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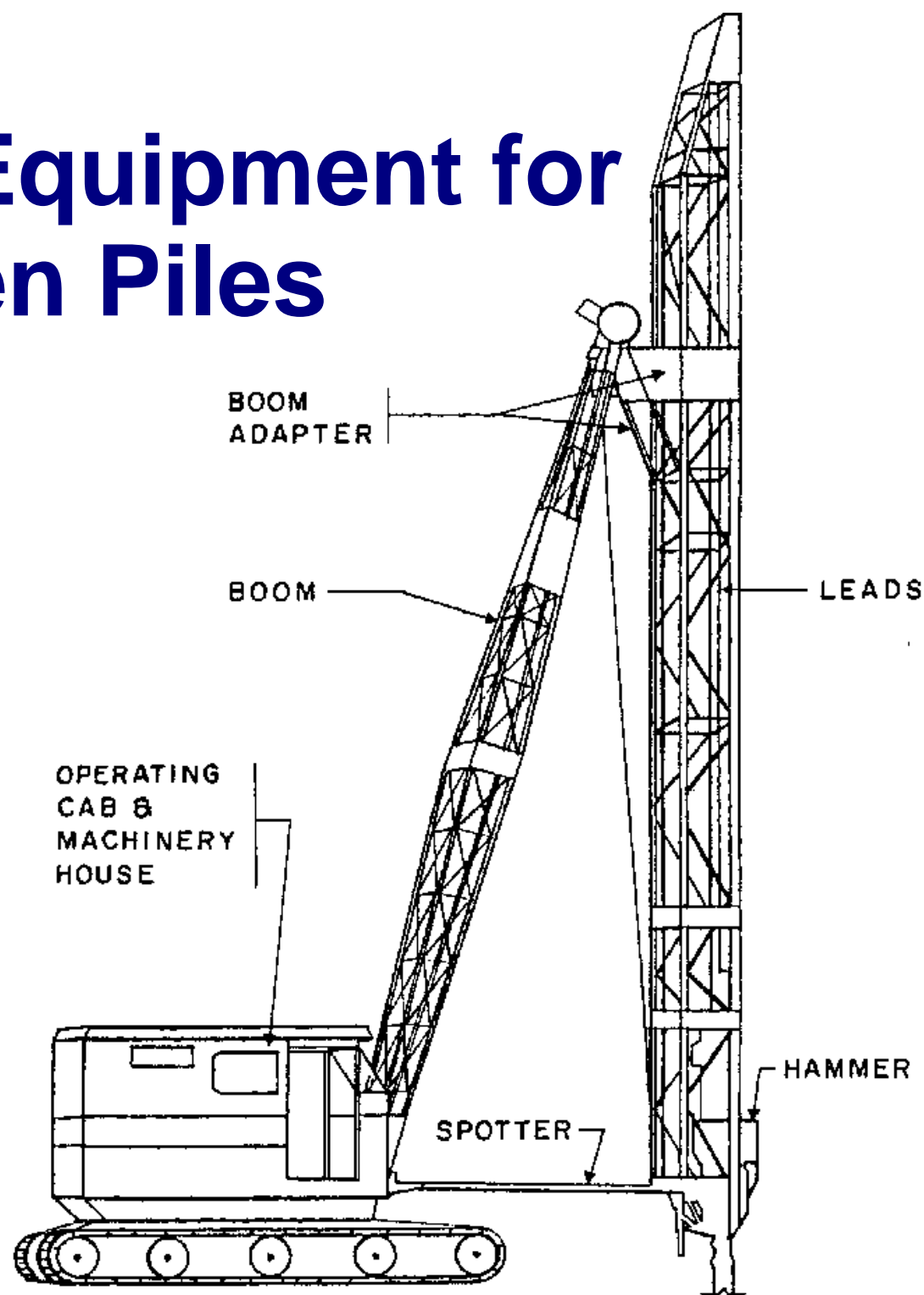
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# Installation Equipment for Driven Piles

- Pile Driving Rigs
- Pile Hammers
- Hammer Accessories
  - Leaders
  - Cushion Material
- Predrilling, Jetting and Spudding

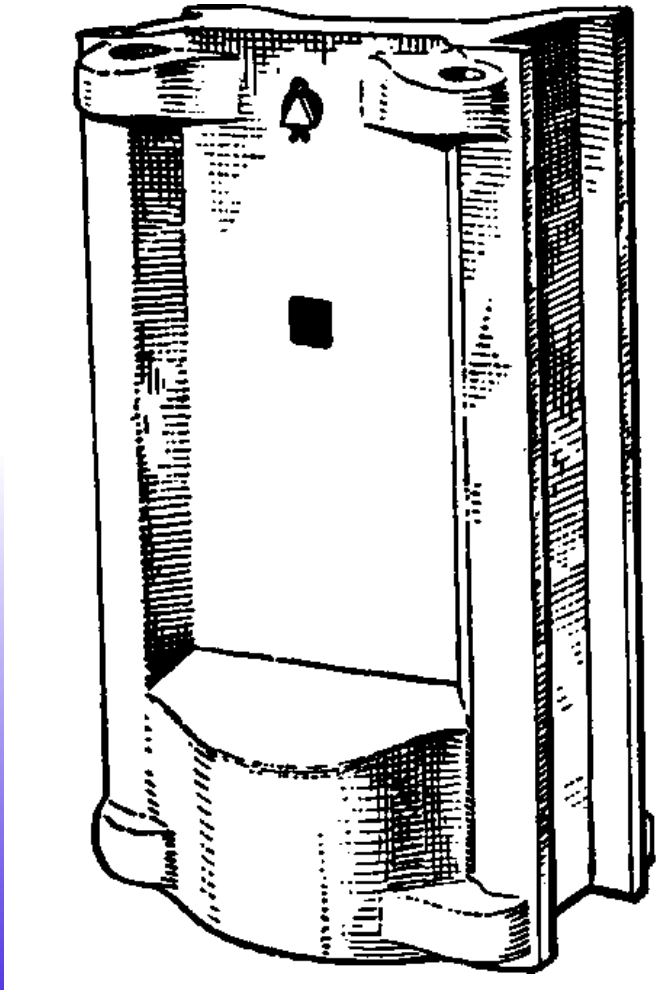


# Pile Hammers

- Impact Hammers
  - Drop Hammers
  - Air/Steam Hammers
  - Diesel Hammers
  - Hydraulic Hammers
- Vibratory Hammers
- Pile Jacking Devices



# Drop Hammers



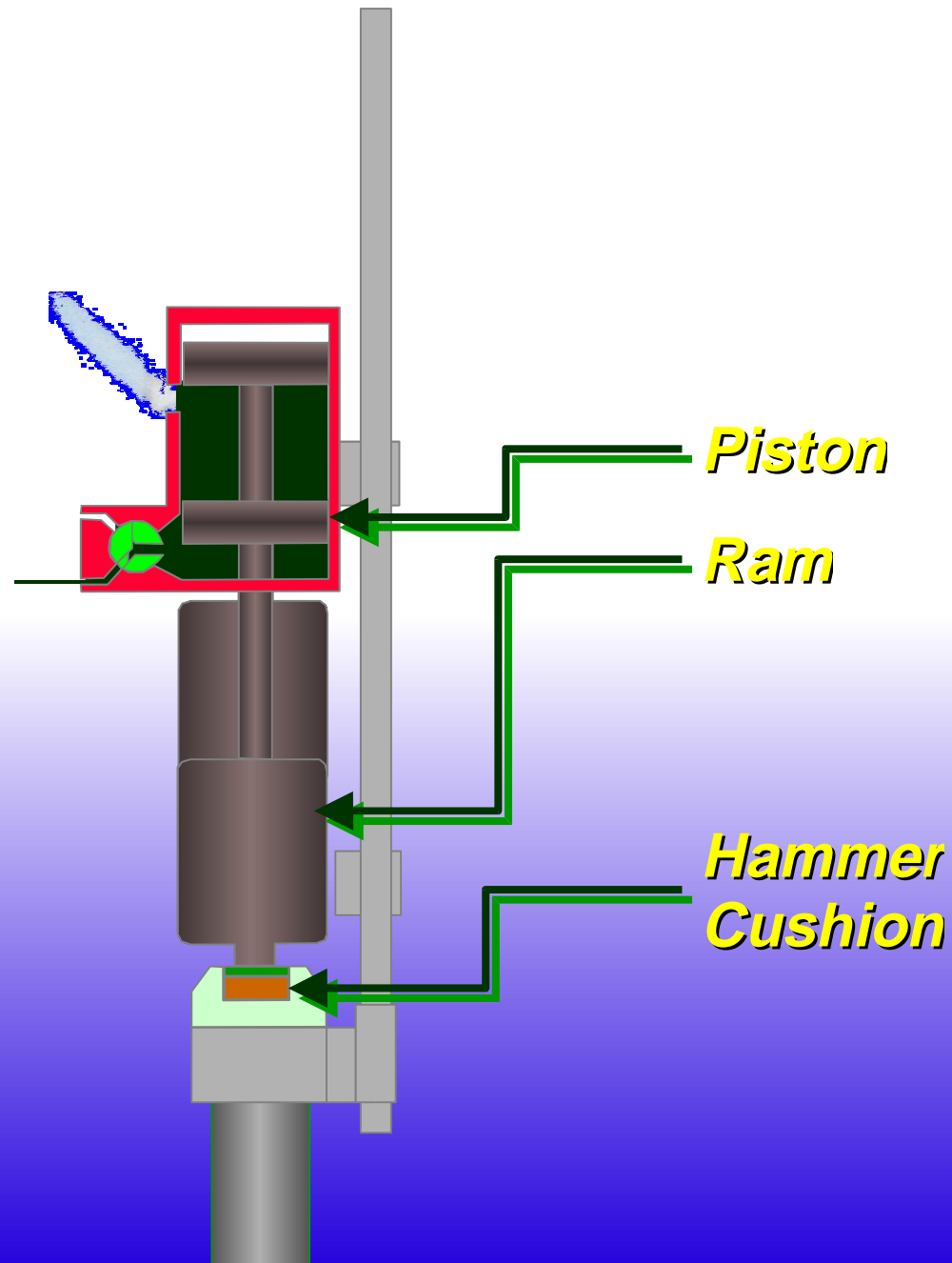
- Oldest type of hammer in use
- Simply raised by the crane and released to impact the pile top
- A very simple hammer, yet slow and efficiency is inconsistent

# Air/Steam Hammers



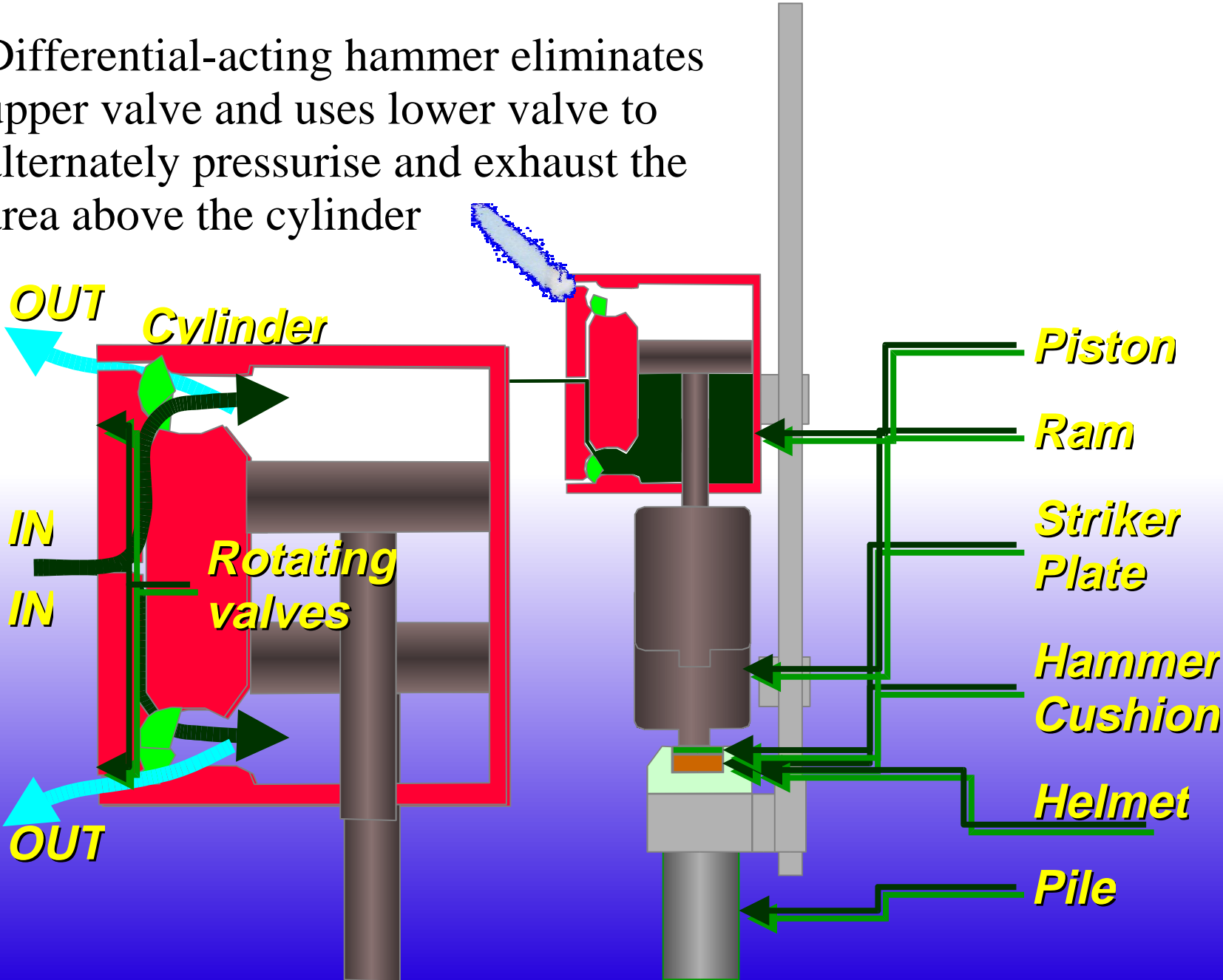
- In use since the nineteenth century
- Hammers are simple; require little maintenance and are of long duration
- Efficiency also variable due to age of hammers and conditions of operation
- Hammers can be single, double or differential acting

# Single Acting Air/Steam Cycle



# Double-acting air/steam hammer cycle up-stroke

Differential-acting hammer eliminates upper valve and uses lower valve to alternately pressurise and exhaust the area above the cylinder



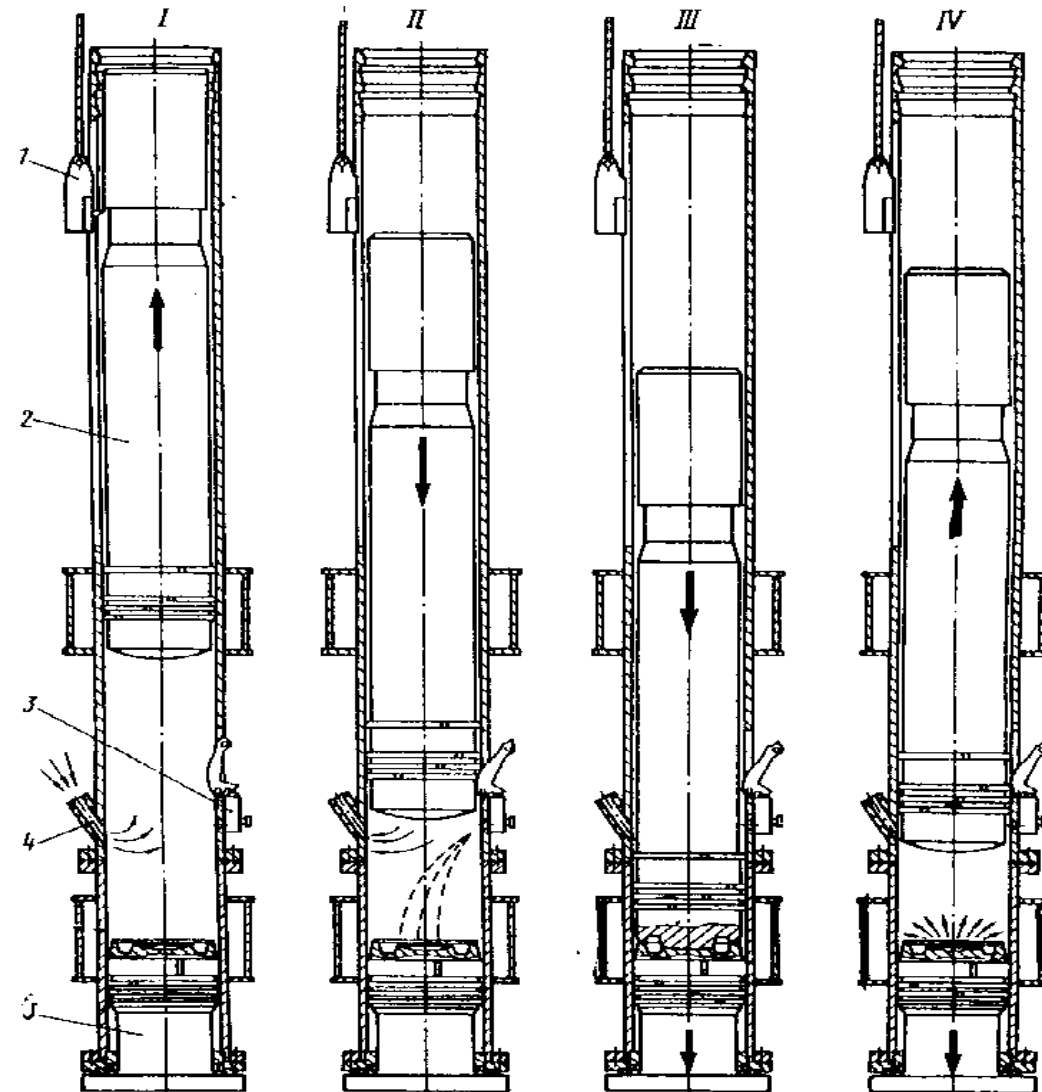
# Diesel Hammers

- Developed in Germany between the two World Wars
- Does not require an external power source; usually light
- Can also be single-acting or double-acting



# Operating Cycle of Diesel Hammers

- I. Upstroke or starting of the hammer with starting device (crab)
- II. Lowering of ram; injection of fuel
- III. Combustion at bottom of stroke
- IV. Fuel ignition and upward lifting of ram



# **Diesel Hammer Cycle - I**

## **Injection of Fuel and Compression**

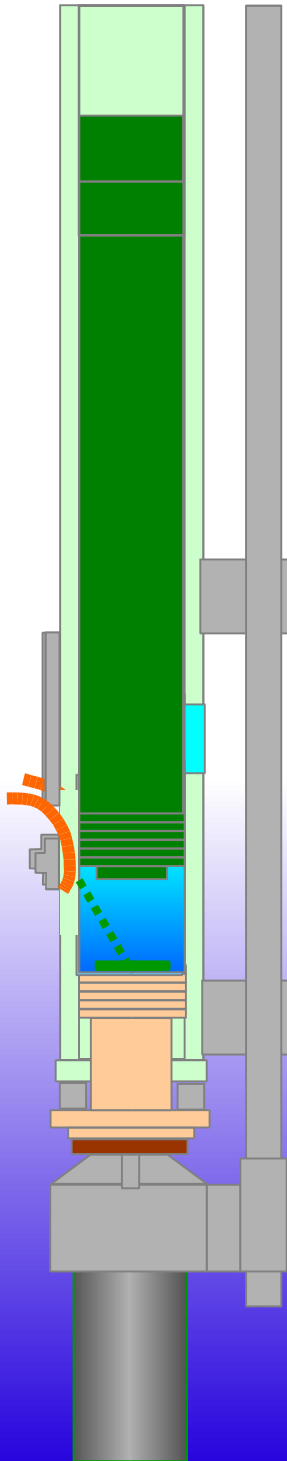
***Piston falls under gravity***

***Inlet port closes as piston descends***

***Air in chamber is compressed***

***Piston triggers fuel injection***

***Air in chamber is further compressed***



## **Diesel Hammer Cycle - 2 Impact and Combustion**

***Pressure and temperature in the chamber become critical***

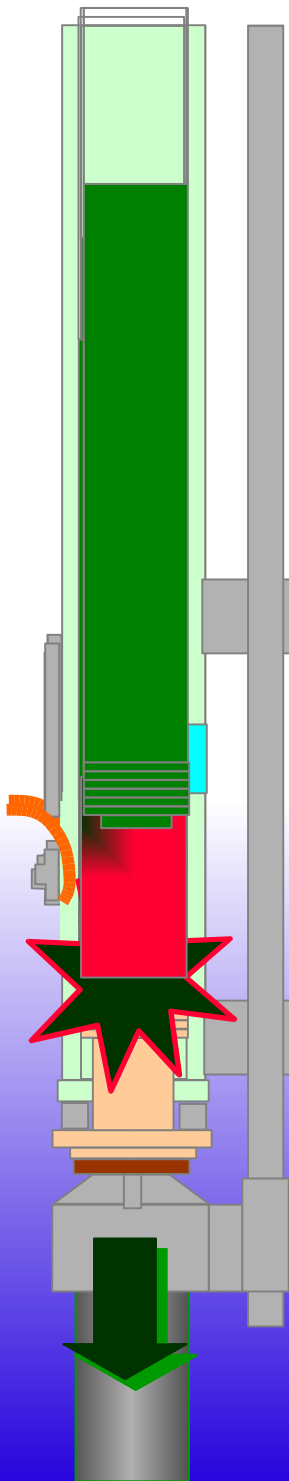
***The diesel fuel combusts***

***Piston [strikes ] impact block***

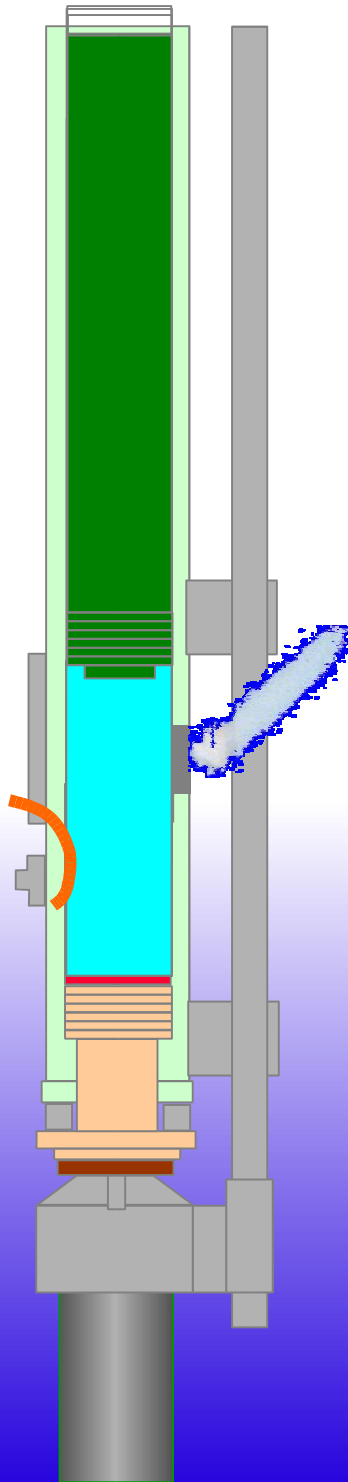
***The impact sends a stress -wave into the pile***

***The combustion also sends a stress-wave into the pile***

***The expanding gases accelerate the piston upward***



## **Diesel Hammer Cycle - 3 Exhaust and Scavenging**



***The piston rises above the exhaust port***

***The exhaust port opens and exhaust gases vent***

***The piston continues to rise decelerating under gravity***

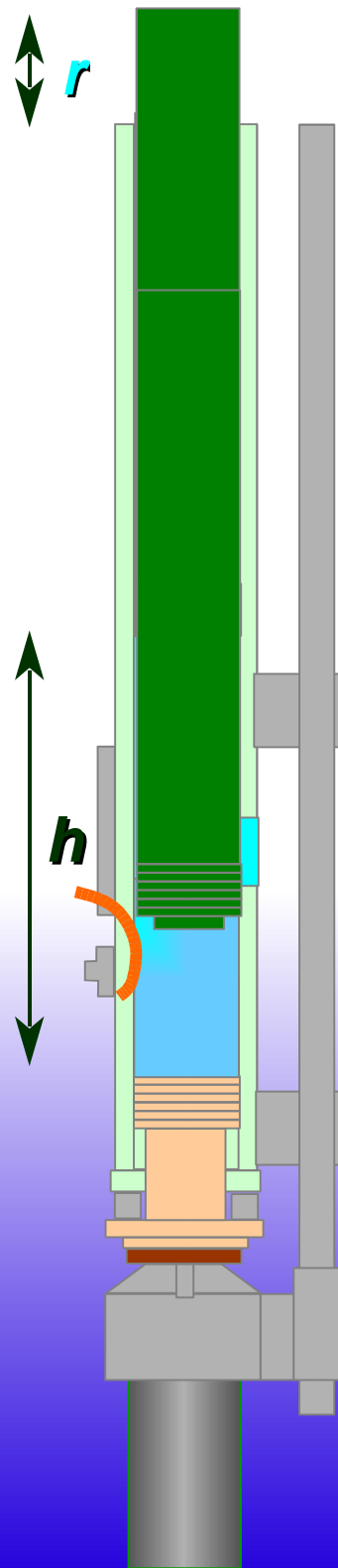
***The rising piston draws in fresh air***

## Diesel Hammer Cycle - 4 Completion - Gravity Effect

*The piston reaches its maximum stroke.*

*Stroke height is assessed by the distance the piston rises above the cylinder or by a **Saximeter**.*

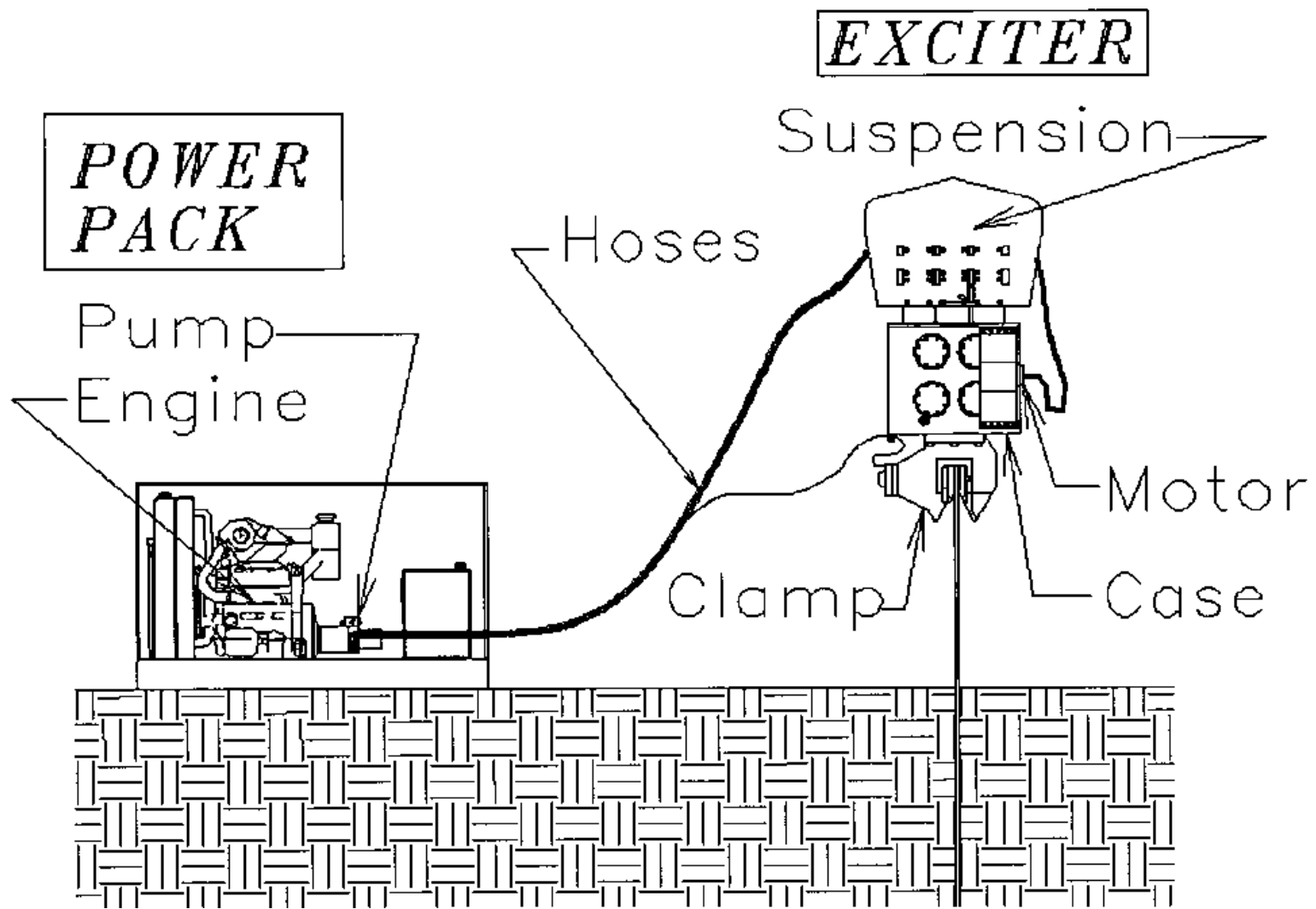
*The piston descends under gravity, and the cycle repeats*



# Hydraulic Hammers

- Newest type of impact hammer
- Uses hydraulic fluid to move the ram up and down
- Usually has some kind of downward assist
- Incorporate energy and blow rate control, along with data recording

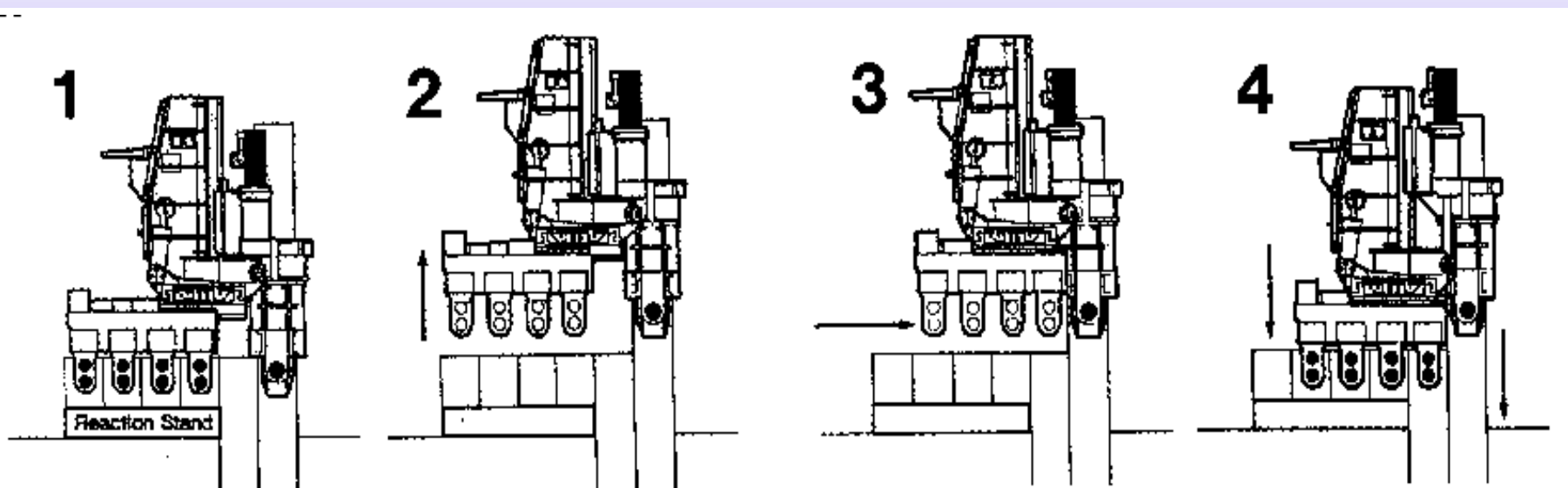




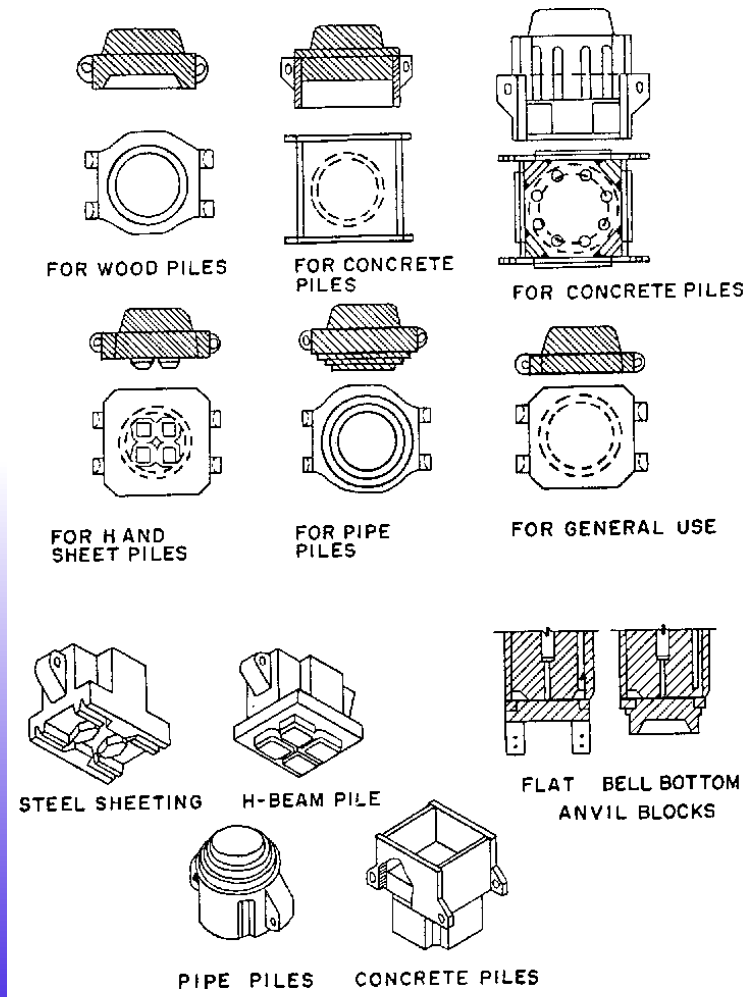
# Vibratory Hammers

# Pile Jacking Device

- Installs piling by pushing them into the soil, not impact
- Useful in situations where vibrations cannot be tolerated

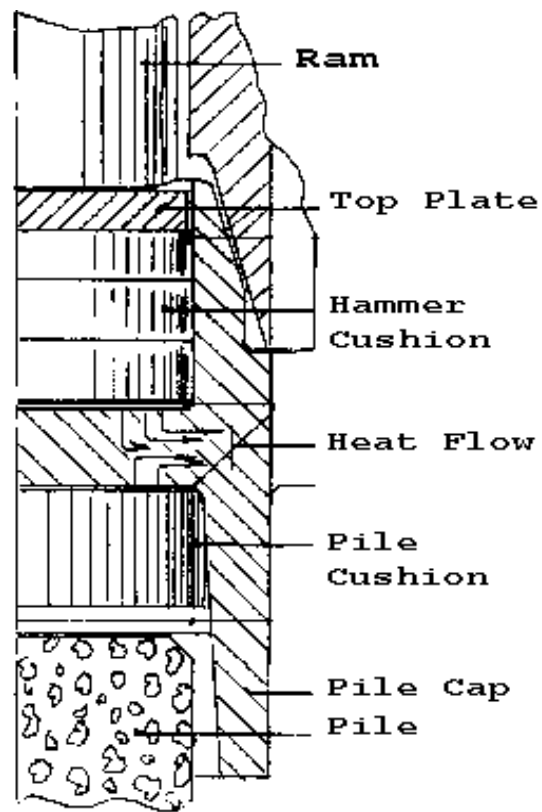


# Driving Accessories

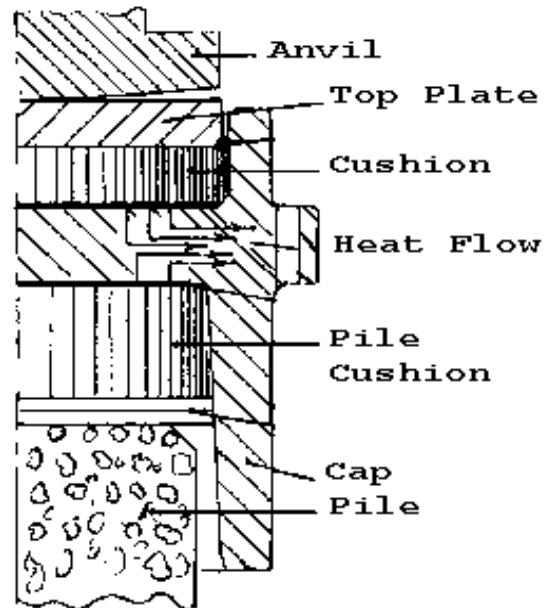


- Drive Caps
- Mate the hammer to the pile
- Hold the cushion material in place
- Weight of the cap influences the energy transmission from the hammer to the pile

# Cushion Material



Air-Steam Hammers  
Integral Ring

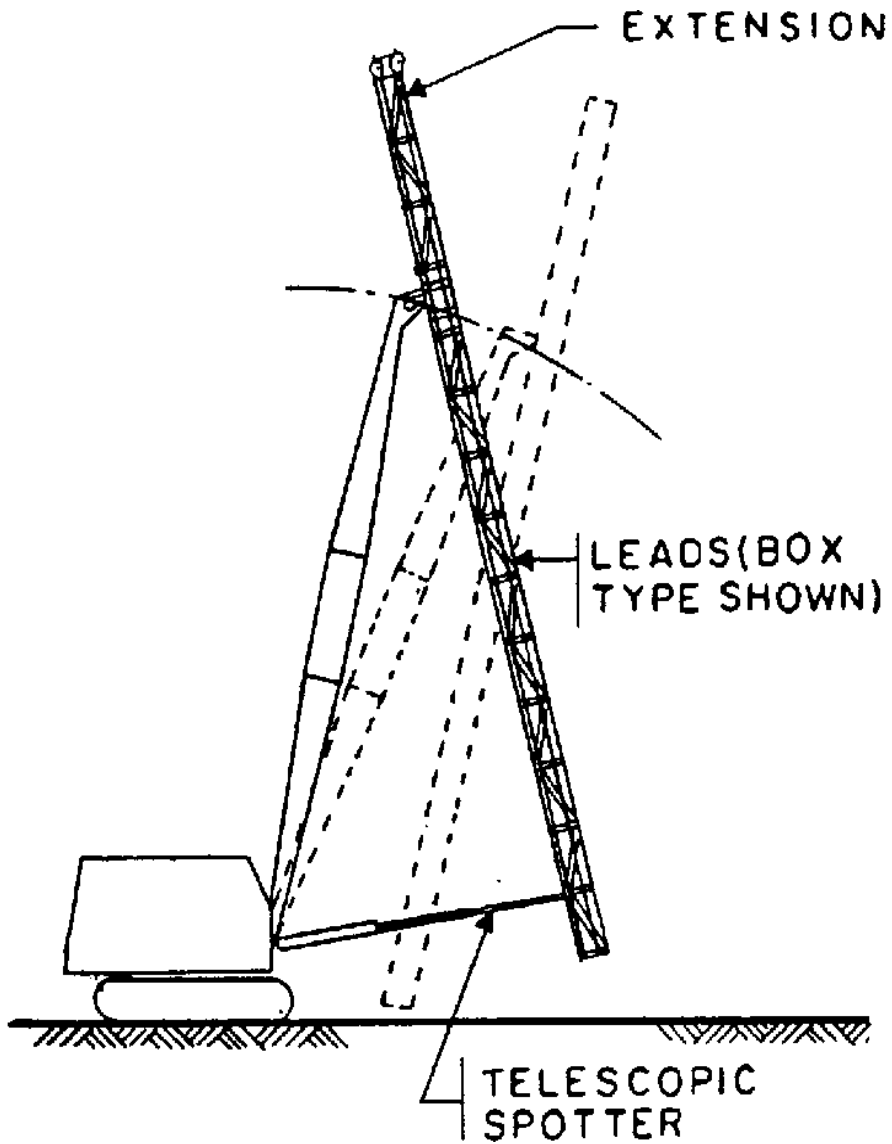


Diesel Hammers

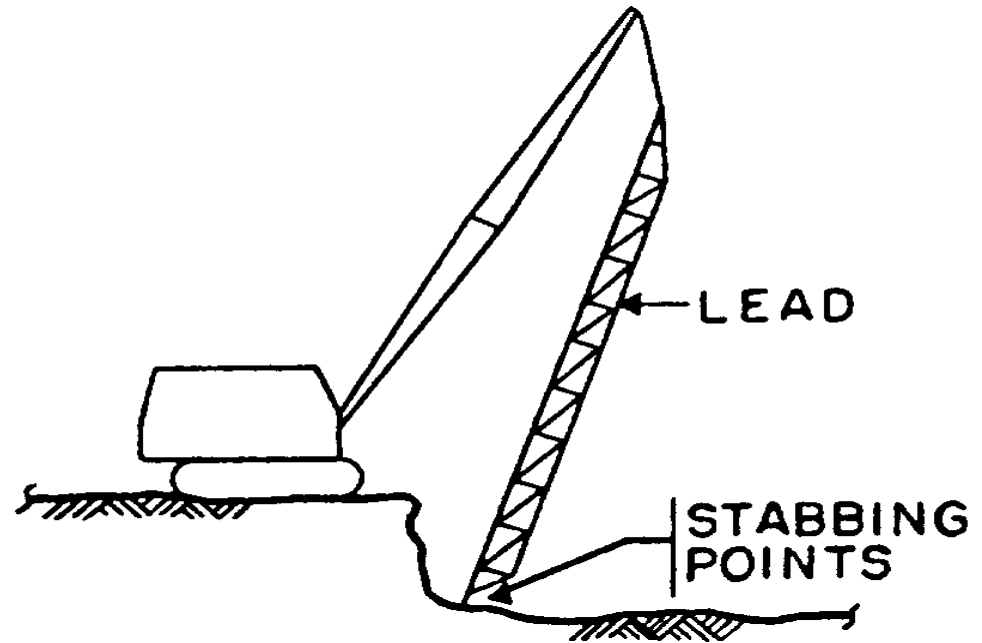
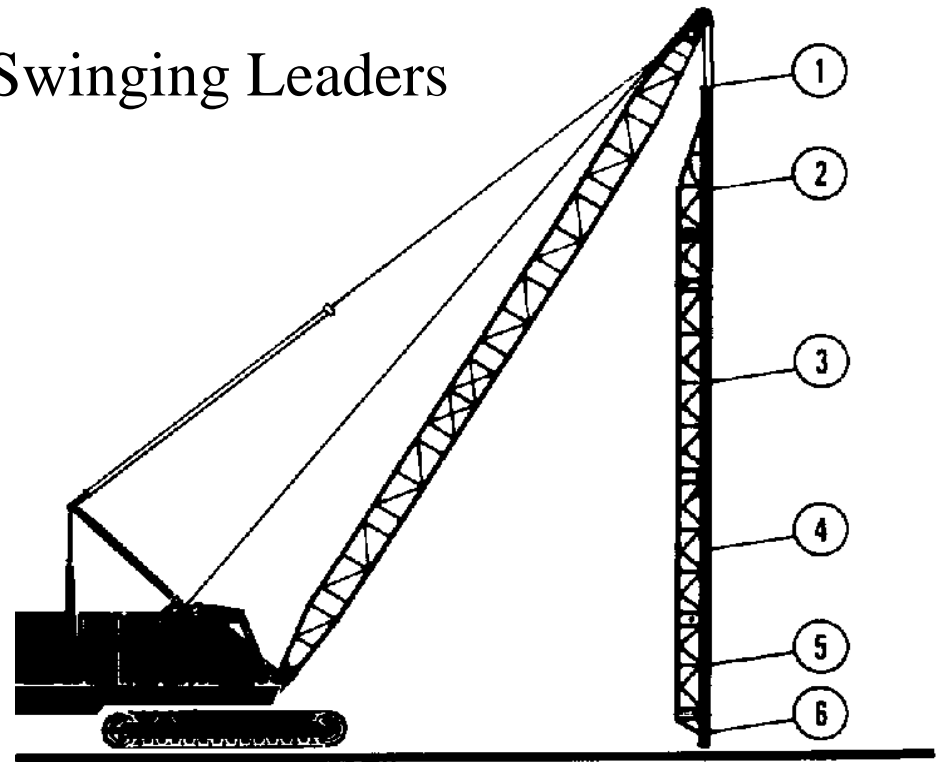
- Hammer Cushion
  - Protects the hammer and modulates the blow
  - Usually struck via a top plate above
- Pile Cushion
  - Used only with concrete piles
  - Protects the pile from cracking and spalling

# Leaders

Fixed Leaders



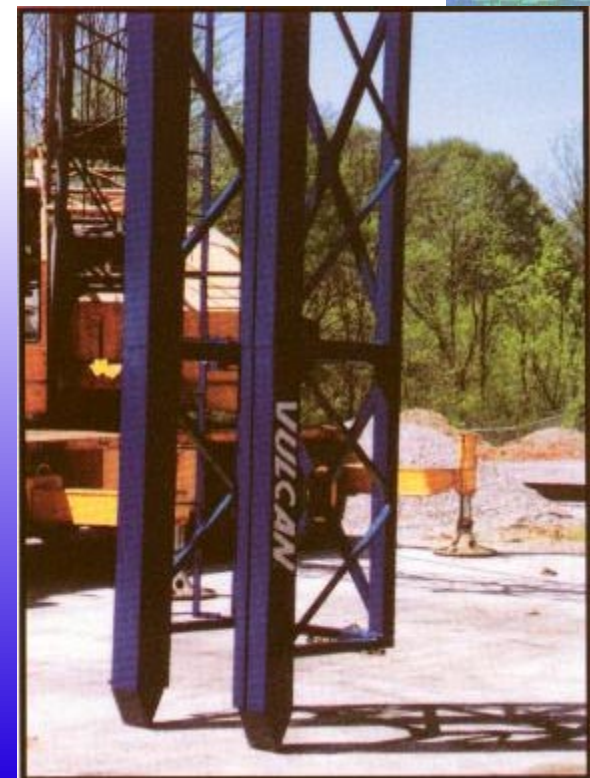
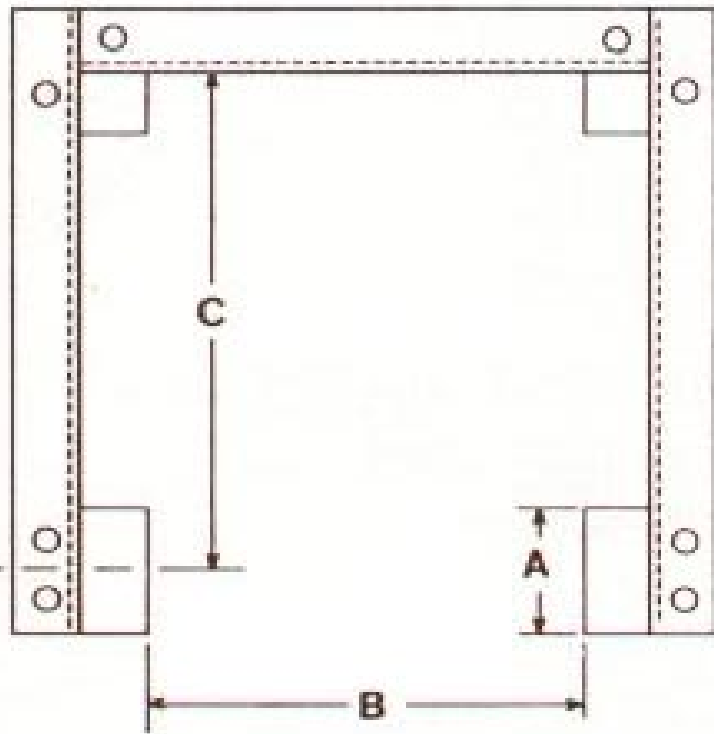
Swinging Leaders



Swinging Leaders w/Batter Pile

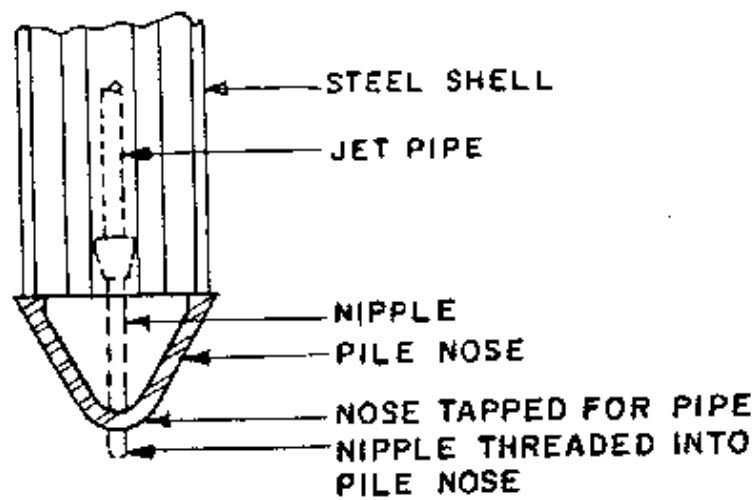


## U-Type (Box) Leaders

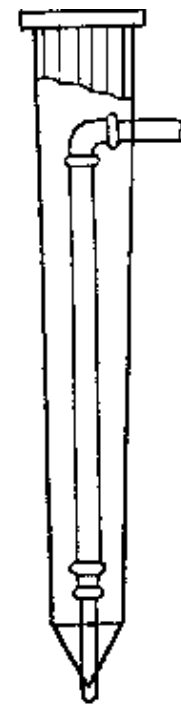


# Predrilling, Jetting and Spudding

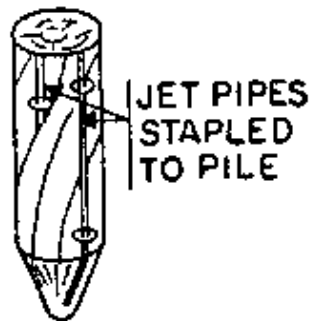
- Methods of reducing the soil resistance to assist driving
- Predrilling
  - Using an auger (usually continuous flight) to drill a hole into which the pile is driven
  - Does result in loss of shaft friction
- Spudding
  - Driving a hard metal point into the ground, then removing and driving the pile
  - Rarely used



STEEL SHELL - INSIDE JET  
(a)



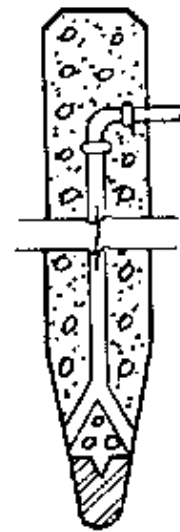
# Jetting



WOOD PILE JET  
(b)



(c)



CONCRETE PILE JET  
(d)



(e)

JET PIPE  
SUSPENDED FROM  
LEADS & WORKED  
UP & DOWN AS  
REQ'D.

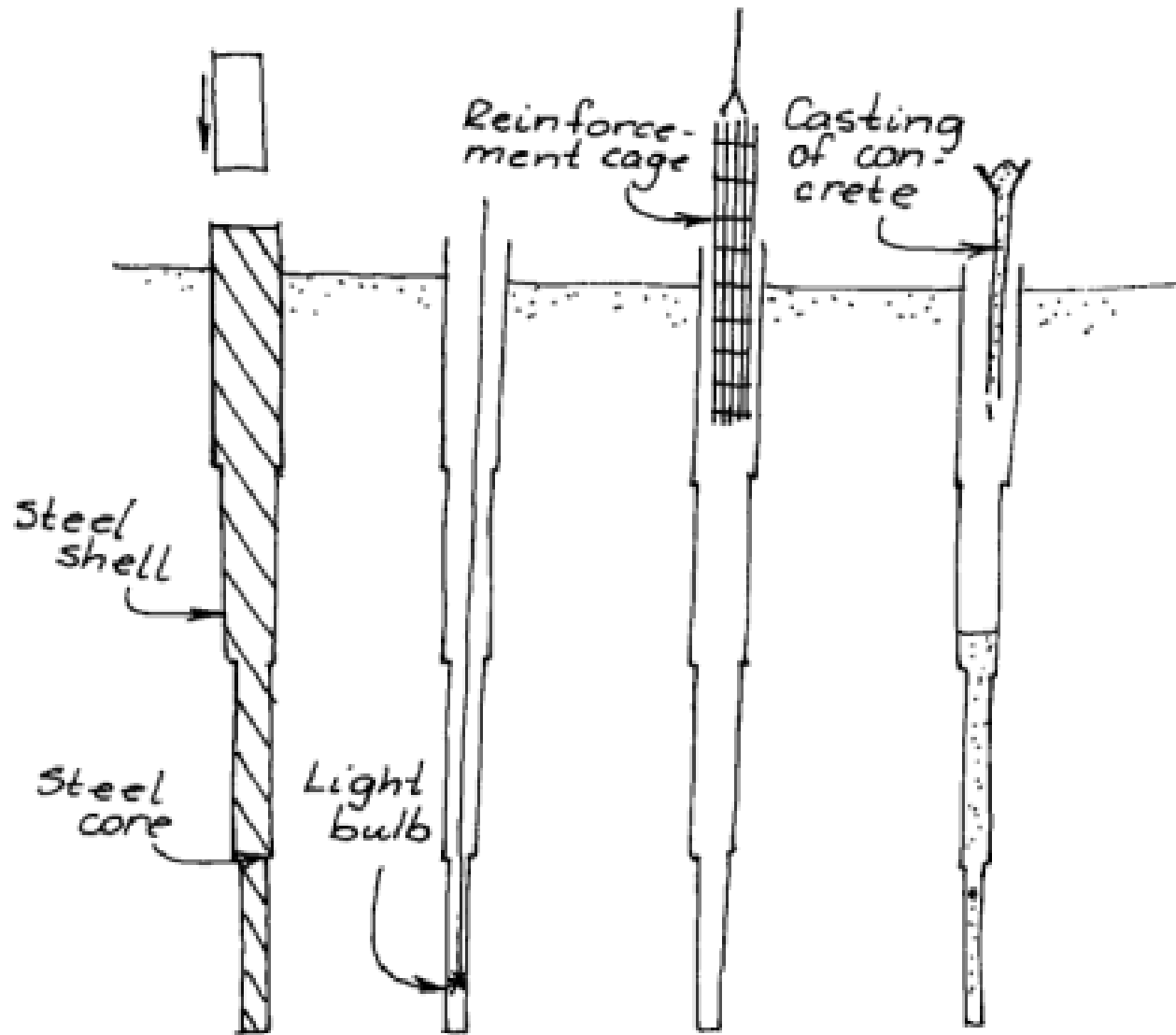


OUTSIDE JET  
(f)

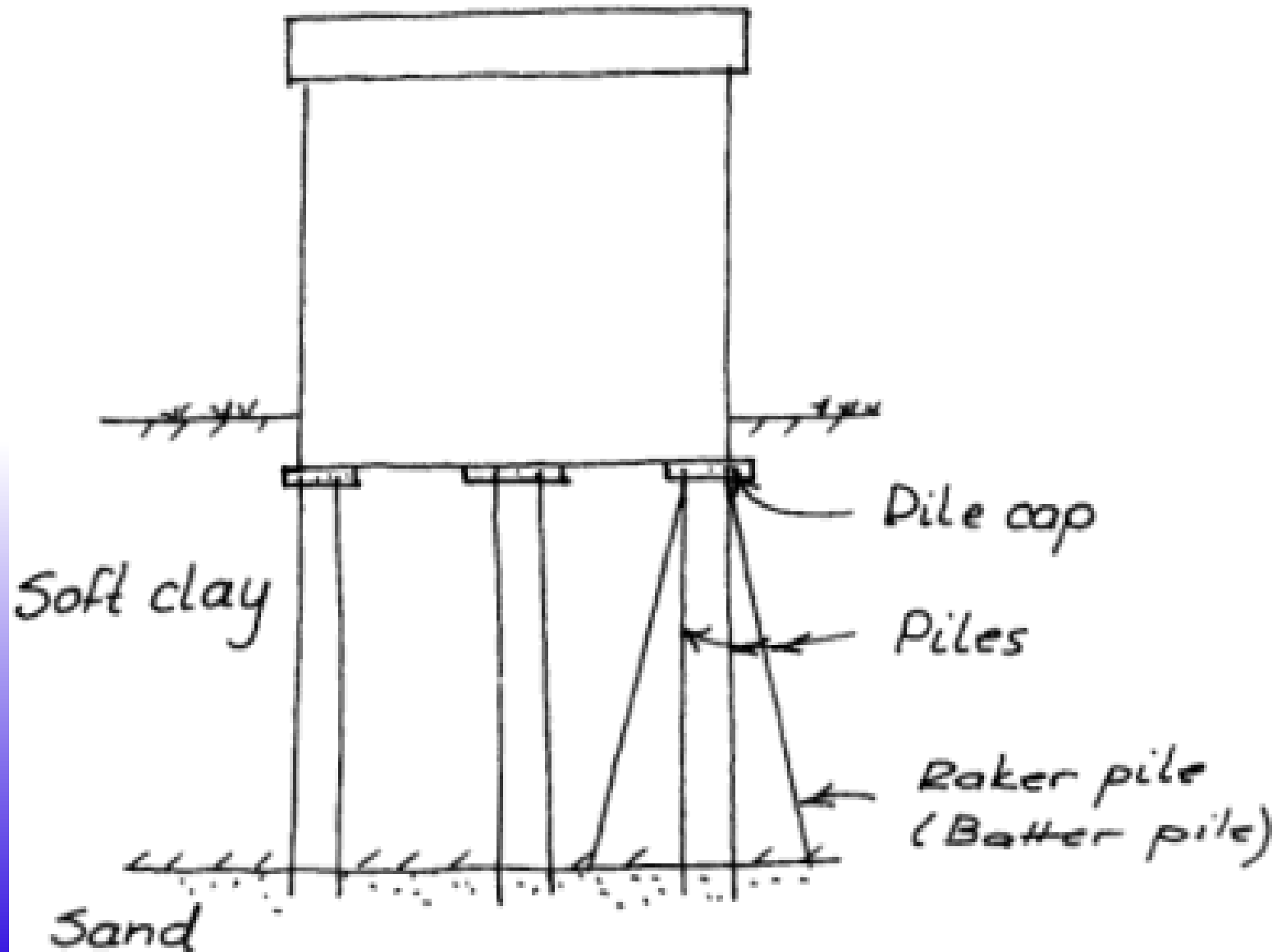
# Mandrel-Driven Thin Shelled Piles

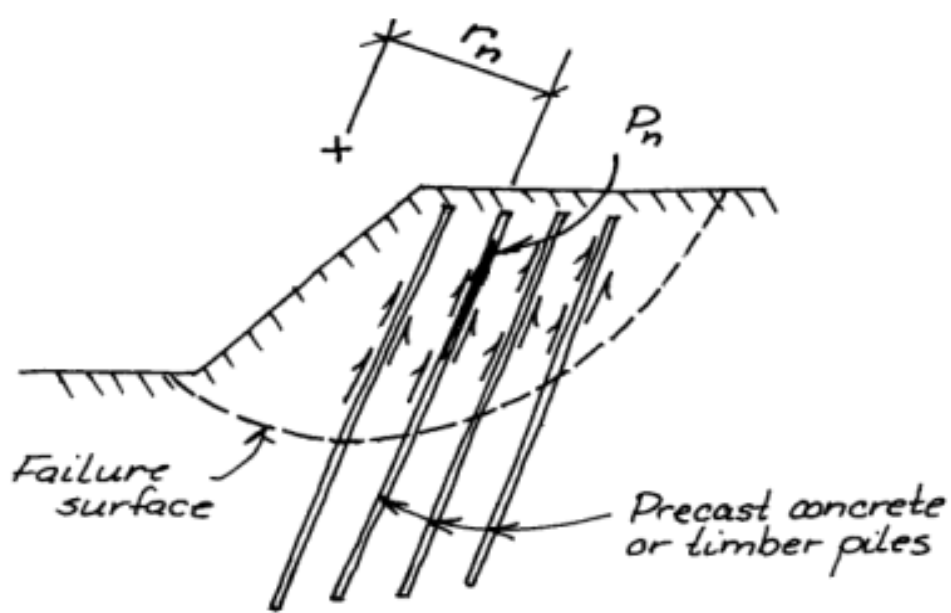
- Thin shelled steel piles which are driven with the assistance of a mandrel, as they would collapse if driven directly (as with pipe piles)
- Piles then filled with concrete and a reinforcing cage
- First widely popular mandrel driven thin shelled pile was the Raymond Step-Taper Pile, but there are many other kinds available today

# Mandrel-Driven Thin Shelled Piles

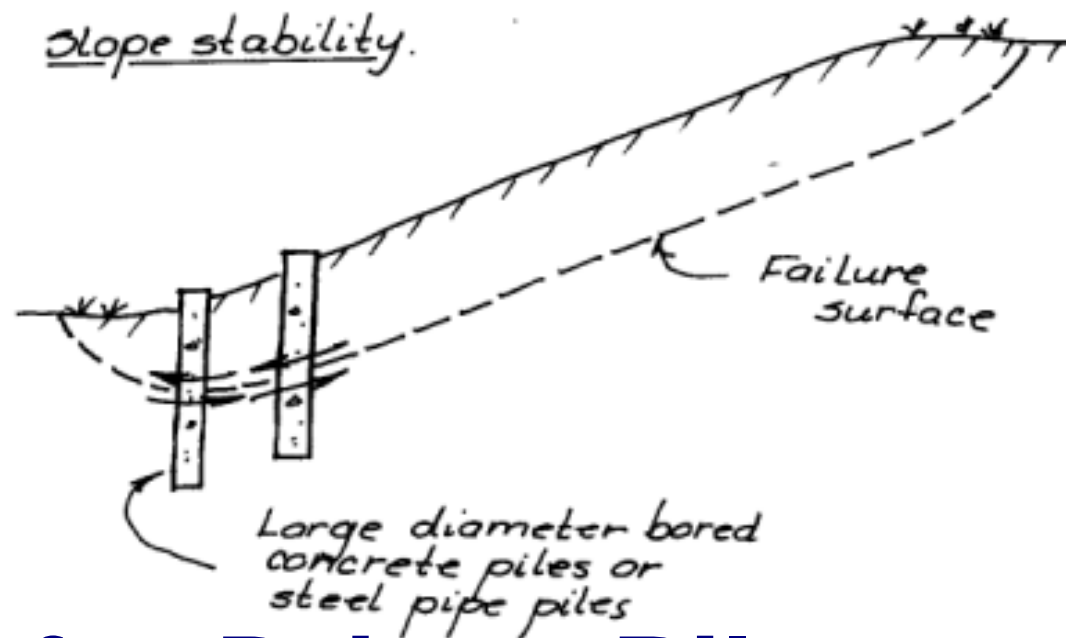


# Applications for Driven Piles

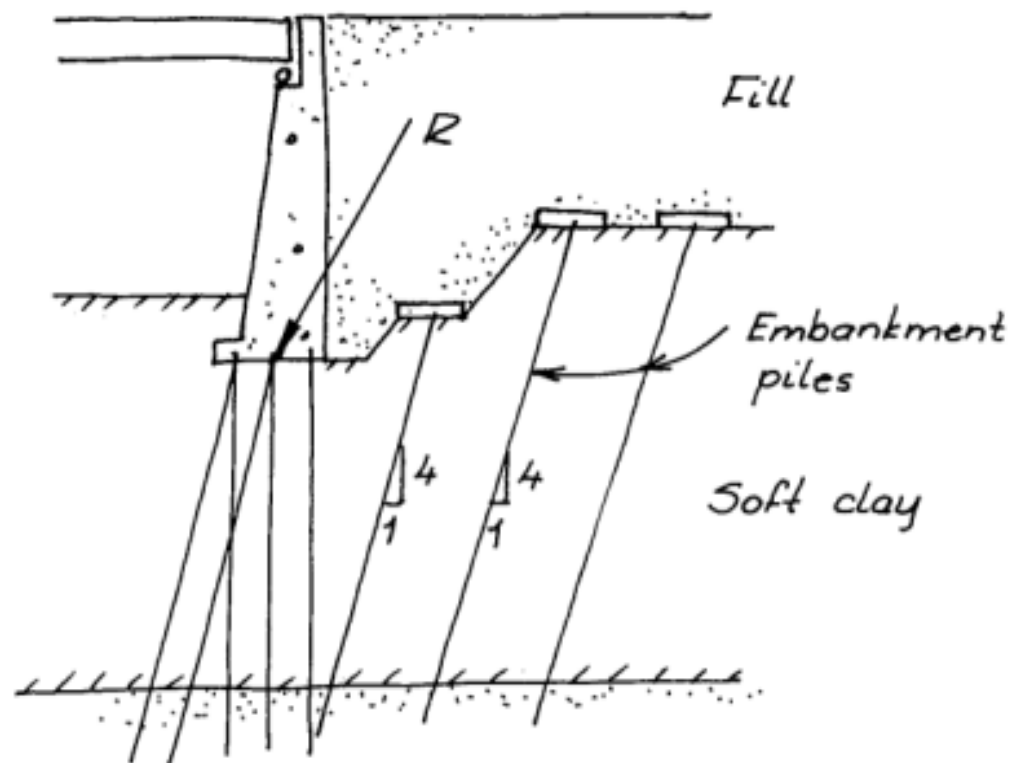
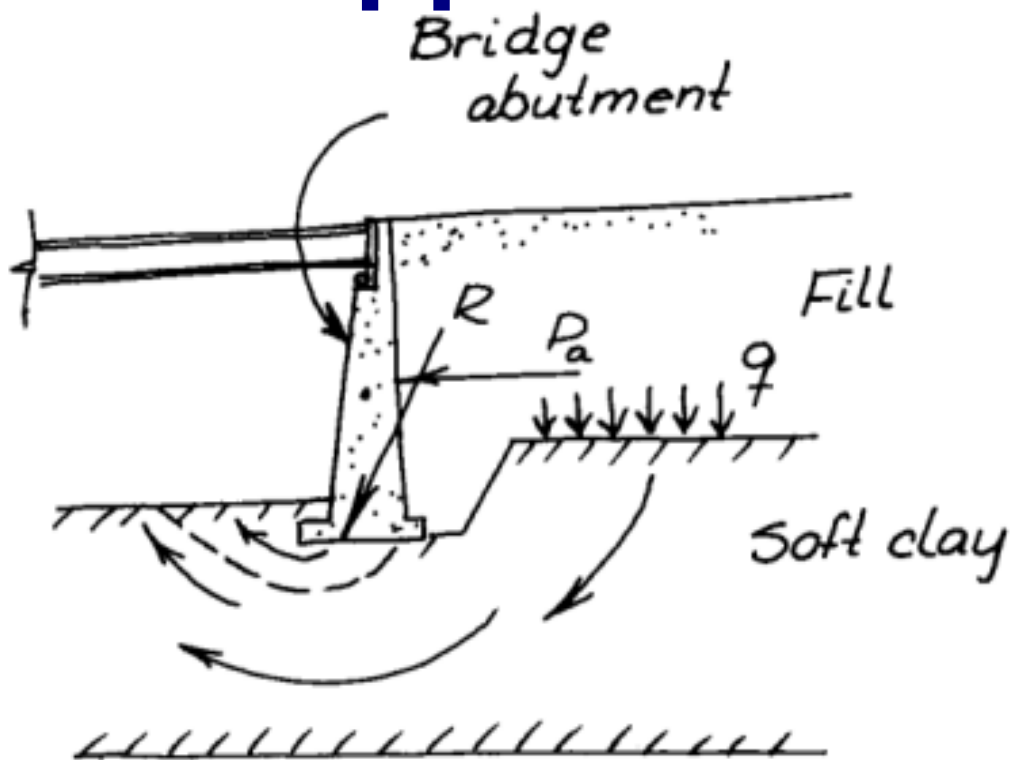




Slope stability.



# Applications for Driven Piles



**Questions?**

