SLOPE STABILIZATION BY MICROPILES : CASES STUDY IN NORTHWESTERN TUNISIA

S. Khediri ,S. Haffoudhi, K. Zaghouani

I. INTRODUCTION

Exceptional event in 2012 in Northwestern Tunisia:

Uncommon heavy rainy episodes

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landslides in the mountainous regions

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Substantial damages : *broken roads, homes,isolated communities*
Risk increased of human losses

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RAPID AND EFFICIENT ACTIONS
(expertise study, geotechnical investigations, solutions)

II. SOME CASES

Photo 1: Reactivated old landslide

Photo 2: Landslide: prefailure state

II. SOME CASES

Photo 3: Landslide: occured failure

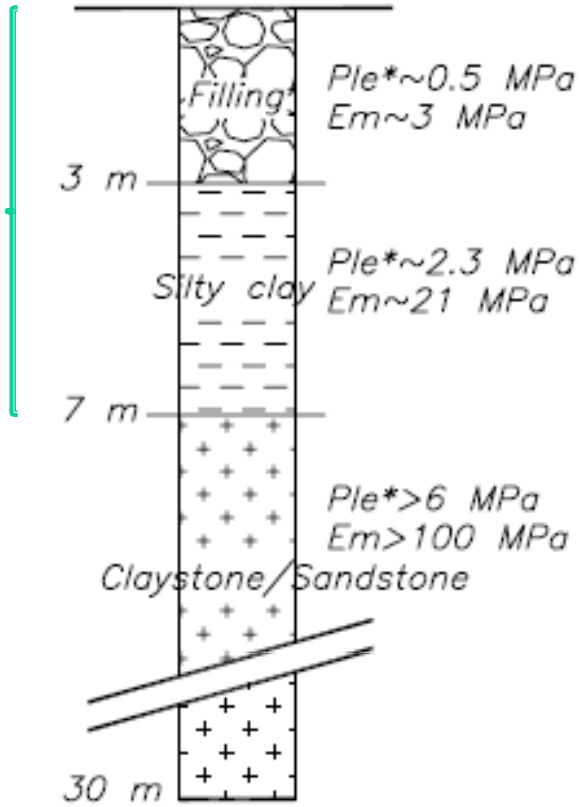
Photo 4: Reactivated old landslide

TOTAL : 30 RECORDED LANDSLIDES

III. GEOLOGICAL CONTEXT

Soils involved

Bedrock: mainly hard marls, compact claystones, sandstone,
Upper layers : filling, scree and plastic clays, lying on steep slope profiles



Upper layers

Bedrock

(low to medium mechanical characteristics)

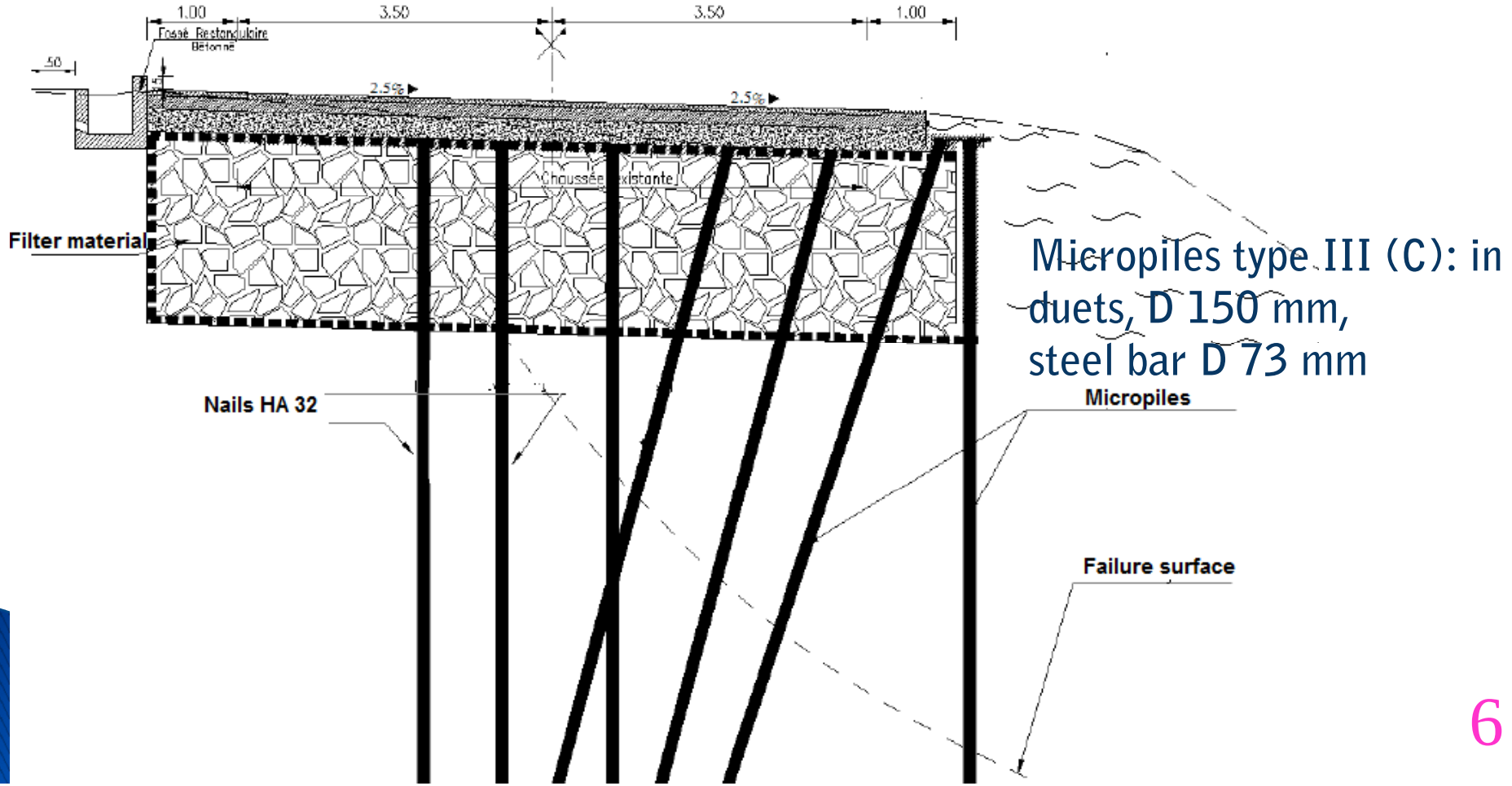
Ple*, E:
pressuremeter parameters

III. SOLUTIONS

Emergency solutions

Case Photo N°2: Prefailure state

- Soften the slope
- Soil nailing: rows of nails and micropiles , drainage system



Micropiles type III (C): in duets, D 150 mm, steel bar D 73 mm

III. SOLUTIONS

Long term solutions

5 options highlighted in the expertise study

- 5 options *involving flexible and rigid structures, associated to earthworks (reprofiling and slope softening)*

- Implemented option:
mostly stabilization by rigid elements coupled with earthworks and drainage actions:

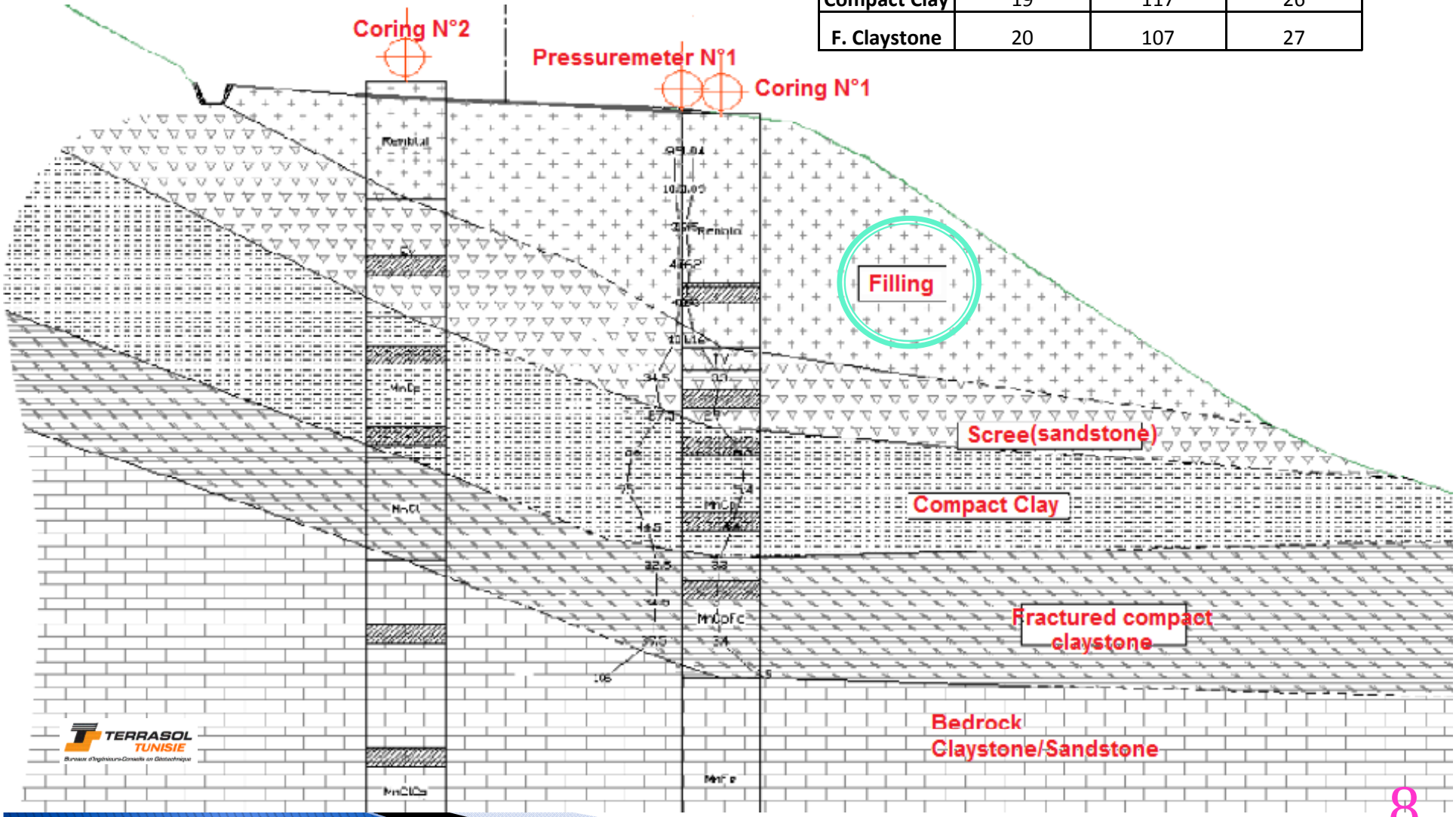
Reinforced retaining walls, founded on duets of micropiles + deep and shallow drainage actions (subhorizontal drains + draining material behind the walls, in the slope)

III. SOLUTIONS

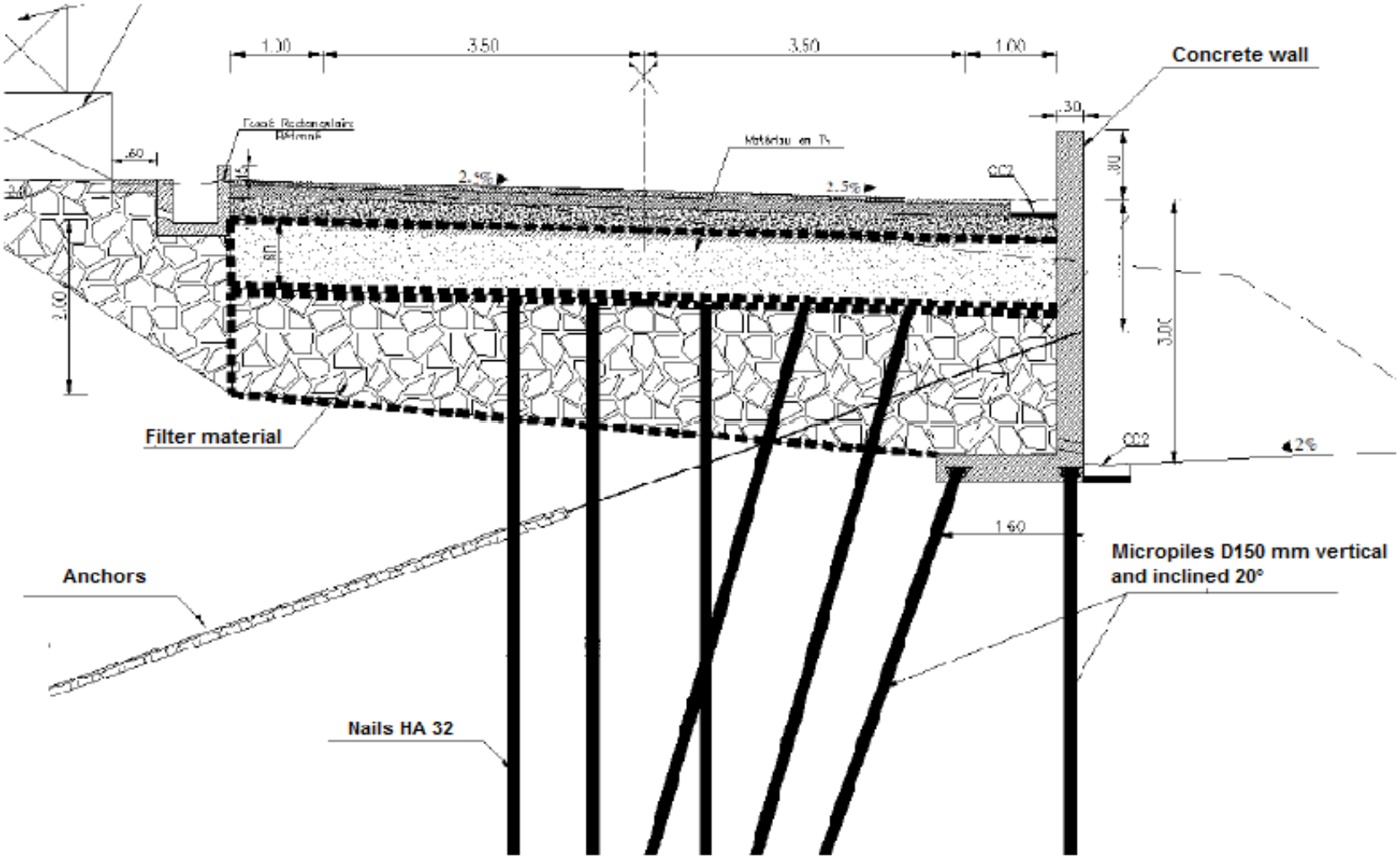
Case Photo N°2: Soil profile: *situation after the landslide*

Mechanical characteristics:

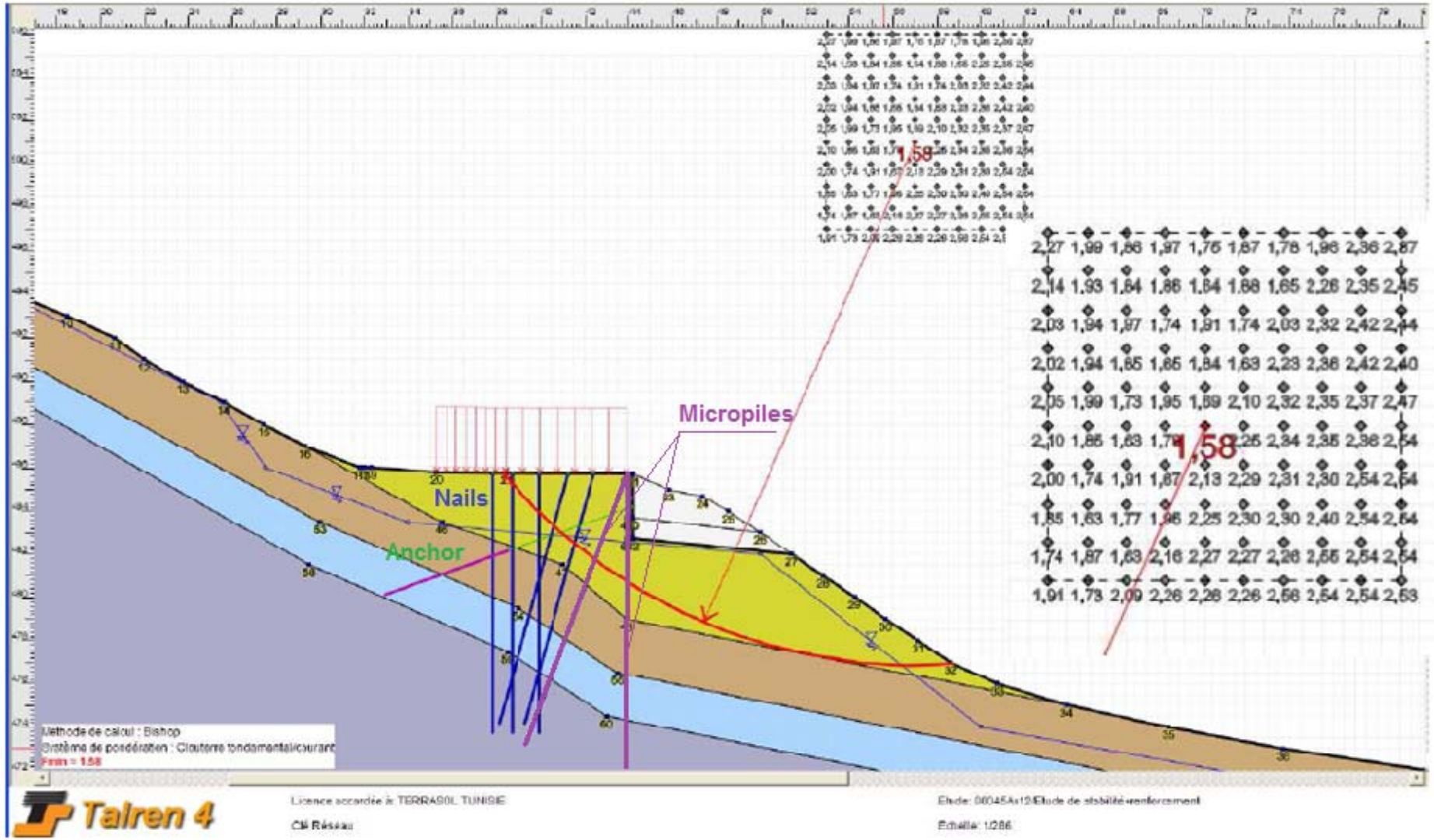
Layer	γh (KN/m3)	C (Kpa)	ϕ (°)
Filling	19	25	20
Scree	18	71	28
Compact Clay	19	117	26
F. Claystone	20	107	27



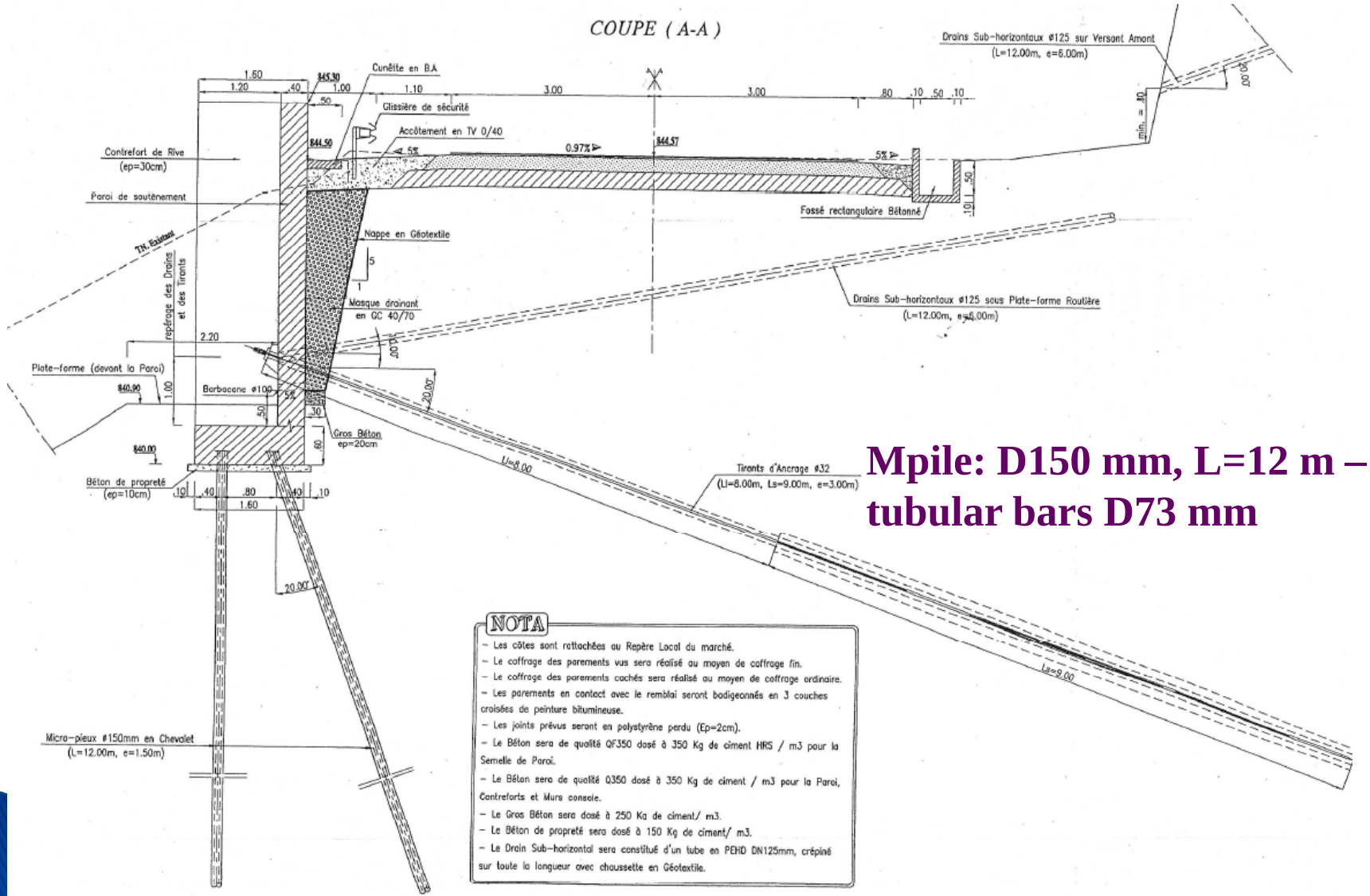
III. SOLUTIONS



III. SOLUTIONS



III. SOLUTIONS



Mpile: D150 mm, L=12 m – 15 m, tubular bars D73 mm

III. CALCULATION AND CONTROLS

CALCULATION:

- *French standard « Fascicule 62 »* : calculation of micropiles admissible bearing capacities, based on pressuremeter data (Software FOXTA)
- *Common standard methods for slope stabilty calculation: Bishop method (Software TALREN), and also Finite Element calculation* (Software PLAXIS 2D)

CONTROLS:

- *Ongoing work control on site*
- *Tensile tests: loaded to 2*Qs*

OTHER MICROPILE USE IN TUNISIA

Many other fields for micropiles use in Tunisia :

- underpinning work on existing foundations (reservoirs, old constructions….)
- Deep foundations for new constructions:
- pylons, storage tanks, industrial and residential buildings
- Berlin walls…….