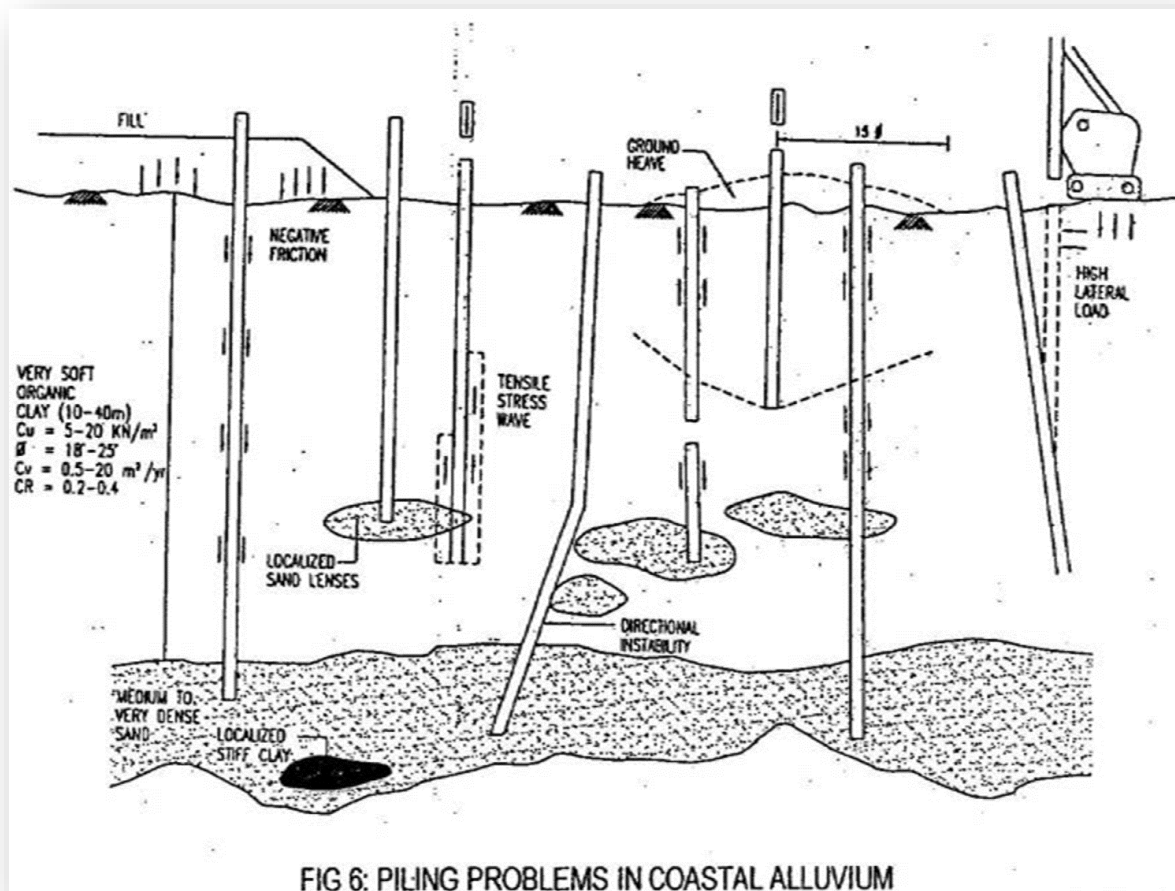


# Typical Piling Problem in **Very Thick Marine Deposits**



## PROBLEMS:

- High tensile stresses generated during driving can cause damage to R.C piles (tension crack)
- Piles may be dislocated at joints
- When piles are clusters/groups, piles driven earlier may experienced upheaval. Hence a check is required and re-driving may be necessary.
- Load test only to be carried out after 4 weeks piles have been installed. (to allow remoulding)
- Piles have to be driven very deep.

## AREA :

Along coastal plains of Peninsular Malaysia

## CHARACTERISTIC :

Deep deposits of very soft silty CLAY

e.g Klang – up to 45m deep soft clay

Kuantan & Pekan – 6.0m of medium Dense SAND at top underlain by 20 to 30m of very soft silty CLAY

Terengganu – Erratic layering of SAND & CLAY.

## CHOICE OF FOUNDATION :

- Spun pile
- R.C pile



Problems of defective pile toe due to overdriving

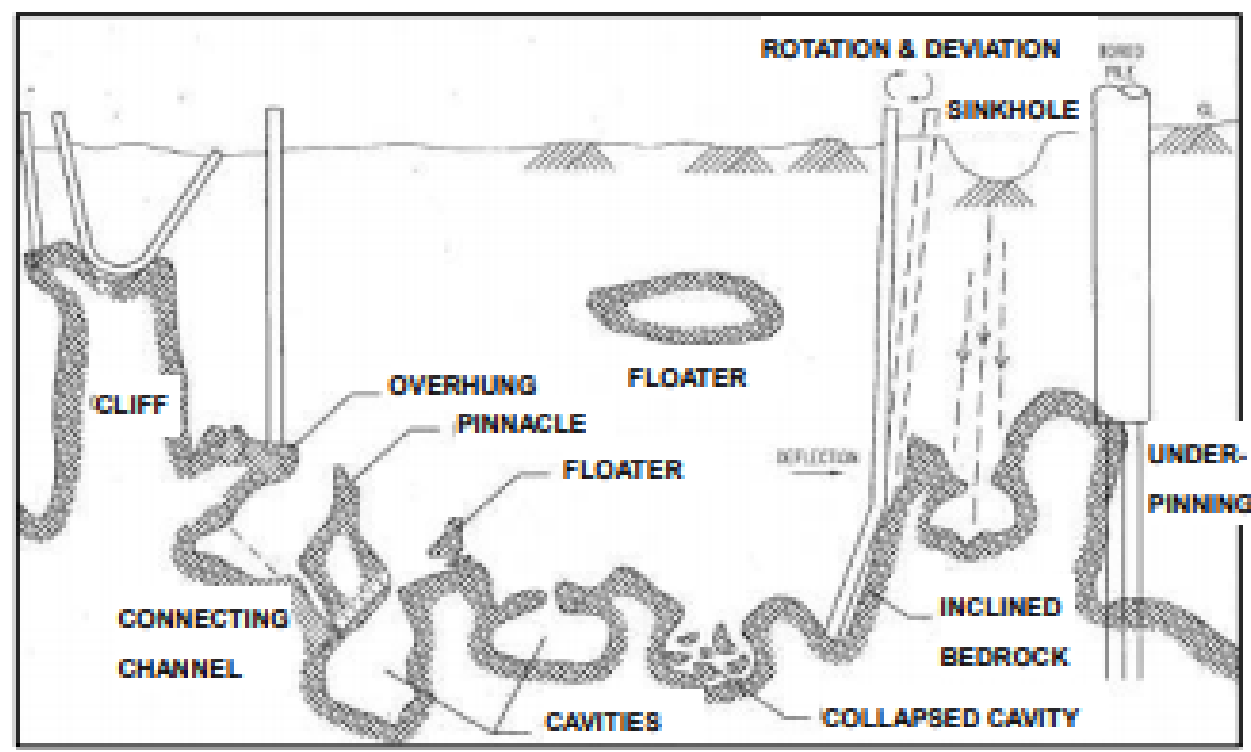


Seriously damaged pile due to severe driving stress in soft ground (tension)



Problems of defective pile head & overdriving

# Typical Piling Problem in **Limestone**



## IMPORTANT POINTS TO NOTE:

- Highly Irregular Bedrock Profile
- Presence of Cavities & Solution Channels
- Very Soft Soil Immediately Above Limestone Bedrock

## PROBLEMS:

- Driven pile experience deflection, rotation, distortion, buckling, bending, cracking or shattering
- Danger of subsidence (rock cavity collapse, ravelling collapse, cracking or shattering.)

## AREA :

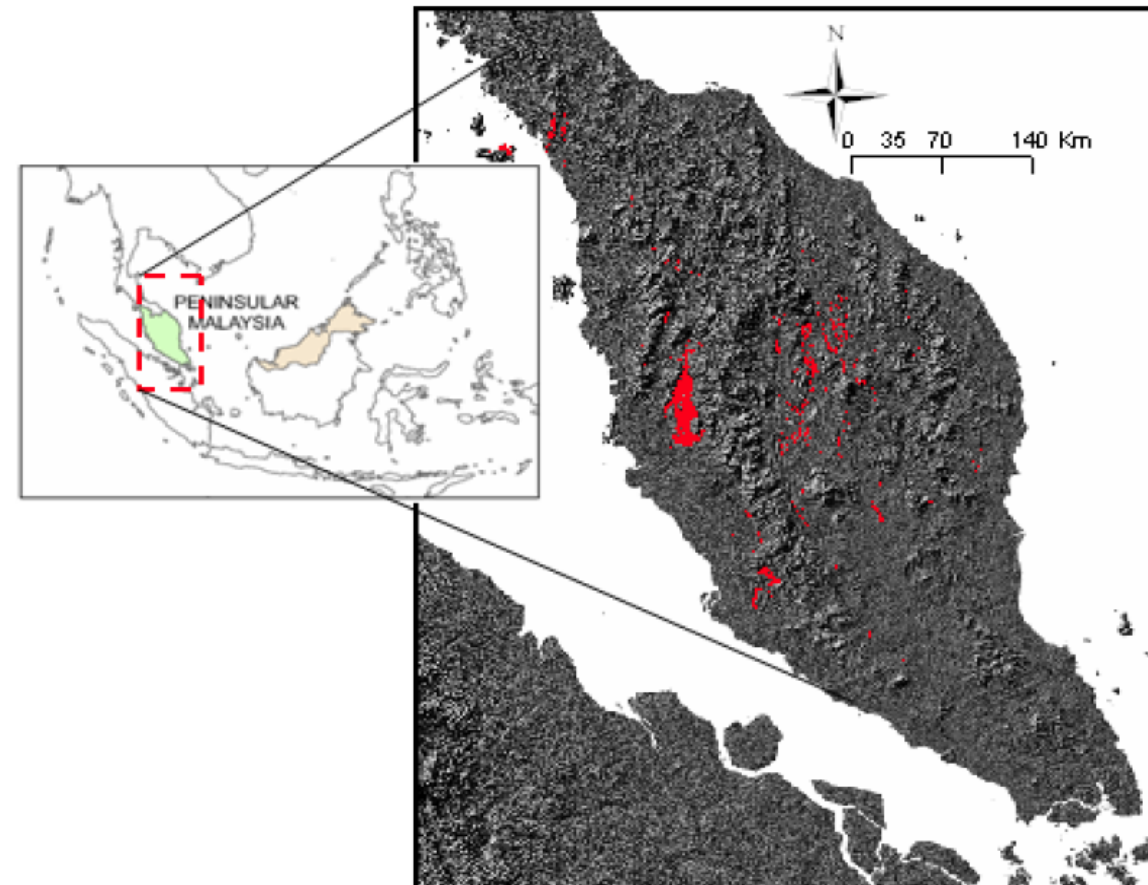
Kuala Lumpur, Ipoh, Gua Musang, Perlis.

## CHARACTERISTIC :

Weak overburden soils overlying erratic limestone bedrock with karstic features such as cavities, pinnacles & overhung rock.

## CHOICE OF FOUNDATION :

- Micropile
- Steel pile
- Spun Pile with Oslo Shoe



The distribution of limestone (red colour) in Malaysian Peninsular  
(Geosciences Department, Malaysia)



# What Can Go Wrong with Pile Foundation Design & Construction

## STEEL PILE

### WHAT CAN GO WRONG

#### Pile Head Damages

(e.g. buckling, longitudinal distortion, crushing, twisting)

#### Pile Body Damages

(e.g. twisting, crumpling, bending)

#### Collapse of Tubular Piles

#### Pile Toe Damages

(e.g. buckling, crumpling)

**Base Plate** rising relative to the casing, loss of plugs or shoes in the cased piles

### POSSIBLE CAUSE

- Overdriving
- Incorrect use of dollies, helmets, packing
- Rough cutting of pile ends
- Eccentric hammering

- Unsuitable hammer weight
- Inadequate directional control of driving/ inadequate stiffness
- Overdriving/ hard obstruction

- Insufficient thickness

- Overdriving/ hard obstruction
- Inadequate shoe design
- Difficulty in toeing into rock

- Poor welding
- Overdriving
- Incorrect use of concrete plug



H-Steel Pile



Overdriving of Steel Pile



Damage of Steel Pipe Pile



Damage of Steel Pile

#### REFERENCES:

1. GUE, S.S. & CHOW, C.M. PILED FOUNDATION PILED FOUNDATION DESIGN & CONSTRUCTION DESIGN & CONSTRUCTION [POWERPOINT SLIDES]. RETRIEVED FROM [HTTP://WWW.GNPGCO.COM.MY/DOWNLOAD/PUBLICATION/L2009\\_03.PDF](http://www.gnpgco.com.my/download/publication/L2009_03.pdf)
2. NEOH, C.A. (2005). "PILE FOUNDATION DESIGN AND CONSTRUCTION—WHAT CAN GO WRONG", PROCEEDINGS OF IEM GEOTECHNICAL ENGINEERING COURSE 2005.

# What Can Go Wrong with Pile Foundation Design & Construction

## CONCRETE PILE

### WHAT CAN GO WRONG

#### Pile head damages

(e.g. shattering, cracking, spalling of concrete)

\*note: Overdriving means driving stress exceeds the permissible stress.

#### Damages of pile shaft

(e.g. fracture, cracking, spalling of concrete)

#### Damaged pile toe

(e.g. collapsing, cracking, spalling of concrete)

#### Damages due to excessive tensile stress

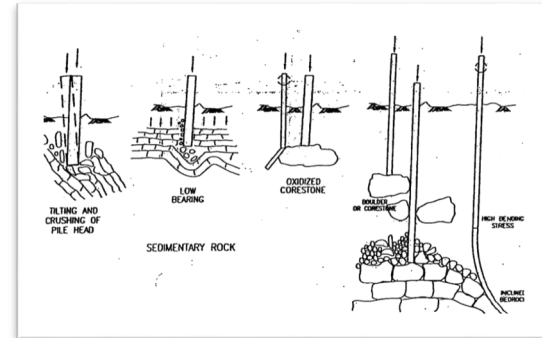
### POSSIBLE CAUSE

- Improper reinforcement detailing and MS plate detailing for pile head
- Insufficient reinforcement
- Poor quality concrete
- Inadequate concrete cover
- Eccentric hammering
- Incorrect use of dollies, helmets, packing/ cushion
- Overdriving

- Excessive restraint on piles during driving
- Improper hammer weight/ cushion
- Poor quality concrete
- Inadequate or incorrect concrete cover
- Hard obstructions or overdriving
- Pile not straight/ too slender/ too many joints

- Overdriving/ hard obstruction
- Poor quality concrete
- Insufficient reinforcement
- Inadequate or incorrect concrete cover
- No rock shoe where required

- Uncontrolled drop height of hammer
- Undersize or under strength in joints or reinforcement, etc.



Undetected Problems in Piling

Damage to RC Pile Head



Damage to RC Pile Shaft

Damage to RC Pile Toe



Piles encountered unexpectedly hard driving conditions, which led to large compressive stresses during driving.

#### REFERENCES:

1. GUE, S.S. & CHOW, C.M. PILED FOUNDATION PILED FOUNDATION DESIGN & CONSTRUCTION DESIGN & CONSTRUCTION [POWERPOINT SLIDES]. RETRIEVED FROM [HTTP://WWW.GNPGEO.COM.MY/DOWNLOAD/PUBLICATION/L2009\\_03.PDF](http://www.gnpggeo.com.my/download/publication/L2009_03.PDF)
2. NEOH, C.A. (2005). "PILE FOUNDATION DESIGN AND CONSTRUCTION—WHAT CAN GO WRONG", PROCEEDINGS OF IEM GEOTECHNICAL ENGINEERING COURSE 2005.



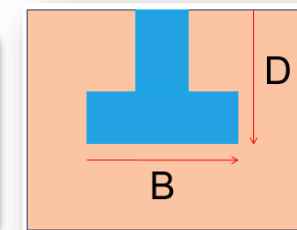
# Standard Specification For Building Works 2014 — Important Notes

## SECTION C : FOUNDATION WORKS AND WORKS BELOW LOWESTS FLOOR LEVEL SHALLOW FOUNDATION



### Defined :

- Depth,  $D < 3\text{m}$  below finished ground level
- $D/B \leq 1$

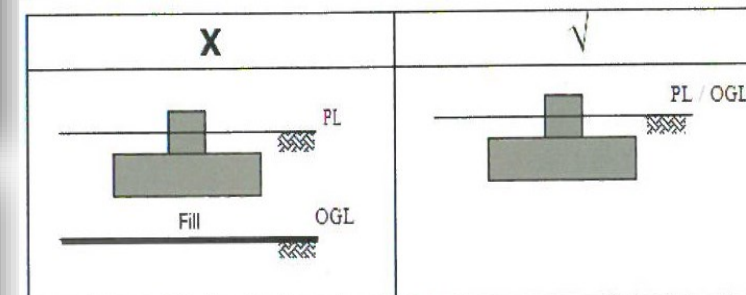


### Foundation depth :

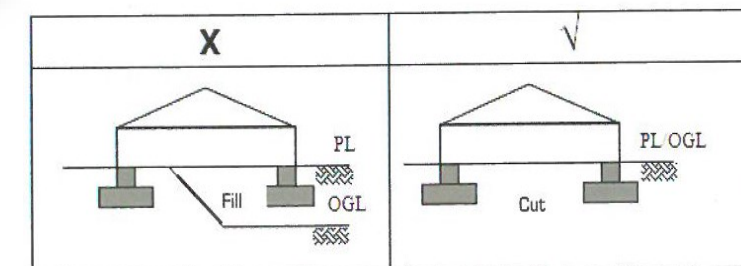
- Must be deep enough to exclude undermining by flowing water
- Must deep enough for stability
- Must deep enough to avoid "swelling and shrinkage"
  - JKR practice  $1.5\text{m} > D < 3.0\text{m}$



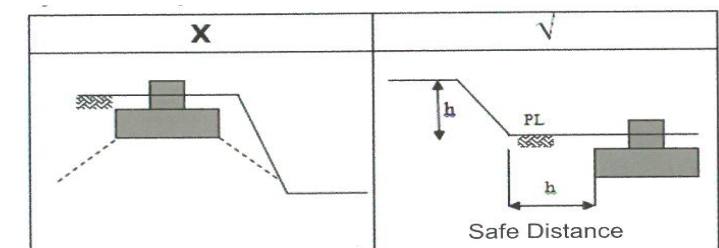
Undermining by flowing water



Pad footing shall not be constructed on fill ground



Shallow foundation shall not be constructed on partially cut & fill ground



Shallow foundation is not advisable to be constructed near slope without stability analysis study



Probe Test

### Confirmatory Bearing Capacity Of Soil :

- The Contractor shall conduct a Probe Test as stated in the Drawings to confirm the required design bearing capacity.
- The Contractor shall submit the Probe Test result to the S.O. for approval.



Plate Bearing Test



Ground Settlement

### Guides for shallow footing (pad) construction

- Not on filled ground (clause 1.3.2)
- Not for cut and fill ground
  - may caused differential settlements
- Not too close to the slope
- Confirmatory Probes to be carried out on every footing position
- Carry out concrete screeding as soon as possible.
- No different type of foundation on the same building unless separated structurally.

### REFERENCES:

- JKR STANDARD SPECIFICATION FOR BUILDING WORKS 2014

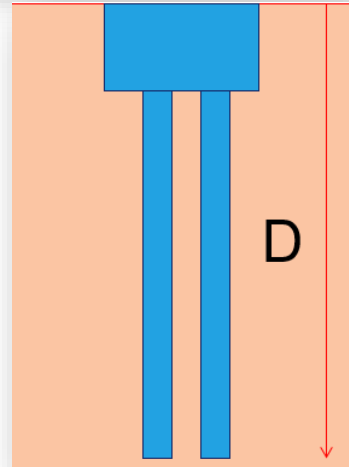


# Standard Specification For Building Works 2014 — Important Notes

## SECTION C : FOUNDATION WORKS AND WORKS BELOW LOWESTS FLOOR LEVEL DEEP FOUNDATION

### Defined :

- Depth,  $D > 3\text{m}$  below finished ground level
- **Preliminary pile :**
  - \* Install before commencement of main piling work
  - \* To establish driving criteria & confirming adequacy of design, dimensions & bearing capacity
  - \* Can be treated as working pile
- JKR Practice: Preliminary pile is 10% of total nos of pile or 6 nos of pile



Preliminary Pile

### Position (Kedudukan)

- The maximum permitted deviation of the pile centre from the centre points shown on the Drawings shall not exceed **75 mm in any direction.**

### Verticality

- The maximum permitted deviation of the finished pile from the vertical is **1 in 75.**



Pile tilted and move away



### Rake

- The maximum permitted deviation of the finished pile from the specified rake or the rake shown on the Drawings is **1 in 25.**

### Forcible Corrections (*Pembetulan Dengan daya Tenaga*)

- Forcible corrections to concrete piles shall **not be permitted!!**

#### REFERENCES:

1. JKR STANDARD SPECIFICATION FOR BUILDING WORKS 2014



# Standard Specification For Building Works 2014 — Important Notes

## SECTION C : FOUNDATION WORKS AND WORKS BELOW LOWESTS FLOOR LEVEL DEEP FOUNDATION (CONT'D)

### Piles Out of Alignment or Position (*Tersasar daripada Jajaran atau Kedudukan*)

- **Extract** and **Reinstall** any pile which has deviated out of position or alignment by more than the specified limit, or alternatively the **substructure shall be modified to the approval of the S.O.**

### Unexpected Ground Conditions

- The Contractor shall give a written notice immediately to the S.O any circumstances which, in the Contractor's opinion, **indicate ground conditions that may differ from those expected by him from interpretation of the soil investigation report**

### Adjacent Structures

- The Contractor shall **carry out a condition survey** of to establish the condition of the existing adjacent properties structures and facilities prior to commencement of piling work. Condition Surveys shall be conducted by a registered building surveyor and the result of the survey shall be submitted to the S.O. for record.
- The Contractor **shall be responsible for and shall bear the cost** incurred including claims for damages arising from his execution of the piling works.

Piling on Soft Ground



Damage to Adjacent Structure



#### REFERENCES:

1. JKR STANDARD SPECIFICATION FOR BUILDING WORKS 2014