



PILE HELMETS

Techniques of Operation

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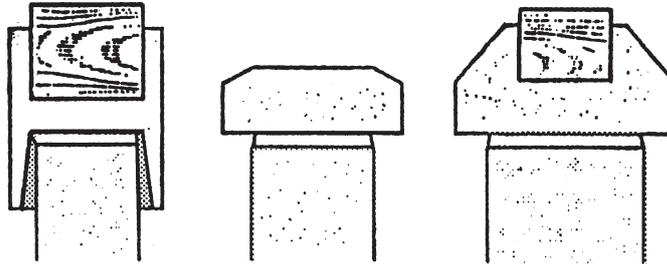
Choosing pile helmets

Pile helmets and striking plates should be applied to all piles and chosen to match them. They distribute the striking energy of the pile hammers evenly on the head of the pile and thus protect it as well as possible.

Pile helmet

Impact plate without dollie

Impact plate with dollie



Pile helmets guide pile head

Impact plates do not guide piles

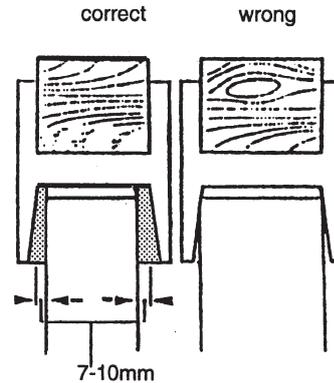
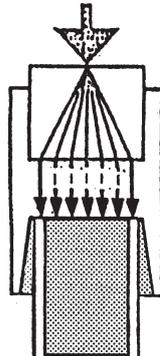
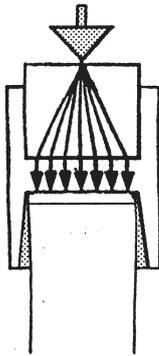
A Pile helmets

1. Choosing pile helmets

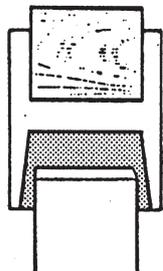
The pile helmet must correspond with the striking energy of the pilehammer and the size of the pile. For piles with a massive head cushion heads with a relatively thin vase can be applied, because it rests on the entire pile head surface and the impact load is distributed over the pile head on a wide basis.

Piles or pipes with a hollow head however require a pile helmet with a thick base. Since the pile helmet only rests on the edge surface of the pile, the striking load is also transmitted to only a small surface of the pile. Thus the pile helmet base must absorb considerably more impact load.

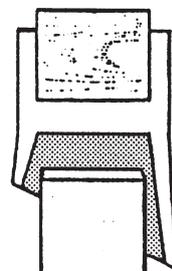
The pile should have a clearance of about 7 to 10 mm in the pile helmet all around, to assure sufficient free movement. If pile helmets fit too tight, damage to the pile head cannot be excluded when the pile point deviates from the driving direction and the pile head is clamped in the pile helmet.



Pile helmets with large bell-shaped openings facilitate loading of pile.



without bell-shaped opening

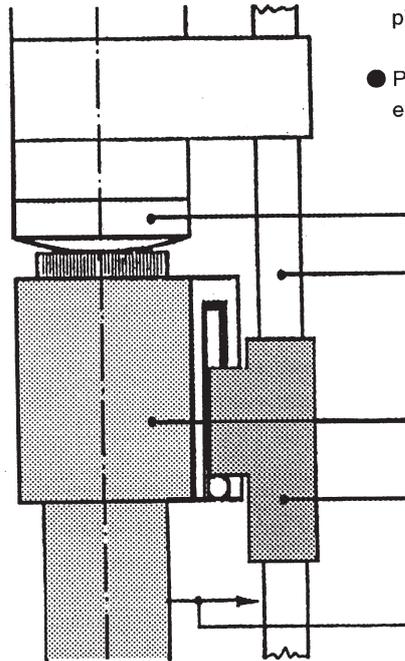


with bell-shaped opening

2.Guiding of pile helmets

Basically every pile helmet should be guided on the leaders. This will result in a number of safety factors which should not be underestimated.

- Prevents pile hammer from falling, because pile head cannot deviate from driving direction.
- Guides pile head exactly. Prevents lateral deviation of pile head.
- Assures constant distance between center of pile to leader guide throughout entire pile driving operation.
- Prevents offset impact loads as long as the distance from pile helmet to leader is matched with distance from pile hammer to leader.



to leader is matched with distance from pile hammer to leader.

- Protects pile head because of exact centering.

Pile hammer

Leader

Pile helmet

Guide for pile helmet

Distance from center of hammer to leader guide

Distance from center of pile to leader guide

2a Separating pile helmet and guide on leader

It is recommended to keep the guide for pile helmet on the leader separated from the pile helmet.

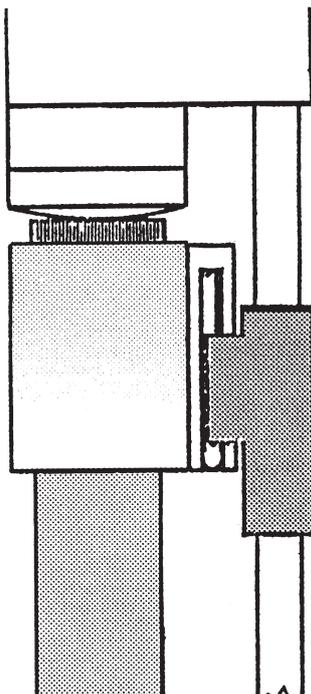
Avoid rigid connections if possible. Advantages:

- The pile helmet can be applied to any leader by exchanging the guide, and can be matched to any distance from center of hammer to leading

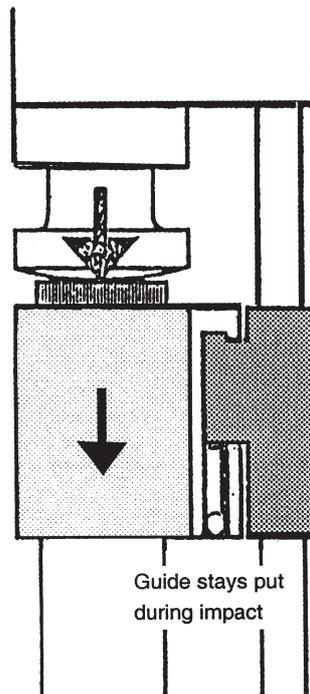
edge of leader guide.

- Guide does not accelerate with impact load, thus less damage on pile helmet.
- Guide can be replaced when worn.

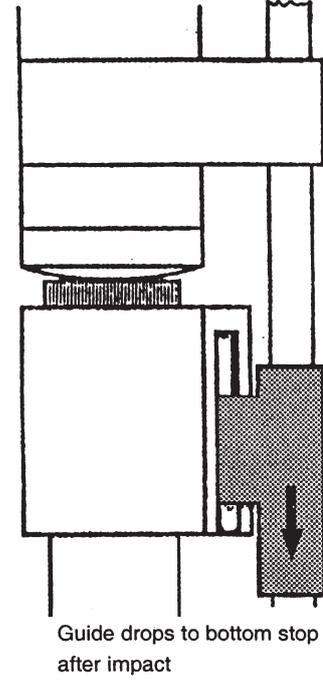
Before impact



During impact

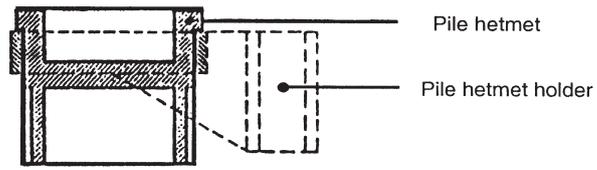


After impact

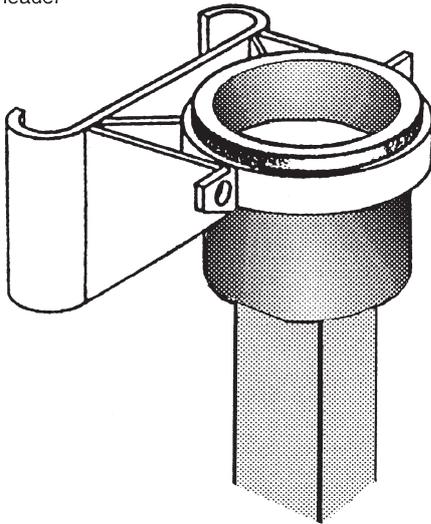


Pile helmet with holders on leader

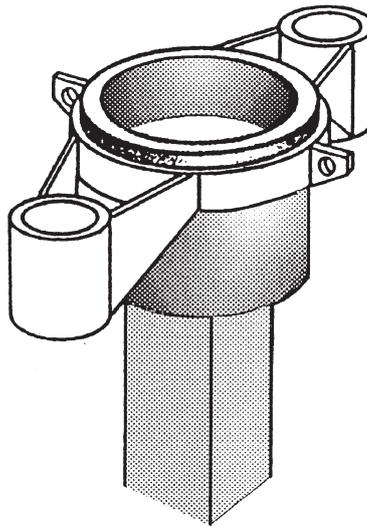
3. Pile helmet with holders on leader



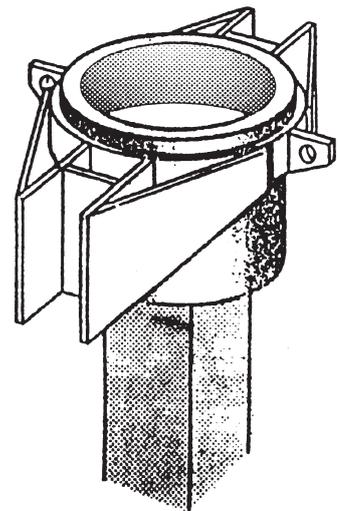
Holder for pile helmet in front of leader



Holder for pile helmet in Dutch frame



Holder for pile helmet in U-leader

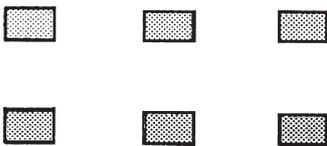


Design advantages

- One pile helmet holder can be used for different pile helmet sizes.
- The pile helmet holder is easy to adapt to different leaders.
- The pile helmet can be turned in its holder.

Disadvantages.

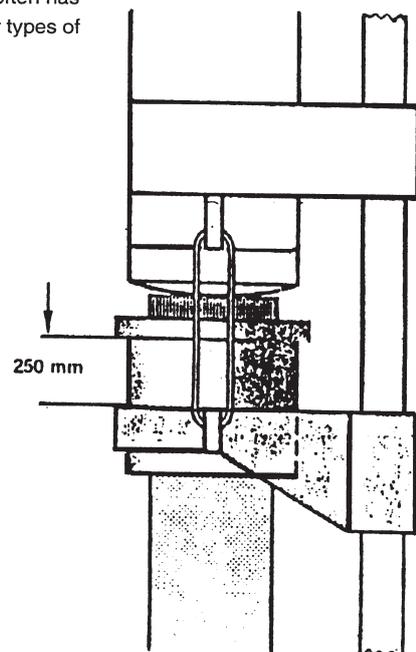
- The pile helmets and their holders are presently heavier than standard designs.
- If a square or rectangular pile should not turn while driving or should be pile driven in a certain position to the other piles, the pile must be guided with an additional pile guide.



- Clamping between the pile helmet and its holder cannot always be avoided, because the relationship between the inside diameter to the guides height is unfavorable.

- The distance from center of pile hammer to leader guide often has to be larger than for other types of pile helmets.

Pile helmet suspended on pile driver



Distance should be at least 250 mm so that pile helmet does not knock against pile helmet holder when pile penetrates fast.

4. Pile helmets with inserts

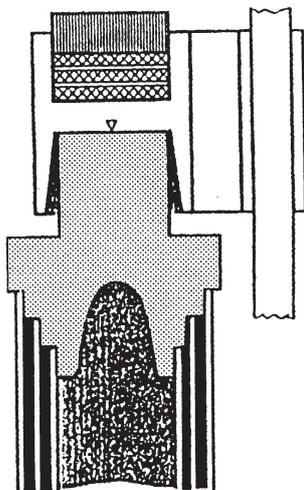
To be able to apply a pile helmet to different size of piles, inserts corresponding with the piles are placed in the pile helmet.

It is absolutely essential to machine the bottom surface of the pile helmet

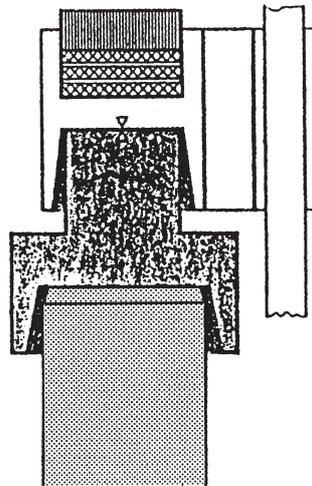
base and the top surface of the insert, when using these together. If these surfaces have just slight imperfections, the pile helmet will crack after just a short period of time.

The degree of impact and thus the amount of energy transmitted to the pile per impact blow is less for pile helmet with inserts than for those without inserts. Insert for piles Insert for sheetpiles

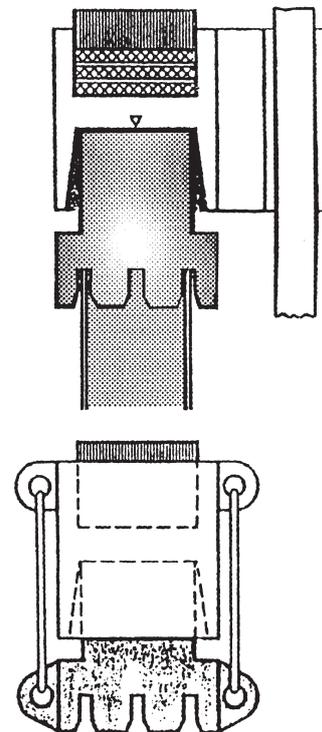
Stepped insert for different pipe diameters



Insert for piles



Insert for sheetpiles

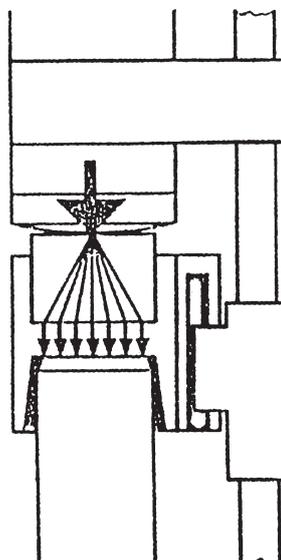


Suspend the insert with cables as close to the pile helmet as possible, so that first of all it is located in the pile helmet properly and secondly the insert cannot fall out.

5. Dollies

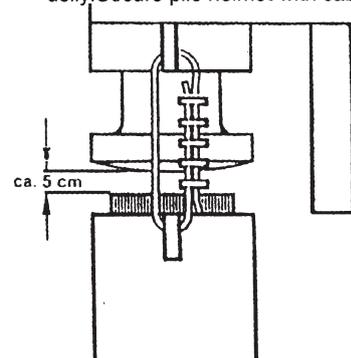
Dollies between the pile hammer and pile helmet will produce the following effects separately or mutually.

- Absorbance of impact force for sensitive piles.
- Protection of piles on hard ground.
- As even as possible distribution and transmission of forces through the dollies to the pile helmet and pile.
- Extension of impact time through storage of impact energy in dolly.
- Extension of pile helmets service life.



Installing pile helmet on pile hammer

Place pile helmet on ground. Lower pile hammer with impact block run out, until the impact block is about 5cm above dolly. Secure pile helmet with cables.

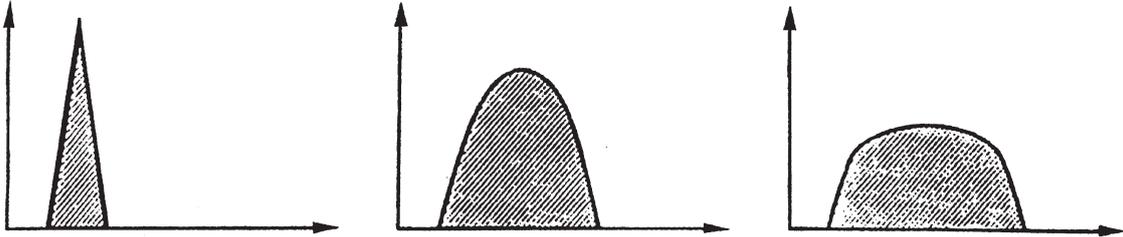


Impact Force and impact Time for Various Pile helmet Dollies

very hard, hardly resilient

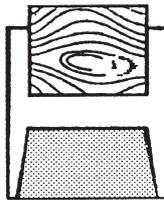
Medium hard and resilient

Soft and very resilient



5a. Wooden Dolly

Appropriate for light to medium piling. Replace as soon as destruction is evident or when they start to smoke and burn. If not, very much of the impact energy will be absorbed.

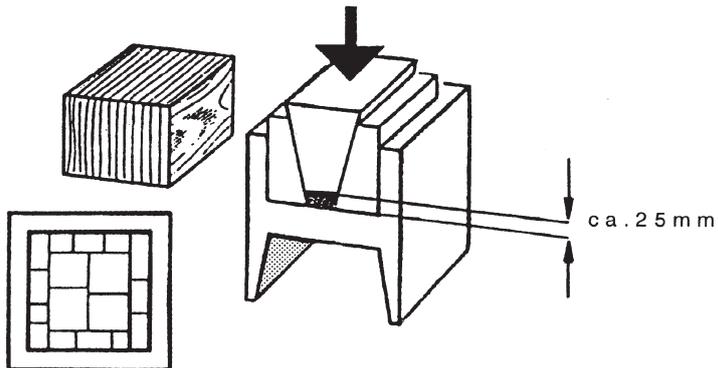


Material

Bongossi wood, also called assombe.
Oak rootwood.
Beech rootwood or similar types of wood

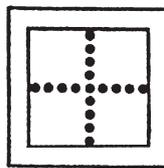
Installation

Install wood with evident grain, so that the grain direction is vertical. Wood is harder in the direction of grain, is less resilient and will withstand the impact forces longer. The simplest and best solution is a three-piece dolly cut in wedges (see illustration). It is forced into the pile helmet in one direction, fits tight and holds long. If only small pieces of wood are available, the larger pieces are placed in the middle, the smaller ones are used to brace.



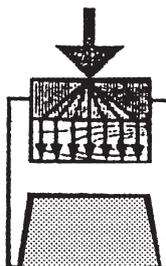
Removal

Either drill holes in cushion according to illustration and chisel out rest, or knock out pieces through openings on sides of cushion head to relieve tension on wood. Then chisel out cushion from above.



5b Wooden Dolly with steel Plate

For medium to heavy pile driving. These dollies are harder than our wooden dollies. They last longer because the steel plate spreads the impact load over the entire dolly surface. However their life is not as long as cushions made of plastic, resin-bonded fabrics or steel cable.



Material

Wood

Bongossi wood, also assombe. Oak rootwood Beech rootwood, or similar types of wood.

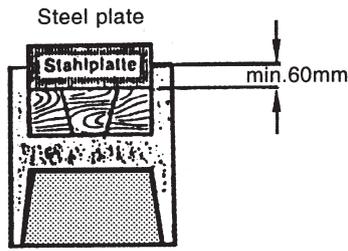
Steel Plate

(see page 6)

Installation

Install wooden dollies as described on page 5

Choose width and length or diameter of steel plate so that it fits in the pile helmet without force.

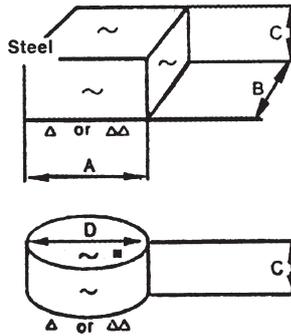


Removal

Lift steel plate and chisel out wooden dolly as described on page 5

5c Steel Plate

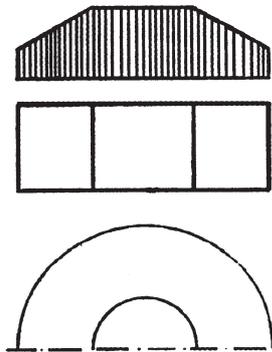
Steel 37.11:50.3 is better. Its beating surfaces must be machined. It should fit at least 60 mm deep in pile helmet.



Wide steel plates or such with large diameters are made up according to the illustrations. In spite of their large size they are not likely to break, because the material thins out toward the circumference and thus loads here are weaker.

Steel Plate Thickness

Impact Energy per blow	Width x Length A x B	Dia. D	Thickness C
up to 3500mkg	400 x 400	to 420	100
up to 10000mkg	550 x 550	to 600	160
up to 15000mkg	max.500 x max.800	to 800	200
up to 20000mkg	max.600 x max.1200	to 1310	300



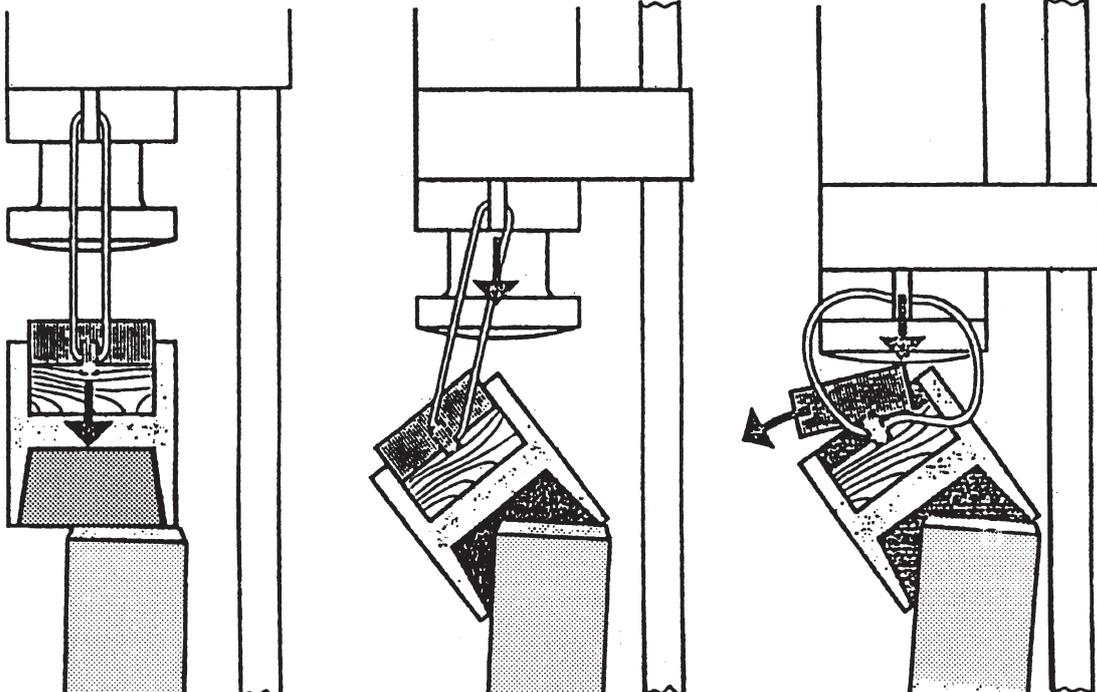
Securing Steel Plate

If a steel plate is used to cover a wooden or plastic dolly, measures must be introduced to prevent it from falling out of the pile helmet.

This could happen when the pile helmet is not guided on the leader. When lowering the pile helmet, its edge could hit a pile and it will then tip forward or sideward.

The hammer, which is applied to the

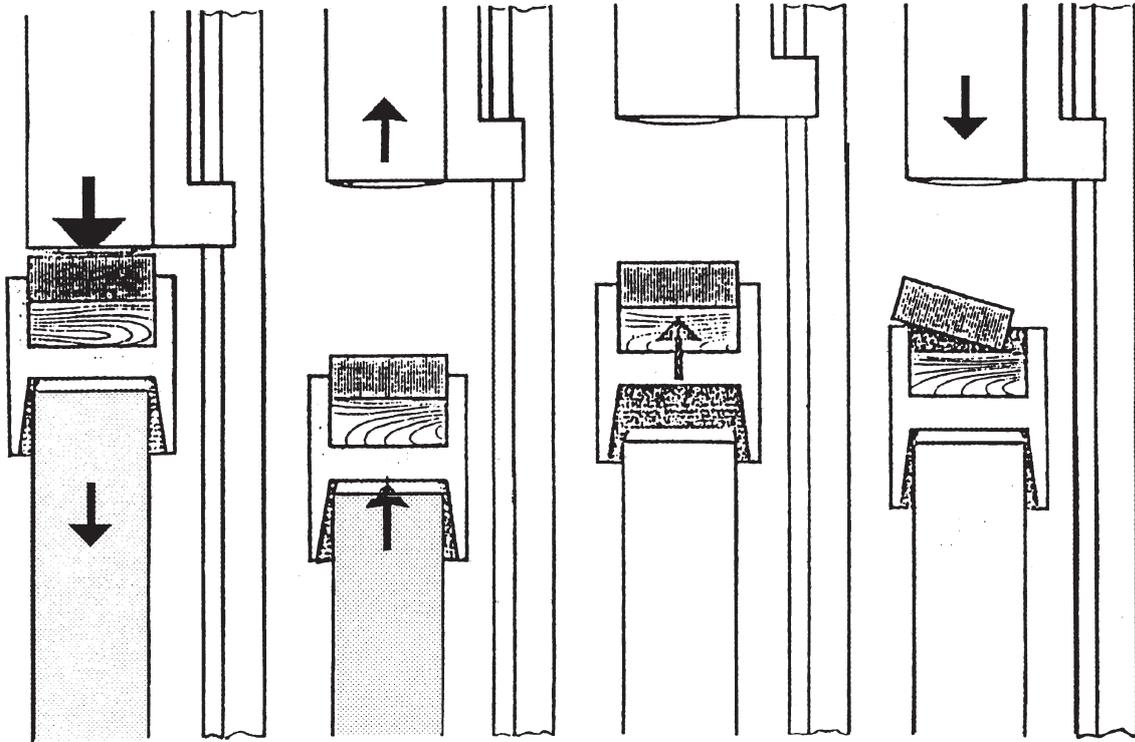
inclined steel plate, could tilt the plate and cause it to fall down.



When using free falling or hydraulic pile hammers on very resilient piles and ground, the hammer could lift

off of the pile helmet before the pile has resiliated. The resiliating pile will knock up the pile helmet, tilting

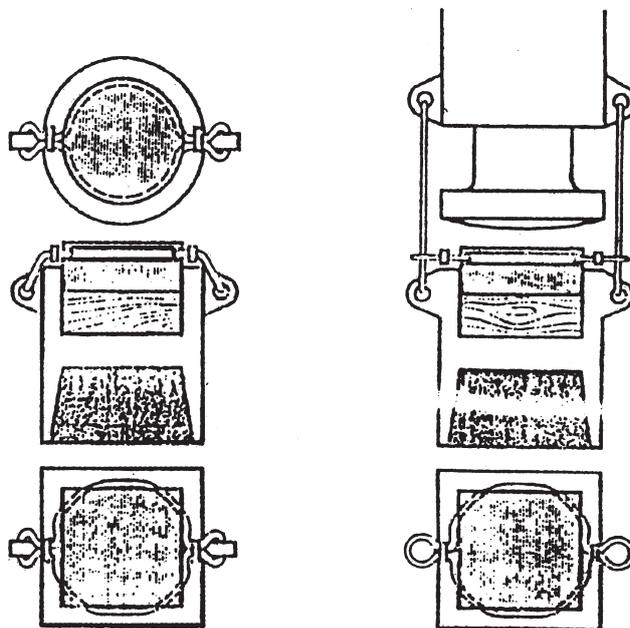
it off of the pile. When falling back it could knock out the steel plate.



The steel plate is secured either direct to the pile helmet or via the retaining cables, with which the pile helmet is suspended on the pile hammer and remains connected during the entire pile driving operation.

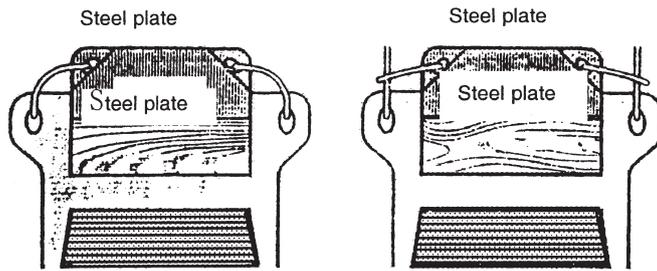
Place a steel cable in the steel plate's machined groove and pull it through the eyelets of the pile helmet. Tighten the steel cable with cable clamps until it fits tight in the steel plate's groove.

Place steel cable in steel plate's machined groove and connect with cable clamps to produce two eyelets on both sides. However cable must fit tight in steel plate's groove. The retaining cable connecting the pile helmet with the pile hammer is then pulled through the eyelets.



If the steel plates are cast, it is recommended to cast two eyelets too. Don't weld eyelets. The welding seams would break after just a short period of time due to the extraordinary impact force.

Steel plate Steel plate



5d Plastic or Resin Bonded Fabric Dollies

For medium to heavy pile driving. These dollies are less resilient than wood and thus have better degrees of impact. However both pile helmet and piles are subjected to higher loads.

Material

Plastic Plates

Polyamide (nylon), known under brands Sustamid Plus, Endura. Green Makrolon, Lesan. Ultramid, Durethan Resin Bonded Fabric Plates Novotes Resitex or similar

For light to medium pile driving the fabric used in bonded fabric dollies can be wool or cotton. For heavy pile driving sandwiched asbestos is best. Asbestos absorbs much heat and will not burn. Metal inserts will improve the strength and carry off heat.

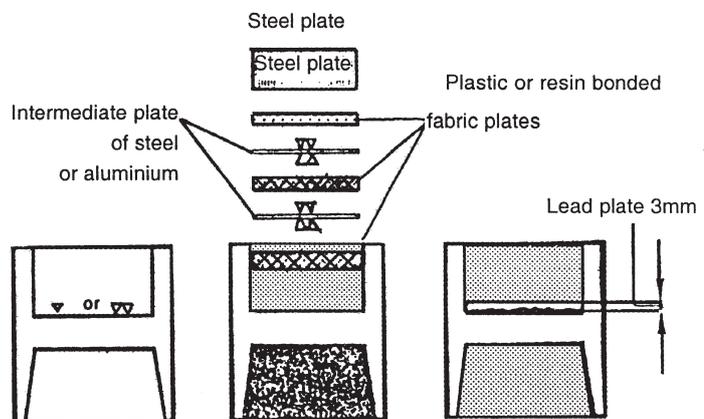
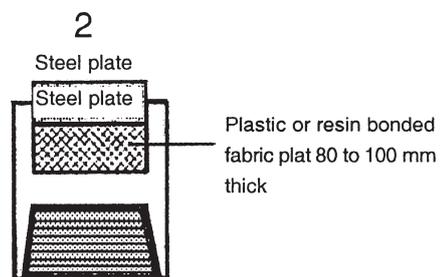
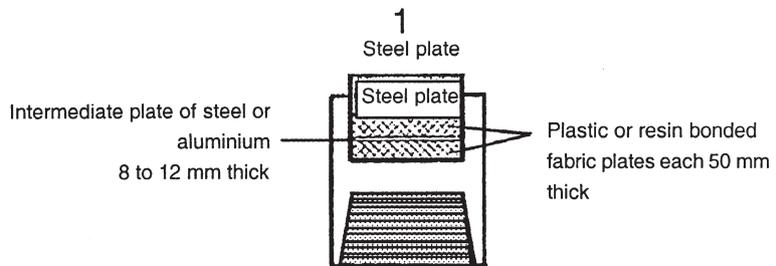
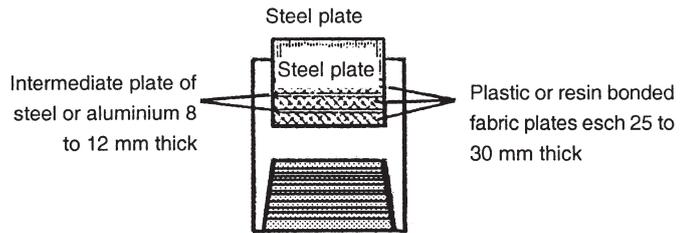
Design

Plastic dollies always require steel plate and depending on design intermediate plates of steel or aluminum.

The assembly of illustration 1 is very favorable. The heat is carried off sufficiently and expenses are relatively low as well. Of the examples illustrated, illustration 1 shows the most resilience, illustration 2 the least.

Important! The base of the pile helmet, as also the surfaces of the steel plate and intermediate plates, must be machined to prevent the plastic plates from breaking during the first impact blows. Broden plates disintegrate quickly and destroy very much impact energy. If it is not possible to machine the cushion head's base, place a 3 mm thick lead plate between the base and the first plastic plate.

The lead will compensate the roughness of the base during the first impact loads and as an excellent bearing surface for the plastic plates on top.

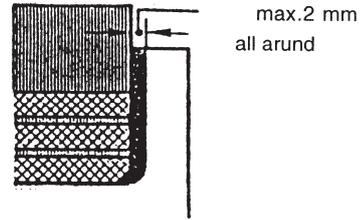


Dolly between pile head and pile helmet

Usually the corners between the base and walls of the pile helmet are rounded. The edges of the bottom plastic plate must be chamfered, so that it rests flat.

Produce the separate plates for the dolly so that they can be inserted in the pile helmet without force.

Secure the steel plate as described on pages 6 through 8



5e Steel Cable dollies

Appropriate for medium to heavy pile driving. These dollies have an extraordinary long service life, but are also very hard - especially if compact cables are used. The degree of impact is strong, the resilience weak. Both pile helmets and piles are subjected to heavy forces.

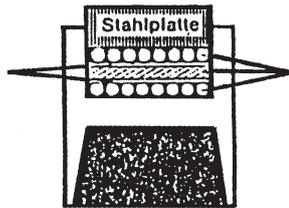
Design

Steel cable dollies always require a steel plate as well as intermediate plates of steel. The plates need not be machined; it is sufficient that they be flat. Place first layer of cable pieces in one direction, second layer in cross direction and third layer same as first layer. See illustration for layers of dolly.

Material

Pieces of steel cable 25 to 30 mm in diameter. Don't cut pieces of steel cable with a cable cutters, but instead with a welding torch to prevent the ends from unwinding. Pieces of steel cable with a hemp core will initially be more resilient than those with a steel core. Cut steel cables to lengths which will fit in the pile helmet without binding.

Intermediate plate of steel 12 mm thick



steel plate Steel cable pieces 25 to 30 mm dia.

6. Dolly between Pile Head and Pile Helmet

Concrete piles and other similarly sensitive piles can only be driven if a cushion is placed between the pile head and the pile helmet. This will assure that

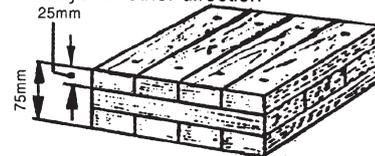
- the roughness of the pile helmet base and the pile head is compensated,
- the impact forces are transmitted evenly through the pile head into the pile.
- the impact peak forces are eliminated, the impact time extended and
- the pile head is protected and not destroyed.

Best experience has been made with dry fir or spruce wood. Important! The wood's grain must always run horizontally. The result is

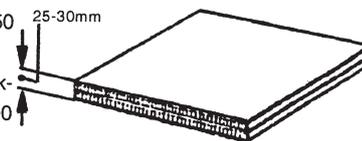
- better resilience,
 - better and quicker adaptation of cushion to pile head and pile helmet base.
 - faster elimination of impact peak forces,
 - extension of impact time and protection of pile head.
- Depending on ground conditions, soft or hard, and total driving time, short or long, the thickness of the cushions varies between 50 and 150 mm. Soft or hard, and total driving time, the thickness Hard ground and long driving time 100 to 150 mm cushion thickness.

Design

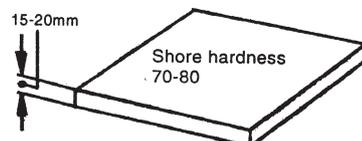
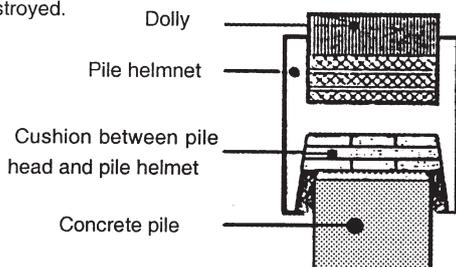
Alternately one layer in one direction and one layer in other direction



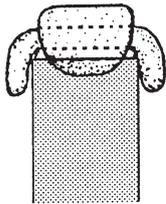
Soft plywood can also be used as a dolly for prefabricated concrete piles in soft ground and with short driving times. However, the dolly should be at least 25 to 30mm thick



Dollies made of natural or synthetic rubber have also proven themselves for operations which are not too heavy. But they are considerably more expensive than wooden dollies.

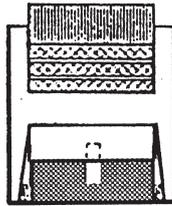


Paper bags or plastic sacks filled with wood wool are also excellent dollies. Place two filled sacks across each other and then place in pile helmet. The bottom pile helmet opening must however be chosen larger than usual, so that the sacks have enough room on the sides. The sacks are pressed together.



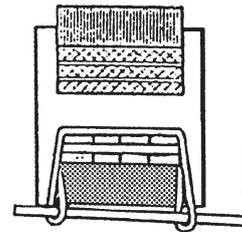
Securing Cushion Plates in Pile helmet

The plates used as a dolly must be cut large enough that they have a slight press fit in the bottom opening and still are flat against the pile helmets base when the pile helmet is placed on the pile. Dollies will tilt if they do not have a slight press fit in the pile helmet opening.



Removal

Experience shows that the following solution is best. Insert a cable loop, as illustrated, when installing the dolly. After driving a pile, place a steel rod through both loops and then pull down on rod. The tight fitting dolly can be removed easily. A cable can be used for many dollies.



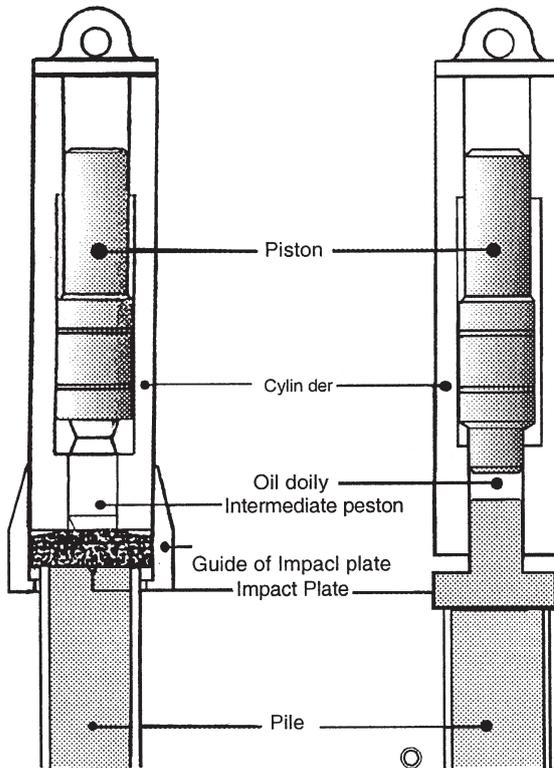
Ca. 6mm dia. steel cable loop

Impact plates

Impact plates are mainly applied to rapid stroke pile hammers and false leaders.

1. Impact plates for quick acting pile hammers

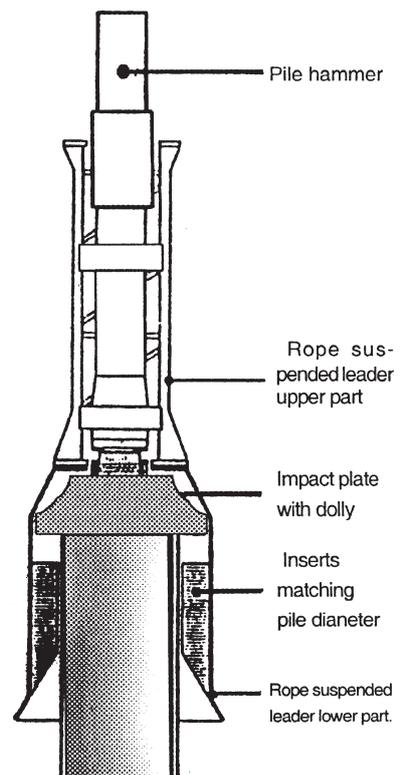
The impact plate for quick action pile hammers has no dolly. Usually transmitted from the piston via an intermediate piston and the anvil to the pile. The anvil is held in location by an anvil guide. In some special cases the impact is transmitted to the anvil via an oil cushion. The neck of the anvil is located in a cylinder, like a piston, and also serves as an oil seal.



e. g I or  or

2. Impact plates for rope suspended leaders

Steel on steel cannot be driven with these impact plates because of the large forces per impact blow which have to be transmitted to the pile via the anvil. The same cushions are used as those for pile helmets. The shape and sizes must match the pile size and force per impact blow of the pile hammer. Installation of dolly and securing of steel plate as described on pages 6 through 9.



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