance could be based on many practical aspects such as rig crowd force, bespoke tuning of plant hydraulics and many other potential variables.

In GES's experience, the sheet pile length and presence of groundwater are the most significant variables in coarse-grained strata. GES's experience of sheet pile driving using rig-mounted vibratory hammers into granular strata is summarised in Table 2 below:

SPT Range	Relative density	Sheet pile length range (m)					
		0-6		6-12		12+	
		Dry	Wet	Dry	Wet	Dry	Wet
0-4	Very loose 0-15%	Moderate	Easy	Moderate to 6m. Refusal without pre- or post-auger beyond 6m	Easy	Impacting of sheet piles is recommended.	Moderate. Experience is limited.
4-10	Loose 15-35%	Moderate	Easy	Moderate becoming difficult with depth to 6m. Refusal without pre- or post-auger beyond 6m	Easy	Impacting of sheet piles is recommended.	Moderate. Experience is limited.
10-30	Medium dense 35-65%	Moderate becoming difficult with depth	Easy	Moderate becoming difficult with depth to 6m. Refusal without pre- or post-auger beyond 6m	Moderate	Impacting of sheet piles is recommended.	Difficult. Experience is limited.
30-50	Dense 65-85%	Difficult	Moderate	Difficult to 6m. Refusal without pre- or post-auger beyond 6m	Difficult	Impacting of sheet piles is recommended.	Difficult. Post-auger may be required. Experience is limited.
>50	Very dense 85-100%	Refusal without pre- or post-auger	Difficult	Refusal without pre-auger. Difficult with pre-auger. Post-auger may be required	Difficult. Post-auger may be required	Impacting of sheet piles is recommended.	Refusal beyond 15m without pre-and post-auger. Experience is limited.

Notes:

Easy – piles driving within bounds of hammer capacity, pile advancing at a rate greater than 0.1m/s*

Moderate – piles driving close to bounds of hammer capacity, pile advancing at a rate up to 0.05m/s*

Difficult – piles driving at hammer capacity typically, pile advancing at a rate of up to 0.01m/s*
(generally achievable with leader rig crowd force, not achievable with excavated-mounted hammers)

Refusal – pile resistance in excess of hammer capacity, pile advancing at a rate less than 0.01m/s*

Inter-clutch activity is much more pertinent in granular soils and the most common cause of refusal is material migrating into the clutch causing the adjacent pile to bind. Isolated elements (e.g. H-piles) may drive to greater depth with much less difficulty.

***Driving rates are averaged over 1m depth of driving**

Table 2 - Summary of GES experience of sheet pile installation using vibratory methods