PILING IN IRELAND

CURRENT PRACTICES
INTRODUCTION

Murphy International Ltd. have been operating in Ireland since 1968. We began constructing piles in 1973 using tri-pod bored piles. Since then we have evolved with the current demands and building practices in Ireland. Buildings are bigger and safety & environmental standards have become more stringent, particularly in the last 20 years. Engineers and architects are becoming more ambitious with their designs. The technology available today to piling companies has advanced to meet these demands.
The first documented historical reference to piling can be traced back to the 4th century BC where records how the Greeks lived in dwellings erected on timber piles driven into a lake bed. Similar dwellings have been found in Switzerland which are believed to be 6000 years old. The Romans would have also used piling techniques to build bridges as they advanced across Europe. In Ireland and Scotland such dwellings were called Crannogs and are believed to have dated back to the 12th Century.
Crannogs were timber buildings constructed out on a lake to protect villagers from invaders. Timber piles were driven to refusal and the dwelling was constructed on top.
The Romans would construct bridges built on timber piles as their armies advanced across Europe. The engineers were so advanced that they would instruct the soldiers to break step as they crossed so that the bridge would not be subject to dynamic loadings.
HISTORY OF PILING

Cheshire Calwell Auger Rig.  Crane Mounted Hammer Grab.
MIL installed Tripod Piles in 450mm, 500mm and 600mm diameters.

- Slow construction.
- Labour intensive.
- Limited Depths.
- Not cost effective.

MIL Tripod Piling behind the Forecourts in the early 1980s.
Currently in Ireland there are a large number of piling techniques. On one end of the scale, there are rigs which can fit through your front door to install piles in your house and on the other end there are rigs which can install bored piles up to 40m deep. Taking out rock is not the problem it used to be as there are rigs available with up to 50T of torque which can break out even the toughest of Irish rock.
Some of the larger piles MIL have installed are:

- **Monaincha Wind Farm – Rotary Bored Piles.**
  - 31m deep, 900mm diameter piles, with a 5m rock socket into solid limestone.

- **M8 Motorway – Steel Driven Piles.**
  - 65m deep, 305*305 steel section, welded together in 5 separate lengths.

- **N11 Kilmacanoge – Precast Concrete Piles.**
  - 36m deep, 350*350 precast concrete sections in 12m long lengths.
ROTARY AUGER BORED PILES

Drill and push casing into the ground with the rotary drive

Drill with the rotary tools: bucket, auger or core barrel. Stabilize the borehole using the casing

Install the reinforcement cage with the auxiliary winch

Pour concrete through the tremie pipe into the cased borehole

Extract the casing with the rotary drive during concreting
Typical pile diameters and maximum loadings.

<table>
<thead>
<tr>
<th>Nominal Pile diameter. Mm</th>
<th>Nominal working Load. kN</th>
<th>Maximum Working Load, with rock socket. kN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>1,500</td>
<td>2,500</td>
</tr>
<tr>
<td>900</td>
<td>3,000</td>
<td>5,000</td>
</tr>
<tr>
<td>1,200</td>
<td>5,000</td>
<td>7,500</td>
</tr>
<tr>
<td>1,500</td>
<td>7,500</td>
<td>10,000</td>
</tr>
</tbody>
</table>
MIL first bought a dedicated bored piling rig in 1990 from Soilmec in Italy.

- **Soilmec R10.**
  - First Rotary Auger Bored Piling Rig, purchased by Murphy International.
  - 40 Tonne Class Rig.
  - Torque; 10,000 Nm.
Our Rigs have gradually got bigger and more powerful since we first started with the Soilmec R10.

- Soilmec R412. Max depth 21m.
- Soilmec R518. Max depth 23m.
- Bauer MBG24. Max depth 27m.
- Bauer BG28. Max Depth 36m.
- Bauer BG26. Max Depth 36m.

The maximum diameter is dependant on the ground conditions and depths required.

We have also hired rigs directly form the manufacturer to suit various jobs.
ROTARY AUGER BORED PILES

Typical Casings

Bohrrohre

The use of powerful rotary drives of the B 0-series or the use of oscillators requires the application of heavy-duty casings.

Bauer offers two types of casings:
- double-walled casings
- single-walled casings

Double-walled casings can be used universally, as they are designed especially for transmitting high rotational and vertical forces as created by the KDK rotary drives and oscillators.

The use of double-walled casings ensures a flush cut at the tooling.

Single-walled casings can be used for applications where weight reduction is important.

Casings

Long Version:
- Cutting ring can be equipped with BA or B P type teeth (other types on request).
- Male joint, wear ring and cutting ring are machine-faceted.
- Centring groove on wear ring and tack welding of cutting ring to wear ring allow easy replacement of cutting ring on site.

Short Version:
- Cutting ring can be equipped with BA or B P type teeth (other types on request).
- Male joint, wear ring and cutting ring are machine-faceted.
- Cutting ring welded directly to male joint.
Typical Boring Tools

Progressiveschnecken
Tapered Rock Auger

Kernrohre mit Rundschaftmeißel
Core Barrel with round shank chisel
SECANT PILES

Secant piles are interlocking ‘male’ & ‘female’ piles which form a retaining wall. The pile wall is used to retain both soil and water. Accuracy is key and the best way to keep the piles accurate is using a temporary steel casing.

<table>
<thead>
<tr>
<th>Pile Diameter</th>
<th>Typical Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>600mm</td>
<td>500mm</td>
</tr>
<tr>
<td>900mm</td>
<td>770mm</td>
</tr>
<tr>
<td>1200mm</td>
<td>1050mm</td>
</tr>
<tr>
<td>1500mm</td>
<td>1350mm</td>
</tr>
</tbody>
</table>
SECANT PILES

Uncased Piles

Cased Piles
SECANT PILES CASE STUDY

- MAN Trunk UIDs, Trafford Park, Manchester.
- 3 no. Secant pile shafts.
- Launch Shafts for TBM and permanent detention tanks for waste water.
- 192 no. 1200mm diameter piles up to 31m deep.
- Male C28/35, Female C10/12 Concrete.
- “Quick Splice” used to join cage sections.
CONTIGUOUS PILES

Contiguous piles are similar to secant piles except the ‘female’ pile is not required. The reinforced piles are bored close together to form a retaining wall which will keep out soil only. Any water or poor ground will not be retained.

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</tr>
<tr>
<td>900mm</td>
<td>1050mm</td>
</tr>
<tr>
<td>1200mm</td>
<td>1350mm</td>
</tr>
<tr>
<td>1500mm</td>
<td>1650mm</td>
</tr>
</tbody>
</table>
CONTIGUOUS PILES CASE STUDY

- Maryborough Hill, Cork.
- Retaining wall for a road widening scheme.
- 99 no. 900mm diameter piles up to 8m deep with 5m deep rock sockets.
- Piles installed at 1200mm centres.
- C32/40 concrete for all piles.
KING POST/SOLDIER PILES

- Typical Spacing 2m to 3m
- Suitable for Single Basements
- Earth Retention only
- Not Suitable Adjacent to Buildings
KING POST CASE STUDY

- Kestrel House, Clanwilliam Place, Dublin.
- 39 no. 305*305 steel sections.
- Bored 12m deep with 3m deep rock sockets.
- Used 600mm diameter casing and boring tools.
- King Posts at 2.5m centres.
- C30/37 concrete cast into the rock sockets.
Junttan PM 20 Piling Rig driving steel tubular piles in the Kinsale Road Landfill for Wills Bros.

Junttan PM20 Piling rig driving precast concrete piles in Millennium Park, Naas for Kerry Group.
The typical precast concrete pile sections available are as follows.

<table>
<thead>
<tr>
<th>Pile Section Size</th>
<th>Maximum Working Load kN</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 x 250mm</td>
<td>600</td>
</tr>
<tr>
<td>300 x 300mm</td>
<td>1000</td>
</tr>
<tr>
<td>350 x 350mm</td>
<td>1500</td>
</tr>
</tbody>
</table>

Various other sections can be ordered to suit. MIL use a Junttan PM20 rig to drive these piles. The max rake allowed with this rig is 1 in 4.
PRECAST CONCRETE DRIVEN PILES

LEIMET Precast Concrete Pile Joints.

<table>
<thead>
<tr>
<th>PILE SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>235x235</td>
<td>232</td>
<td>232</td>
<td>16</td>
<td>700</td>
</tr>
<tr>
<td>250x250</td>
<td>247</td>
<td>247</td>
<td>16</td>
<td>700</td>
</tr>
<tr>
<td>270x270</td>
<td>267</td>
<td>267</td>
<td>20</td>
<td>770</td>
</tr>
<tr>
<td>300x300</td>
<td>297</td>
<td>297</td>
<td>20</td>
<td>770</td>
</tr>
<tr>
<td>350x350</td>
<td>347</td>
<td>347</td>
<td>20/25</td>
<td>770</td>
</tr>
<tr>
<td>400x400</td>
<td>397</td>
<td>397</td>
<td>25/32</td>
<td>850</td>
</tr>
</tbody>
</table>

<table>
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<tbody>
<tr>
<td>235x235</td>
<td>232</td>
<td>232</td>
<td>16</td>
<td>500</td>
</tr>
<tr>
<td>250x250</td>
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<td>247</td>
<td>16</td>
<td>500</td>
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<td>397</td>
<td>20</td>
<td>700</td>
</tr>
</tbody>
</table>
PRECAST PILES CASE STUDY

- Kerry Group HQ, Naas, Co. Kildare.
- 600 no. precast concrete piles. Both 300mm and 350mm square.
- Driven up to 10m deep.
- Junttan PM20 used to drive the piles.
- Drive analysis determined required set.
- 10% of piles dynamically tested.
- 2 no. static tests. 8.6mm deflection at 150% working load (SWL 1350kN).
STEEL SECTION DRIVEN PILES

- Using our Junttan PM 20, we can drive steel piles up to 400 x 400mm or 406mm diameter.
- Longest pitched Length of 14m which can be extended by welding.
- Larger diameter and longer piles, can be installed using guide frames and crane suspended piling hammers.
- Better suited for bending moments and lateral loads.
• Kinsale Road Landfill, Cork.
• 140 no. 406*12mm Circular Hollow Sections.
• Driven up to 26.5m deep.
• 13m section driven with 12m section then welded on top and driven to set.
• Junttan PM20 used to drive the piles.
• Drive analysis determined required set.
• 10% of piles dynamically tested.
• 2 no. static tests. 4.5mm deflection at 150% working load (SWL 450kN).
TIMBER SECTION DRIVEN PILES

- Earliest material used for constructing piles.
- Easy to handle.
- Inexpensive where timber is plentiful.
- Can be subject to rot above the ground water level.
- Can be easily damaged during driving by boulders.
STEEL SHEET PILES

- Wide Range of Steel Sheet Piles
- Drive by High Frequency or Impact
- Guide Frame
- Crane Suspended Hammers

Combination Sheet Pile and Secant Pile wall for the drive shaft for Shell in the Corrib Tunnel Project.
SHEET PILES CASE STUDY

• Corrib Tunnel Reception and drive shafts for TBM.
• 600 no. 600mm wide sheet piles.
• Driven up to 14m long.
• Sumitomo 50T tracked crane used to drive and pitch piles.
COMBI-PILED WALLS

Combi-Piled Walls are a combination of steel bearing piles/Tubular Piles, with Sheet Pile Inserts. Typical Detail Shown Below;
PRE-TENDER ISSUES

• Receiving the right information.
  – Detailed borehole info. Rotary Cores, Levels, SPT values.
  – Pile Loadings, particularly on Secant & contiguous pile walls.
  – Exact Scope of the works.
  – Tolerances outside the code of practice, both position and level.
  – Communication between designer and piling contractor before design is finalised.
  – Contract Specific Specifications.
PRE TENDER ISSUES

Which detail is more robust?
Cluster of smaller piles? One single large pile?
THANK YOU

Any further questions or comments?