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Installation of Plastic Sheet Piling

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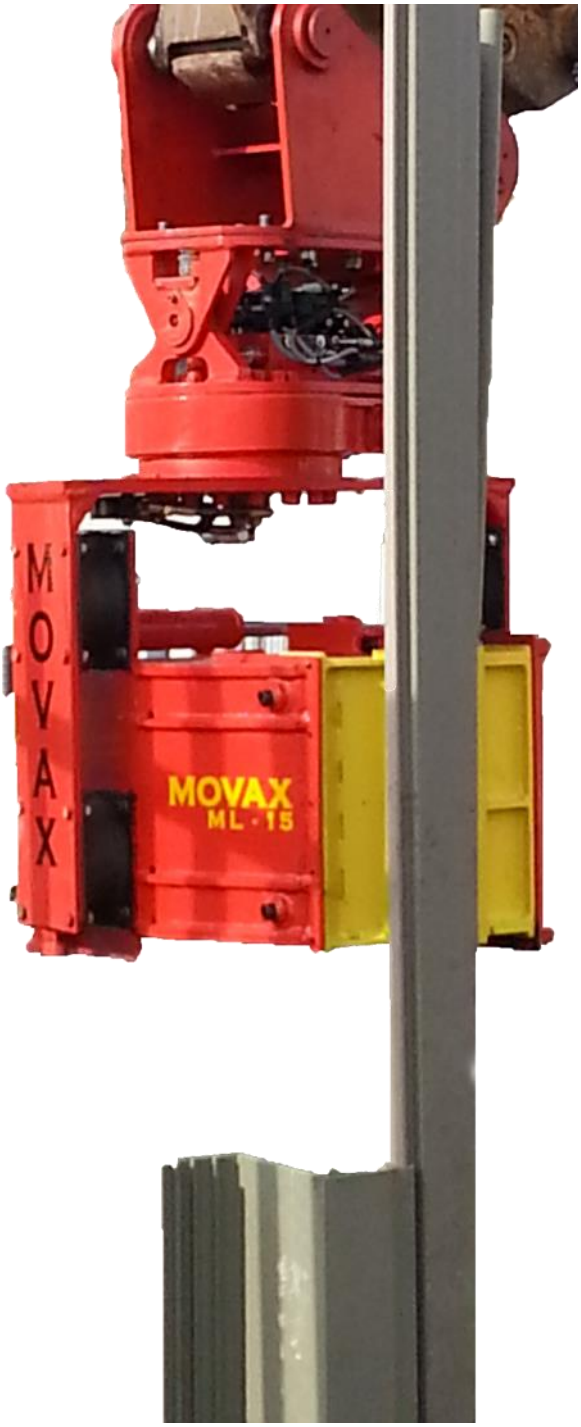
Can Plastic Piling really be driven?



With many different pile types, pile drivers and soil conditions, this generic question can yield many answers, often the question is made in comparison the steel sheet piling. The first answer, is always a question, which steel pile vs which plastic pile? It is an unrealistic comparison to compare hot rolled steel piling to cold form trench sheeting; and they are both steel! So comparisons of steel and plastic piling can be hard to make.

Some generic statements that hold true (most of the time) are:

- Tubular plastic piling, such as the advanced range, will install more efficiently than U or Z plastic piles as they are the most rigid.
- If there are no access or equipment restrictions, the more heavy duty plastic sheet piles will install better than cheaper alternatives (excludes advanced range). This is simply due to the fact that they provide greater rigidity and can handle a larger more powerful pile driver.
- If installing by hand (rubber maul, sledge hammer or even post drivers) narrower sheets are easier to install as there is less skin friction. Again with the available choice, thick, narrow sections provide a good balance between rigidity and friction.
- Plastic Piling is mostly installed either by hand or using some form of vibrator. These vibrators can be simple compactor plates, excavator mounted vibrators, Movax Lite ML15, leader mounted vertical stack vibrators or suspended piling vibrators (standard or high frequency fixed or variable moment).
- Piling vibrators (not compactors) enable the use of steel fabrications called mandrels, these enable plastic piling to be driven faster by increasing the rigidity, clearing obstructions and allowing more down crowd.
- Vibratory driving tends to cause less sheet damage than impact driving. This is especially the case of air hammer pile drivers, as the high blow rate can generate heat and melt the plastic pile.
- PVC is a thermoplastic and so as it warms up, it softens - at relatively low temperatures compared to steel (the is the reason why it can be recycled) so efficiently. Therefore refusal driving with rapid blow air hammers can cause a lot of top damage.
- In terms of cold weather installation, PVC is quite resilient, but as the temperature drop below minus 5°C, care needs to be taken to prevent damage to the piling. A temperature of around minus 10°C is often stated as the limiting temperature for installation. It is advisable to consider thicker plastic piling, such as the Ultra Z11 in very cold working conditions.
- Plastic Piling are all interlocking lead with the male interlock to avoid interlock plugging.
- When using sealed versions of the plastic pile lubricating the interlocks with a water based lubricant will greatly assist installation; without such the tighter interlocks can jam.

In addition to sheet pile installation using a vibrator, impact driving is well established for hard driving conditions, such as dense ground or clay based ground. Impact driving is most commonly used to “back” or finish drive the piles once the vibrator has reached refusal.

There are few impact hammers available for plastic piling, those available includes post drivers and small air hammers.

Those that are available, tend to be small air hammers the size limited to the ability of the plastic piles to support the hammer. The smaller the hammer, the smaller the drive force and so these tend only to be used when installing short lengths of plastic piling.

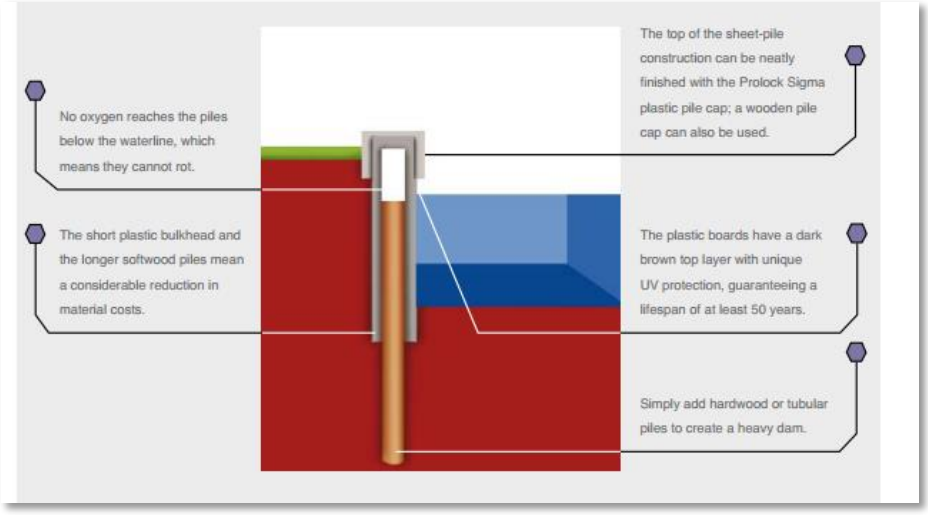
Steel sheet piling in contrast, has a wide array of hydraulic and air powered impact hammers available, as it has the rigidity and strength to support that range of hammers. The recent development of the BSP BH120 hydraulic impact hammer opens up new possibilities for plastic piling.

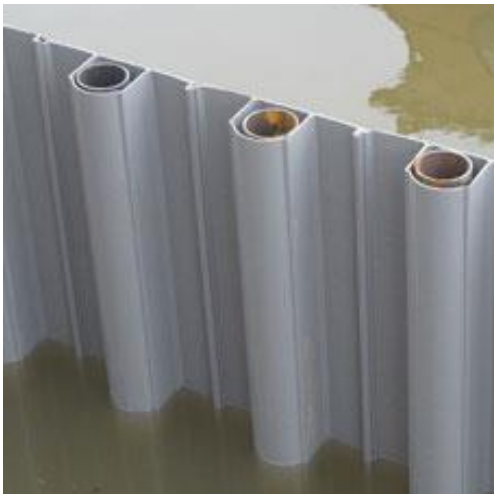
Please note it is not always possible to drive sheet piles at a specific location, in a specific soil type (this holds true as much for steel as for plastic piling). More often the main limiting factor to successful installation is the use of equipment not powerful enough for the task.

When driving sheet piling into the ground, different soils present different resistances and therefore what works on one site may not necessarily work on another.

The best installing product we offer is MultiLock, and this is for a variety of reasons, the pile is exceptionally rigid, and at 500mm wide less prone to twist and deflection as the sheet length increases. Whilst we do sell a lot of MultiLock on its own in long lengths, it can also be used as a hybrid with timber and steel. This combination (rigid post and short sheet) makes for a very efficient installation, even in difficult ground conditions or limited pile driving equipment.

The sheet is driven in to the ground but as little as 500mm, and posts or steel tubes are driven inside and deeper to provide stability. Obviously steel tubes can be driven into quite difficult ground conditions. It also does not form a continuous underground wall and so can be used in areas with tree roots etc.





Types of equipment used

Rubber Mauls




Handheld Impact Hammers




Compactors



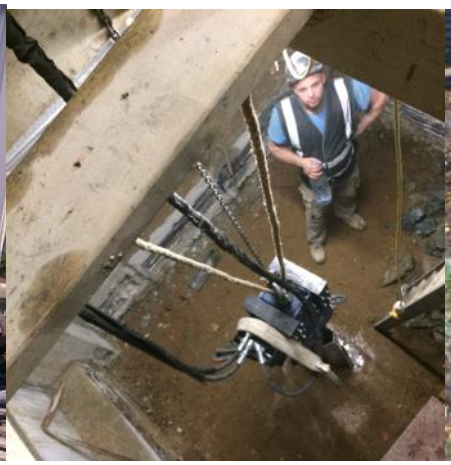

Agricultural Post Drivers




Air Hammers




ESF03 Vibrators




Excavator Mounted Vibrators




Movax



Hydraulic Impact



Leader Rigs Vibros




Piling Mandrels

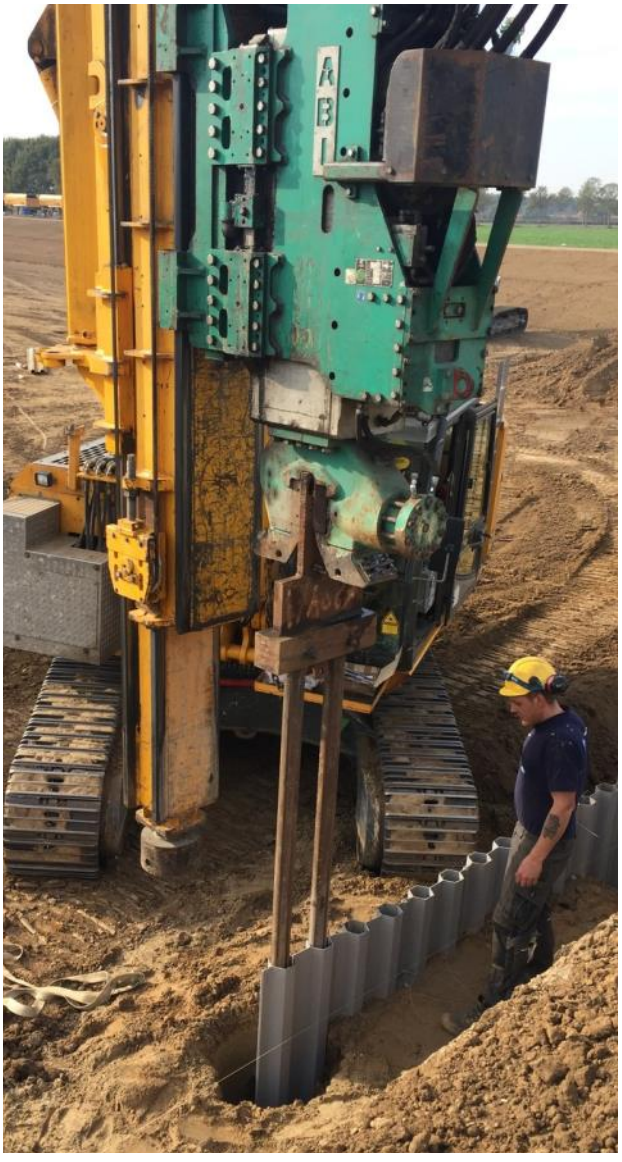
Plastic Piling mandrels are steel fabrications that facilitate the use of larger vibratory equipment, strengthening the piles, helping support the vibrator and piles during installation. Mandrels provide a degree of protection for the plastic sheet pile, either enclosing it fully, partially, protecting the pile toe or clearing in

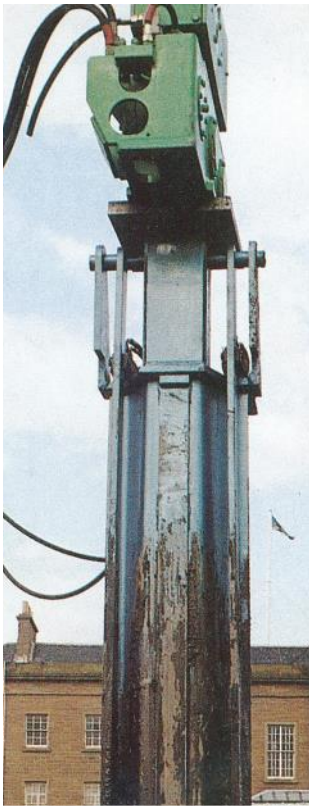
Plastic sheet piling, particularly the thin narrow designs proved more flexible and prone to twisting. The secret to installing plastic piling is maximising and increasing the rigidity, and so making the process as efficient as possible - mandrels help achieve this. In its simplest terms it is the fabrication which is driven, taking the plastic pile along with it. The mandrel is then extracted, leaving the pile in the ground, as such they only work with vibratory equipment.

There are principally three types of piling mandrel

1. Rear or fully enclosed mandrels
2. Side Mandrels
3. Internal mandrels

The main difference between the three types is how much of the pile is in contact or covered by the mandrel. The more the mandrel is covered, the greater the protection, but this comes at a cost in that there is more contact between the mandrel and pile, increasing its chance of pulling the pile out when extracted, further the more steel, the heavier the mandrel and the greater the dampening force., which in turn can require the job to use bigger equipment. There are a few variations on these including side mandrels with internal mandrels. Also to facilitate the use of Movax side driving vibrators, there are also mandrels to strengthen the grip location and enable side and top driving.

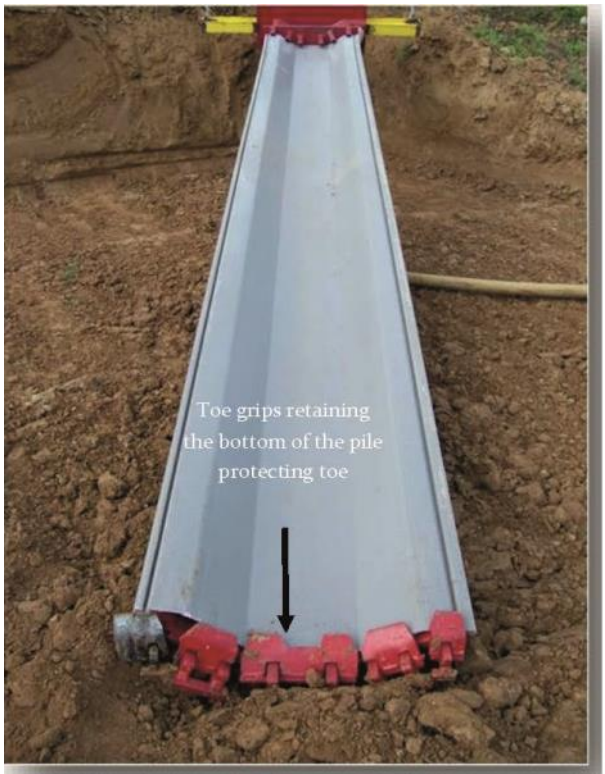


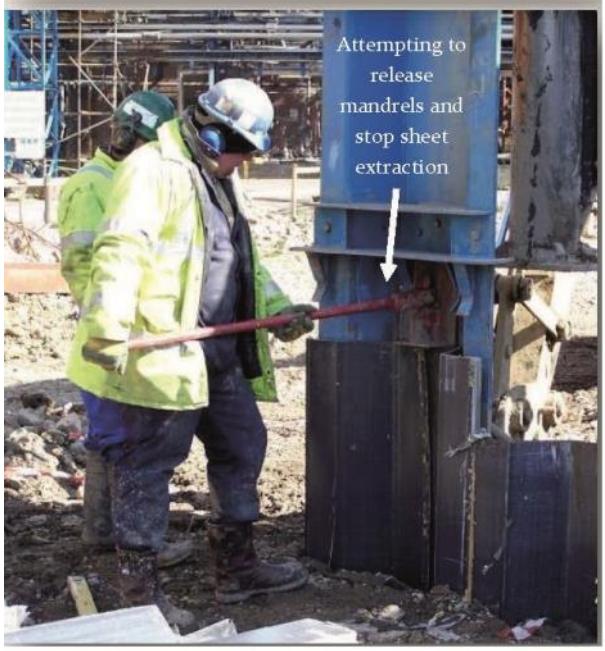


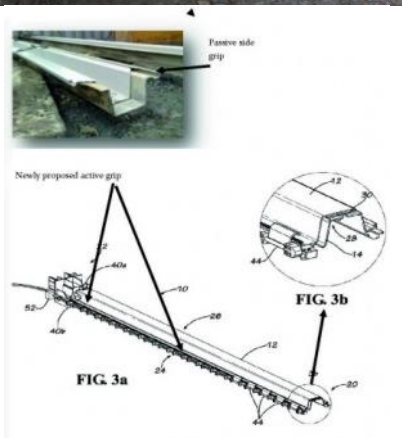
Rear mandrels

Rear mandrels or fully enclosing mandrels were the first types of mandrels to be used, and are exemplified by such designs as the Stabcat Stomper and the CMI PileClaw. As the name suggest the fabrication that have a similar shape to the sheet pile and either cover the back of the pile, or fully encompass. They have their limitations but have proved themselves for driving in hard soils. It is more common to utilize sacrificial toe grips, to stop the pile drifting than flaps. These grips are more expensive, but tends to release the pile better than flaps.

Recent advances in rear mandrels, have introduced element of passive side support, and in the latest PileClaw patents an active side grip has been proposed. This side support does make the designs much safer, however the issue of pile pull out has not been addressed sufficiently.







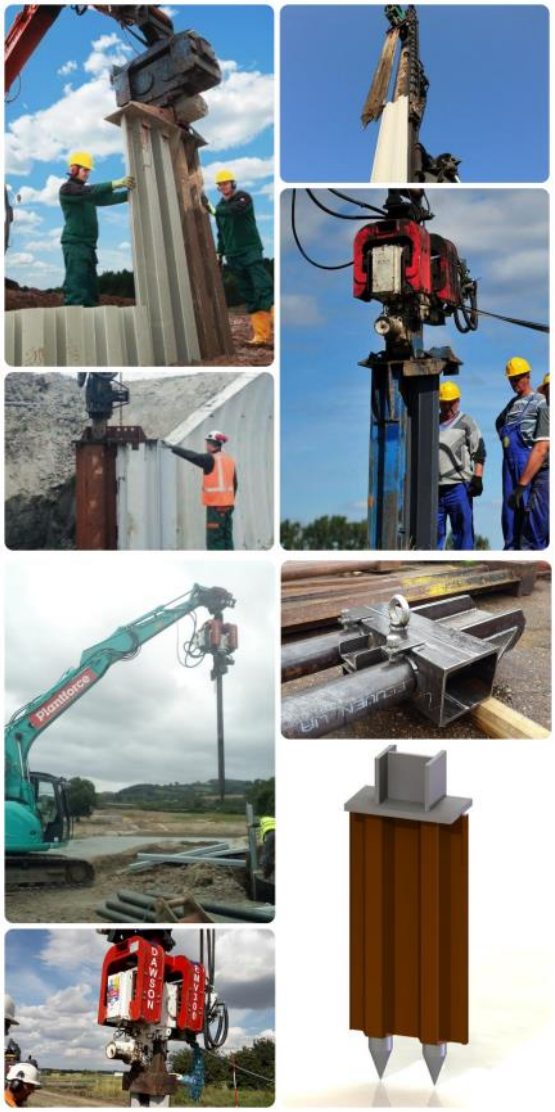
Side mandrels

These we developed through APEhire, 20 years ago, and as the name suggests, this mandrel is positioned to the side of the plastic pile, rather than behind it. The concept is to increase rigidity of the plastic piling, support the weight of the piling vibrator, whilst minimising the surface contact between the mandrel and pile. In summary, more support with minimal contact - the pile is driven efficient and when the mandrel is extracted the pile stays in the ground.

Side support is essential, else the pile will drift, buckle or flex away from the mandrel. This in turn will reduce driving efficiency, and increase the chance of de-clutching or damaging the sheet pile. The recent addition of passive and now active side gripping in rear mandrels simply confirms this.

The side mandrel is first driven on its own, this clears away major obstructions, and in some soil conditions it will leave behind a pile shaped hole. The plastic pile is then inserted into the mandrel, and the combined assembly driven into the ground. The pile is driven more efficiently as there is reduced toe resistance, whilst benefiting from top and side support.

The mandrel is then extracted, and since there is minimal contact between it and the pile, the pile stays in the ground. So unlike rear mandrels there is no need for a re-drive method. In common with rear mandrels, these are heavy and will need a larger vibrator with at least 8mm of amplitude, ideally more.



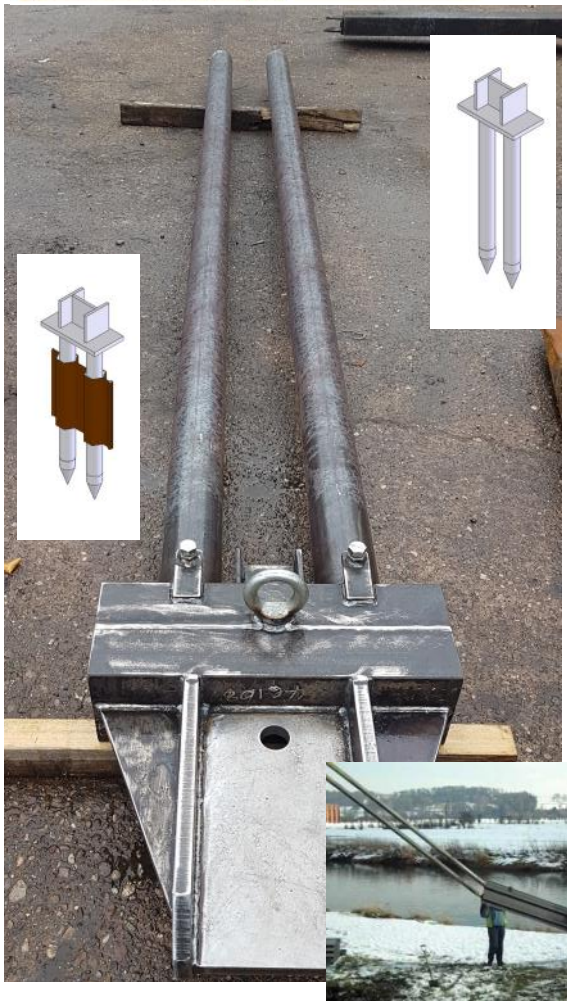
Internal mandrels

Internal mandrels, are basic steel fabrications that are inserted into the inside area of a plastic pile - only available with advanced plastic piles. The mandrels are much lighter; this in turn enables smaller piling vibrators to be used, or for a given size of vibrator makes that pile driver more efficient.

In contrast to rear and side mandrels, internal mandrels extend the use of mandrels to much smaller vibrators, with amplitudes as low as 3mm. This enables the use of mandrels in access restricted sites.

The internal mandrels provide additional rigidity to the pile during installation. The process of installation is made more efficient as the mandrel extends beyond the pile and guide soil and obstructions out of the way, reducing toe resistance.

The internal mandrel is extremely well balanced as it is located inside the plastic pile, and this places it and the pile directly beneath the vibrator where it is most effective. Upon extraction of the mandrel, the pile always remains in place as the skin friction on the outside of the pile is always more than that on the inside.



So minimal contact, maximum support.