



CAWANGAN KEJURUTERAAN CERUN

2020

SLOPE REMEDIAL  
WORKS IN MALAYSIA

## **SLOPE REMEDIAL WORKS IN MALAYSIA**

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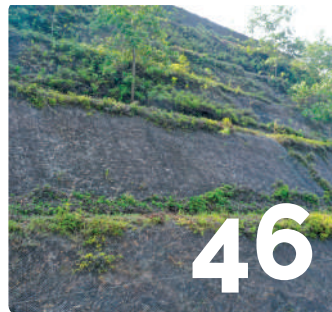
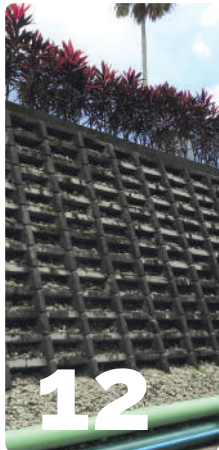
Mohamad Nazri bin Ibrahim

Mohamad Hafiz bin Mat Loddin





# CONTENTS



## RETAINING STRUCTURE

- 2 RUBBLE WALL
- 4 GABION WALL
- 6 REINFORCED CONCRETE WALL
- 8 SHEET PILE
- 10 REINFORCED EARTH WALL
- 12 CRIB WALL
- 14 CONTIGUOUS BORED PILE

## SLOPE STABILIZATION

- 18 GROUND ANCHOR
- 20 SOIL NAILING & GUNITING
- 22 SOIL NAILING & TIEBACK WALL
- 24 SOIL NAILING & GRID BEAM

## SURFACE PROTECTION

- 28 GUNITING
- 29 CONCRETE CANVAS
- 30 STONE PITCHING
- 32 ROCKFILL
- 34 GABION MATTRESS
- 36 GEOSYNTHETICS
- 38 HYDROSEEDING
- 39 CLOSE TURFING

## ROCK SLOPE

- 42 ROCK FALL FENCING
- 44 ROCK BOLT
- 46 ROCK NETTING

## OTHERS

- 48 SABO DAM
- 50 ROCK SHED



“

SLOPE REMEDIAL WORKS IN MALAYSIA was developed by Slope Engineering Branch (CKC), Public Works Department (PWD) of Malaysia.

It provides basic information regarding options for slope remedial works and their application for slope along federal roads, highway and in government premises. This publication is a sequel to the Guidelines for Slope Design published by CKC in 2010.

Thus, I hope this book would provide basic knowledge and information to serve as an introduction and reference to all PWD engineers in recognising the options of slope remedial works.

**Ir. Hj Zulkifly bin A. Ghani,**  
Director of Slope Engineering Branch, PWD Malaysia

”



# SLOPE REMEDIAL WORKS

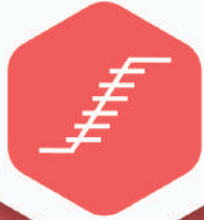
I



## RETAINING STRUCTURE

RUBBLE WALL  
GABION WALL  
REINFORCED  
CONCRETE WALL  
SHEET PILE  
REINFORCED  
EARTH WALL  
CRIB WALL  
CONTIGUOUS  
BORED PILE

II



## SLOPE STABILIZATION

GROUND ANCHOR  
SOIL NAILING &  
GUNITING  
SOIL NAILING &  
TIEBACK WALL  
SOIL NAILING &  
GRID BEAM

III



## SURFACE PROTECTION

GUNITING  
CONCRETE CANVAS  
STONE PITCHING  
ROCKFILL  
GABION MATTRESS  
GEOSYNTHETICS  
HYDROSEEDING  
CLOSE TURFING

IV



## ROCK SLOPE

ROCK FALL  
FENCING  
ROCK BOLT  
ROCK NETTING

V



## OTHERS

SABO DAM  
ROCK SHED

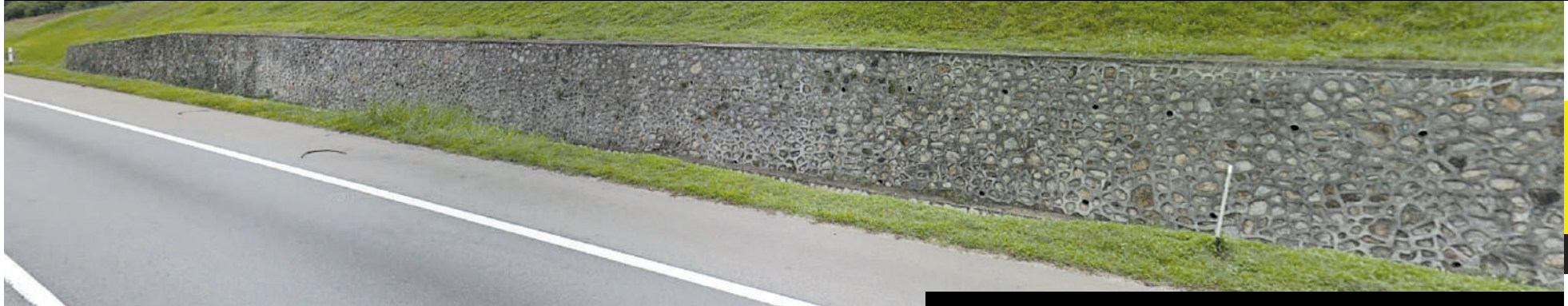
### References:

1. Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)
2. Geotechnical Engineering Handbook, Geotechnical Engineering Branch, PWD (2016)
3. Geotechnical Manual for Slopes, Civil Engineering Department, The Government of the Hong Kong (2000)

# RETAINING STRUCTURE

- RUBBLE WALL
- GABION WALL
- REINFORCED CONCRETE WALL
- SHEET PILE
- REINFORCED EARTH WALL
- CRIB WALL
- CONTIGUOUS BORED PILE





Lebuhraya Utara Selatan (E2)

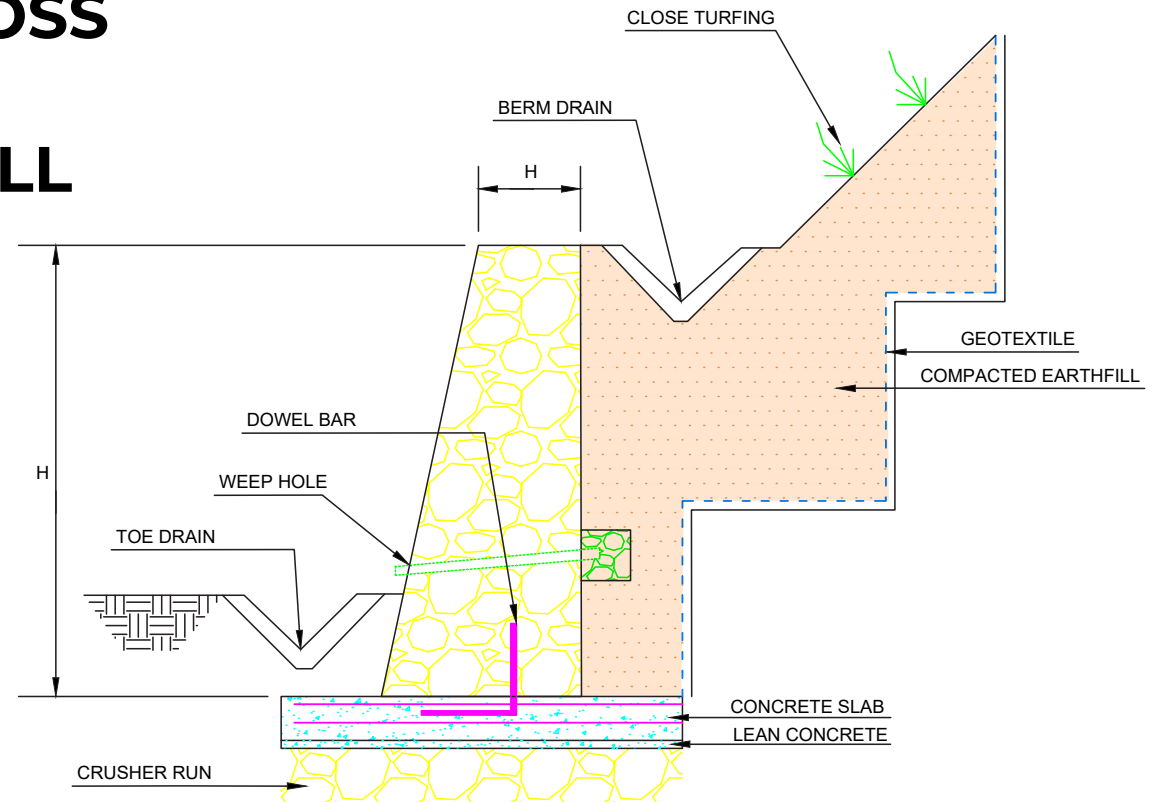
# RUBBLE WALL

RETAINING STRUCTURE



Jalan Kuala Kubu Bharu - Gap (FT55)

# TYPICAL CROSS SECTION OF RUBBLE WALL



TYPICAL SECTION VIEW



# GABION WALL

RETAINING STRUCTURE



Istana Syarqiyah, Kuala Terengganu



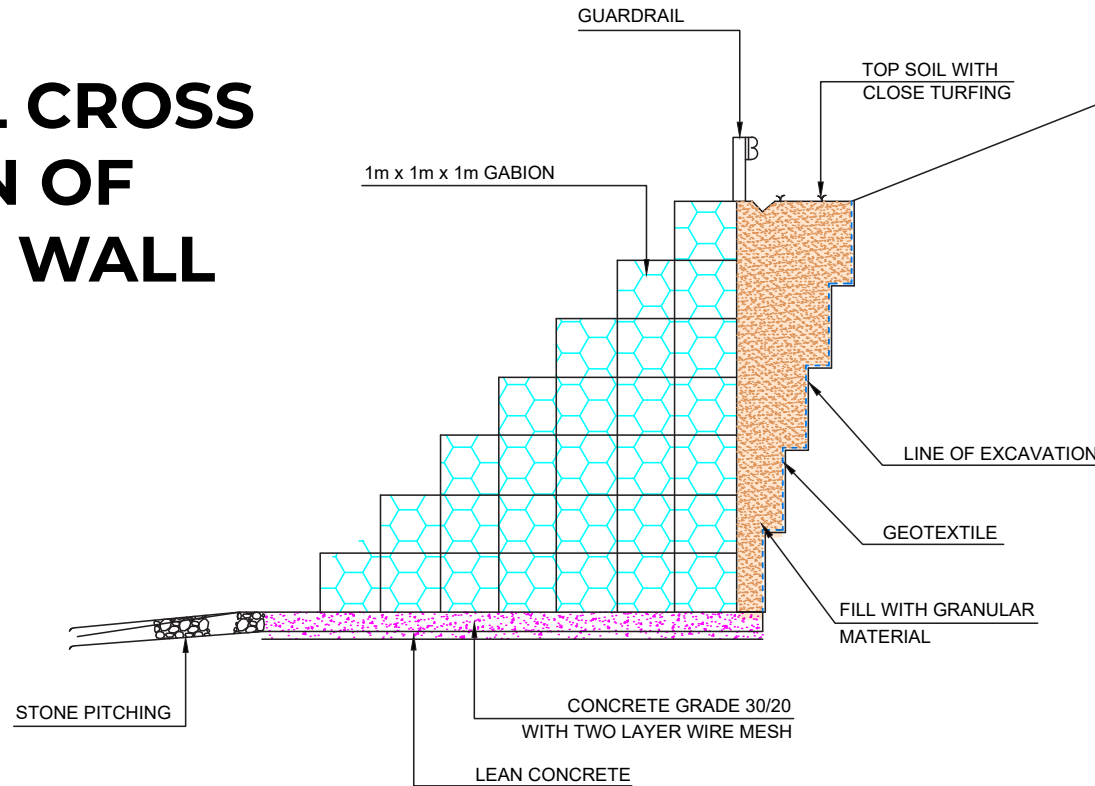
Jalan Karak - Manchis (FT9)



Jalan Aring 8 - Kenyir - Kuala Jeneris (FT36)



# TYPICAL CROSS SECTION OF GABION WALL



TYPICAL SECTION VIEW

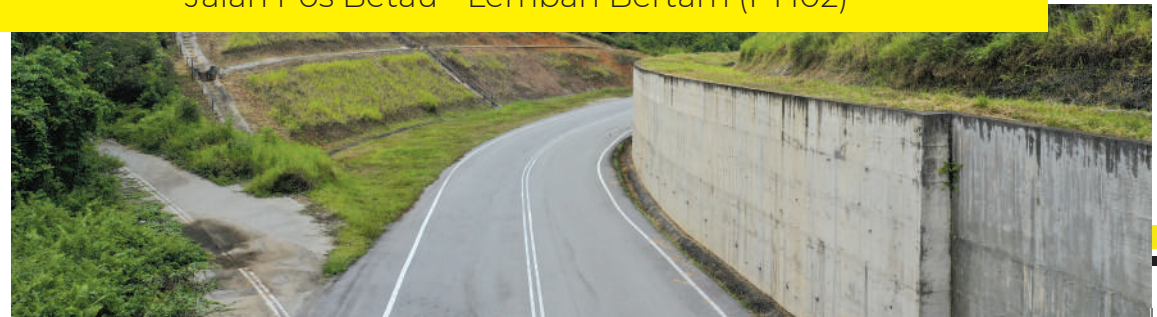
Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)

# REINFORCED CONCRETE WALL

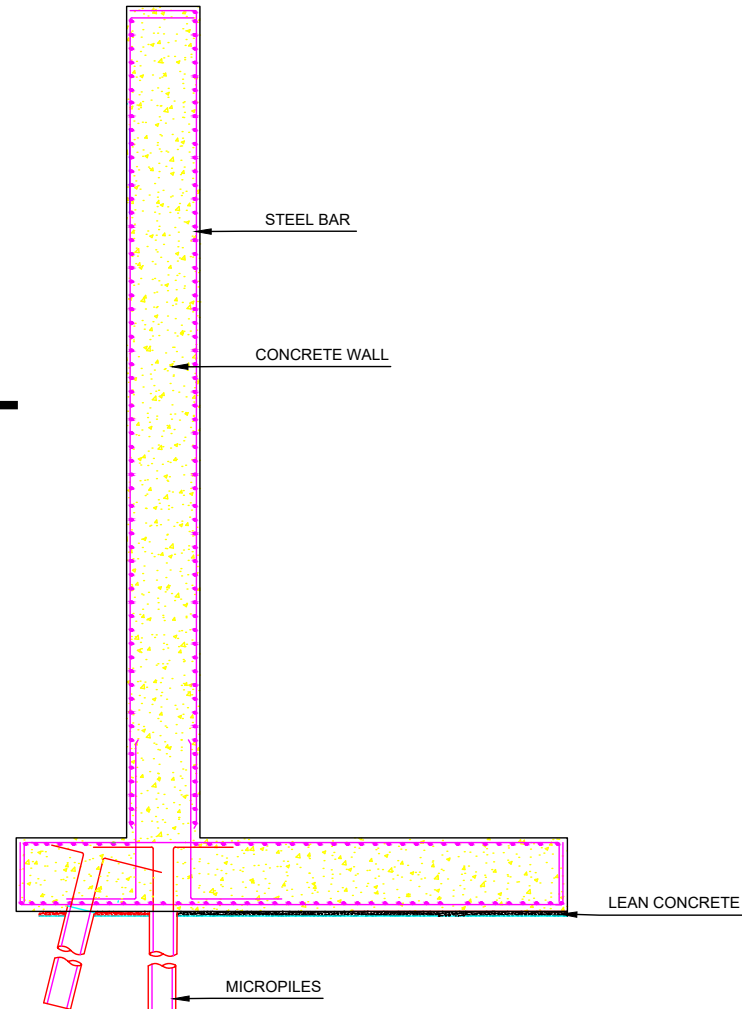
RETAINING STRUCTURE



Jalan Pos Betau - Lembah Bertam (FT102)



# TYPICAL CROSS SECTION OF REINFORCED CONCRETE WALL



TYPICAL SECTION VIEW





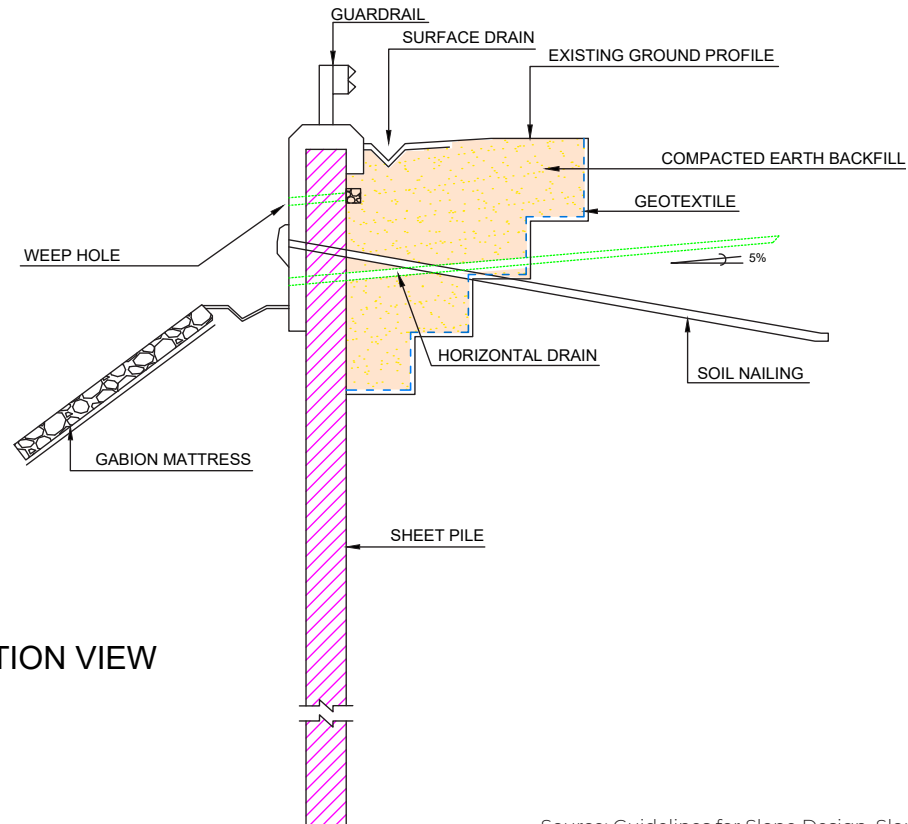
Pusat Tenis Nasional Tun Razak, Kuala Lumpur

# SHEET PILE

RETAINING STRUCTURE



# TYPICAL CROSS SECTION OF SHEET PILE



TYPICAL SECTION VIEW

Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)





Lebuhraya Penyuraian Trafik Kuala Lumpur Barat (SPRINT) (E23)

# REINFORCED EARTH WALL

RETAINING STRUCTURE



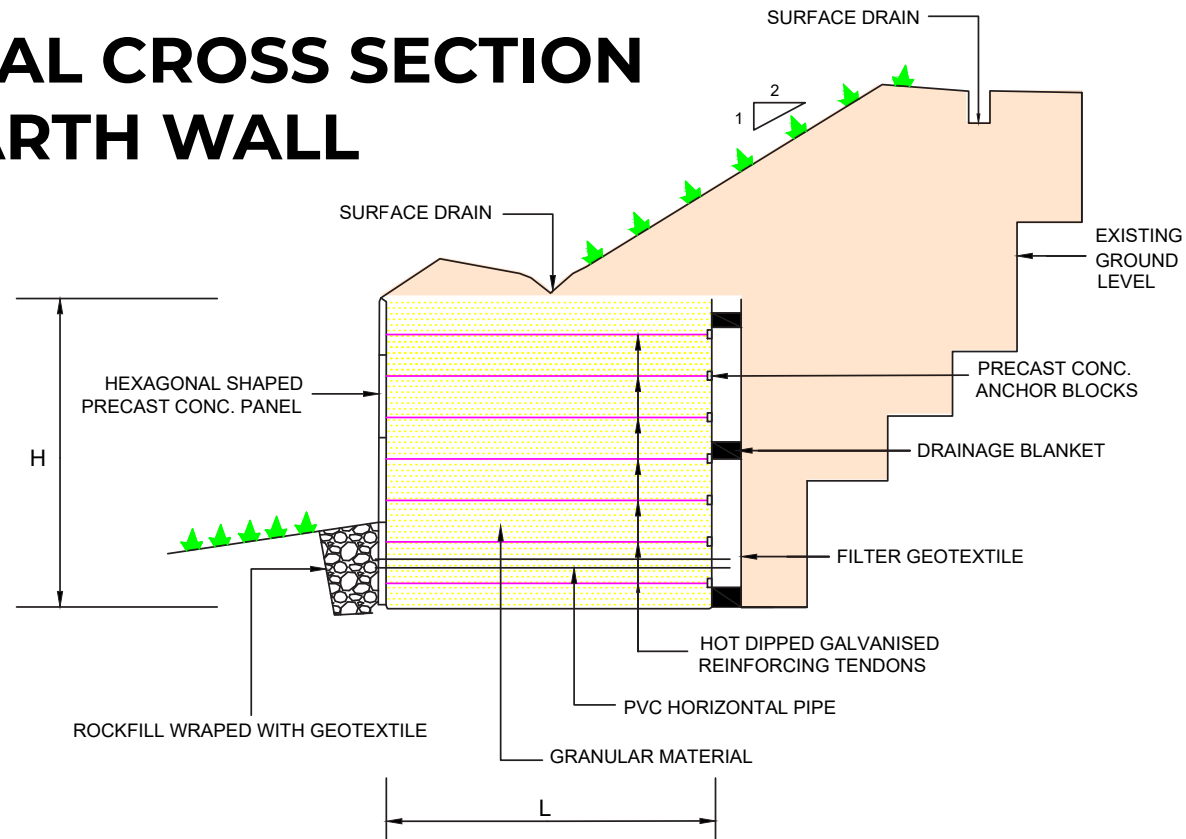
Klinik Kesihatan Tanah Tinggi Lojing,  
Gua Musang, Kelantan



Lebuhraya Pantai Timur (E8)



# TYPICAL CROSS SECTION OF EARTH WALL

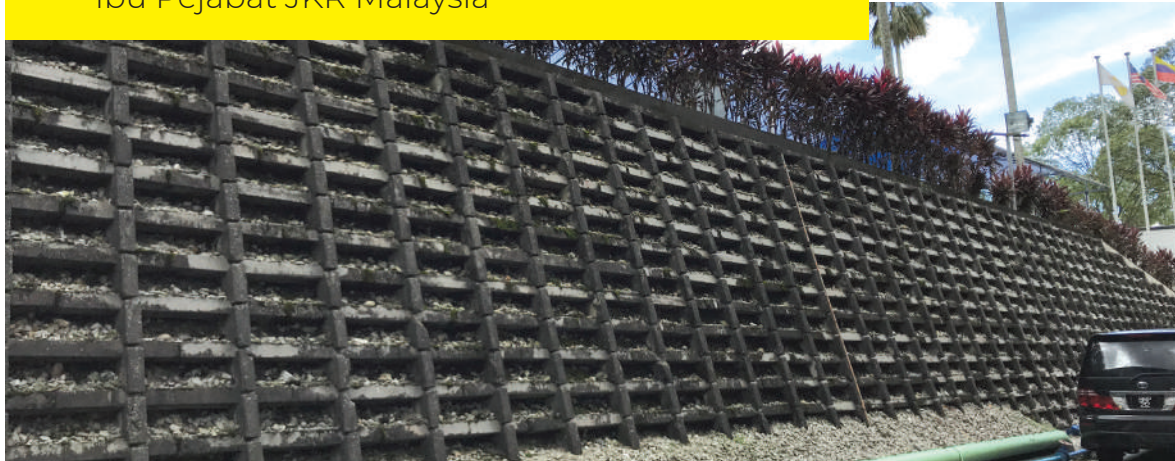


TYPICAL SECTION VIEW

Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)



Ibu Pejabat JKR Malaysia



# CRIB WALL

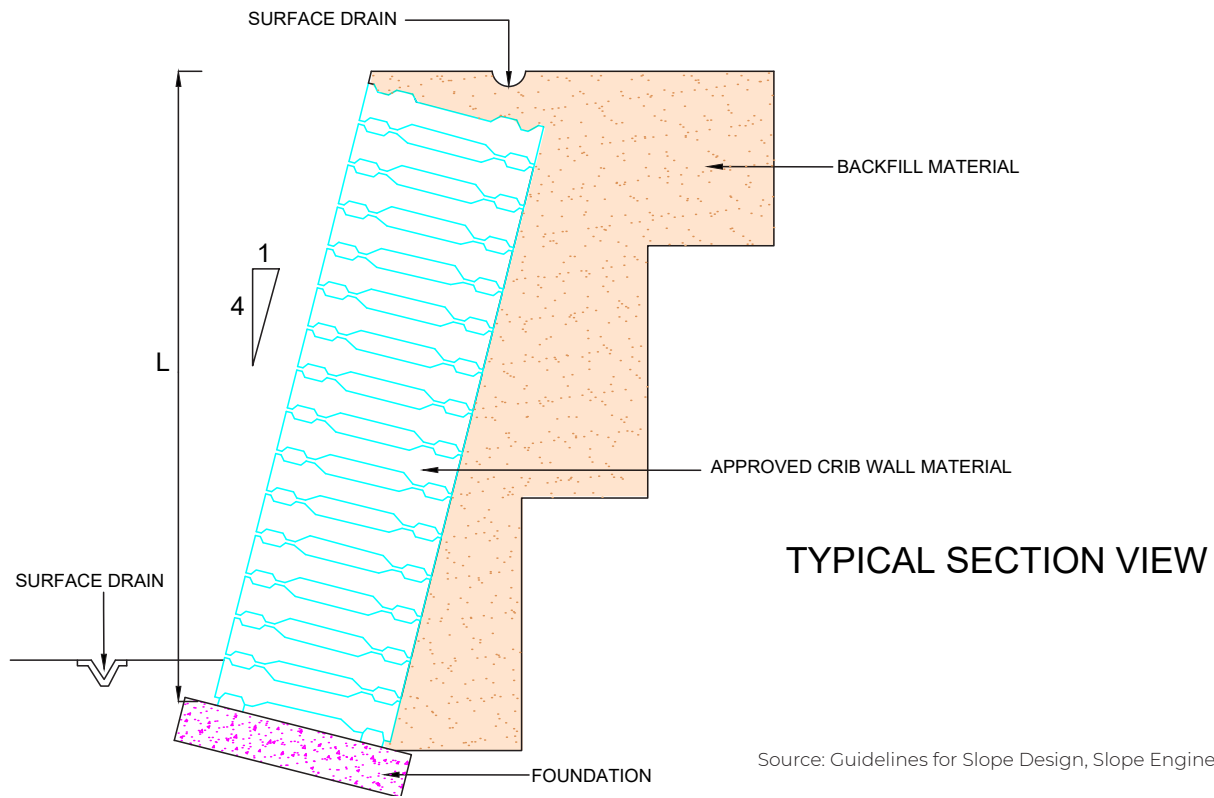
RETAINING STRUCTURE



Mahkamah Majistret Kuala Lipis, Pahang



# TYPICAL CROSS SECTION OF CRIB WALL



Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)





Istana Syarqiyah, Kuala Terengganu

# CONTIGUOUS BORED PILE

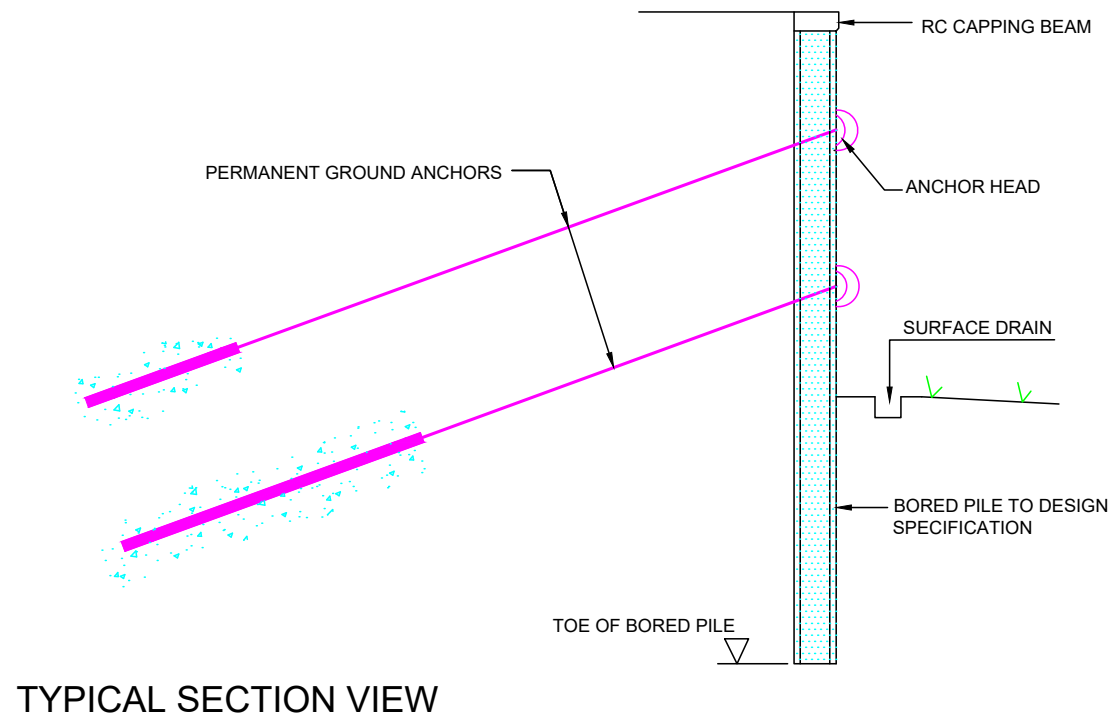
RETAINING STRUCTURE



Jalan Gerik - Jeli (Lebuhraya Timur Barat) (FT4)



# TYPICAL CROSS SECTION OF CONTIGUOUS BORED PILE



Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)







# **SLOPE STABILIZATION**

- GROUND ANCHOR
- SOIL NAILING & GUNITING
- SOIL NAILING & TIEBACK WALL
- SOIL NAILING & GRID BEAM

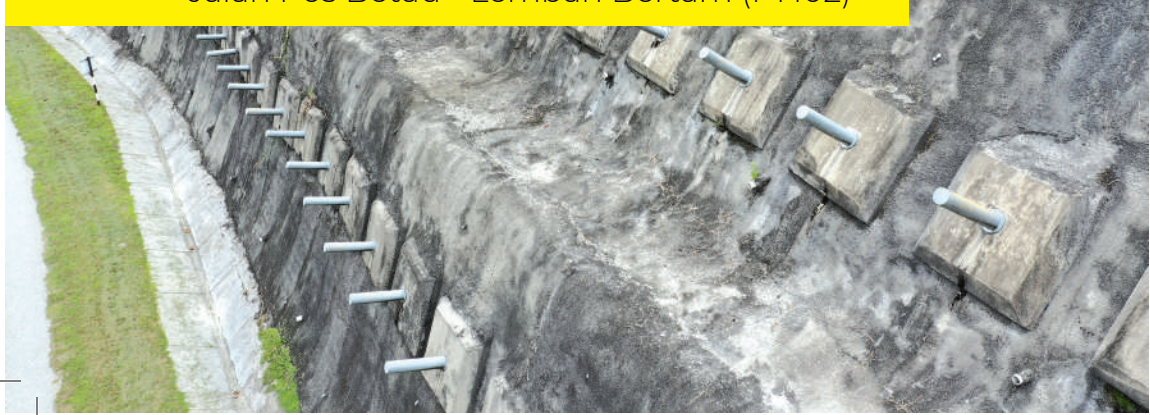




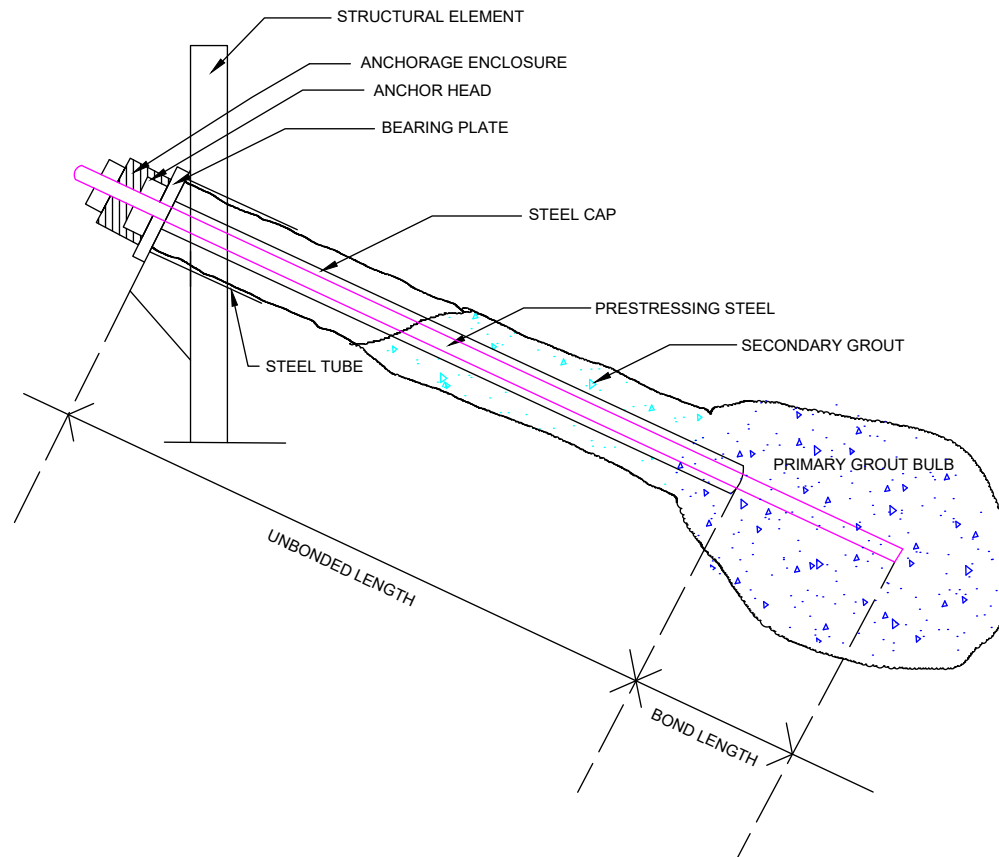
# GROUND ANCHOR

SLOPE STABILIZATION

Jalan Pos Betau - Lembah Bertam (FT102)



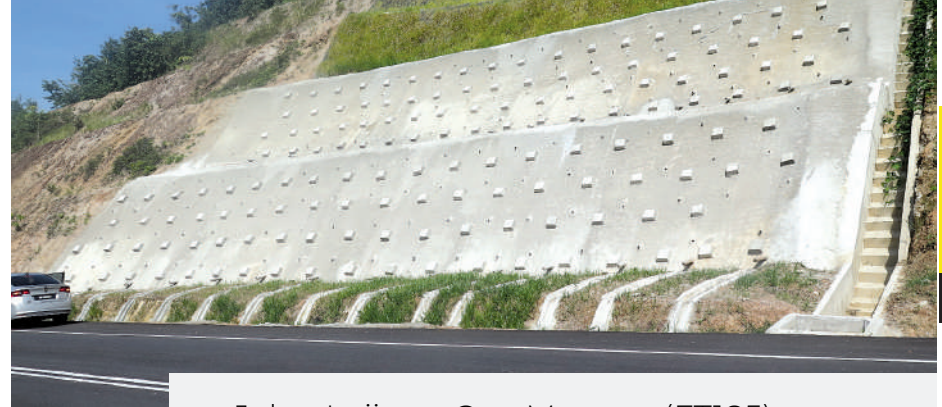
# TYPICAL CROSS SECTION OF GROUND ANCHOR







MRSM Bentong, Pahang



Jalan Lojing - Gua Musang (FT185)

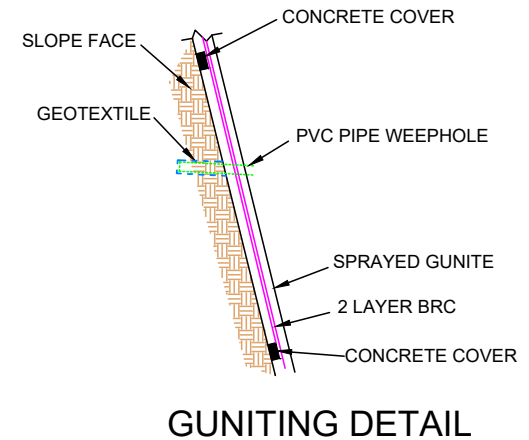
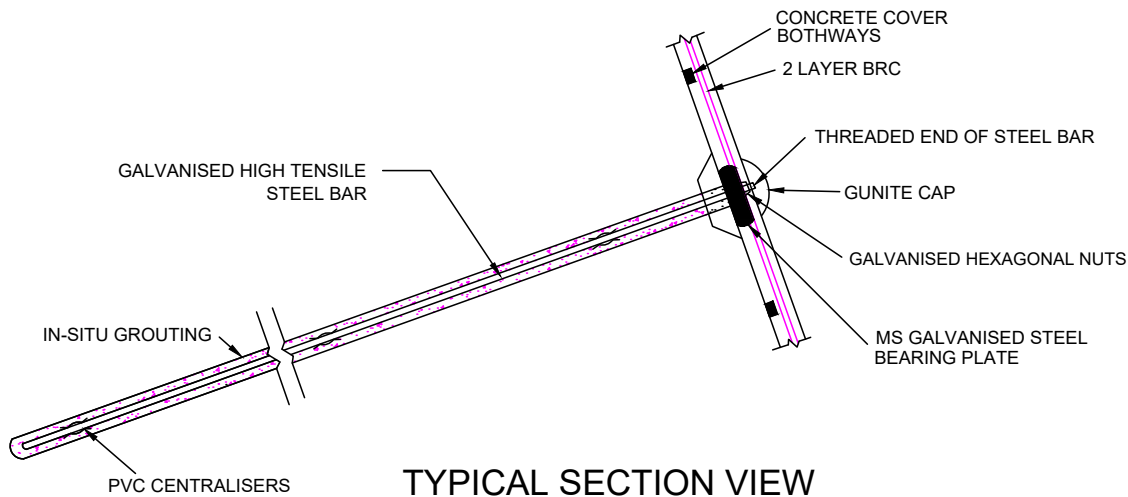
# SOIL NAILING & GUNITING

SLOPE STABILIZATION



Lebuhraya Pantai Timur (E8)

# TYPICAL CROSS SECTION OF SOIL NAILING & GUNITING



Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)



# SOIL NAILING & TIEBACK WALL

SLOPE STABILIZATION



Jalan Aring 8 - Kenyir - Kuala Jeneris (FT36)



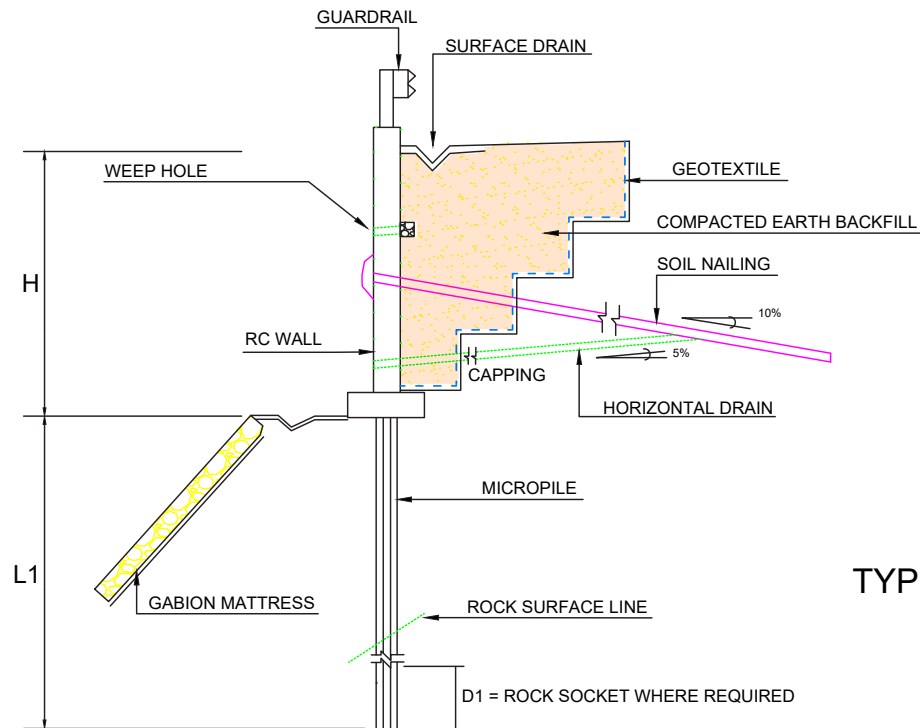
Jalan Maran - Jerantut - Benta (FT64)



Jalan Kuala Lumpur - Bentong (FT68)



# TYPICAL CROSS SECTION OF SOIL NAILING & TIEBACK WALL



TYPICAL SECTION VIEW

Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)





# SOIL NAILING & GRID BEAM

SLOPE STABILIZATION

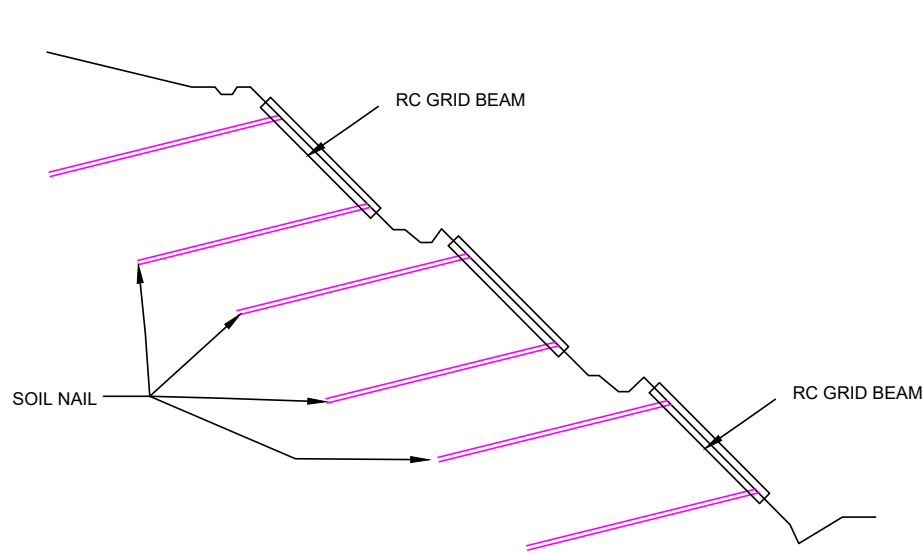


Jalan Gerik - Jeli (Lebuhraya Timur Barat) (FT4)

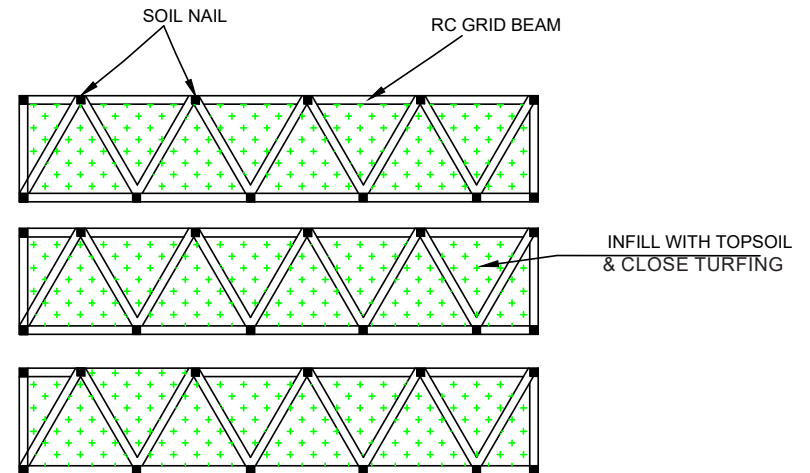




# TYPICAL CROSS SECTION OF SOIL NAILING & GRID BEAM



TYPICAL SECTION VIEW



TYPICAL ELEVATION VIEW





An aerial photograph of a winding road through a dense forest. The image is overlaid with several geometric shapes: a large yellow trapezoid on the right side containing text, a black vertical bar to its left, and several overlapping yellow and black shapes in the bottom-left corner. On the right side, there are several parallel, slightly curved grey lines that appear to be part of a design element.

# **SURFACE PROTECTION**

- GUNITING
- CONCRETE CANVAS
- STONE PITCHING
- ROCKFILL
- GABION MATTRESS
- GEOSYNTHETICS
- HYDROSEEDING
- CLOSE TURFING

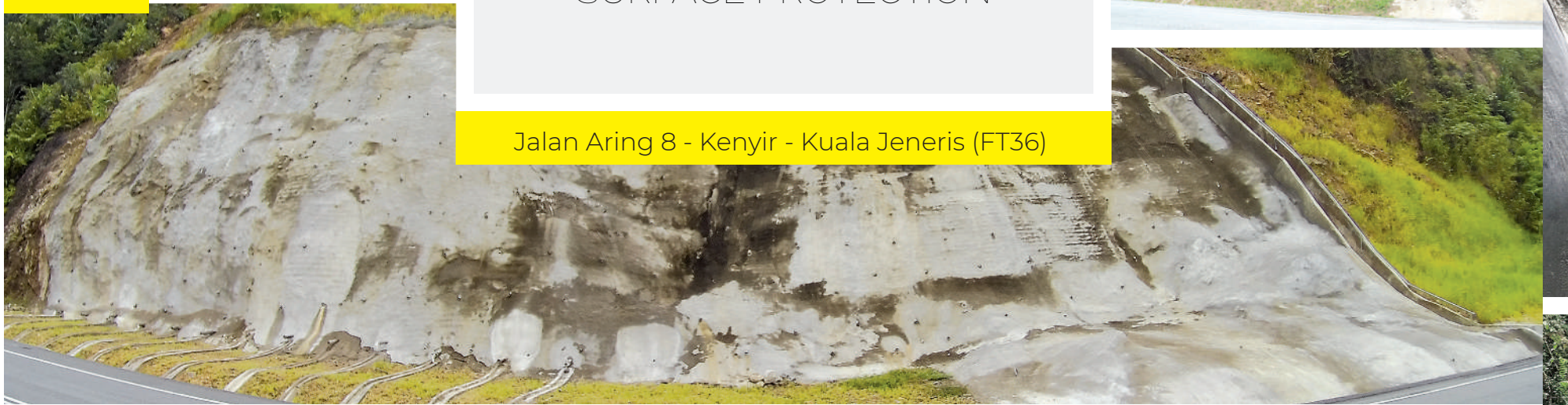


# GUNITING

SURFACE PROTECTION

Jalan Aring 8 - Kenyir - Kuala Jeneris (FT36)

Jalan Kuala Kubu Bharu - Cap (FT55)







Jalan Kuala Kubu Bharu - Gap (FT55)



Jalan Seri Iskandar - Parit (A51)

# CONCRETE CANVAS

SURFACE PROTECTION





Lebuhraya Pantai Timur (E8)



Jalan Aring 8 - Kenyir - Kuala Jeneris (FT36)

# STONE PITCHING

SURFACE PROTECTION

# TYPICAL CROSS SECTION OF STONE PITCHING

TYPICAL SECTION VIEW







# ROCKFILL

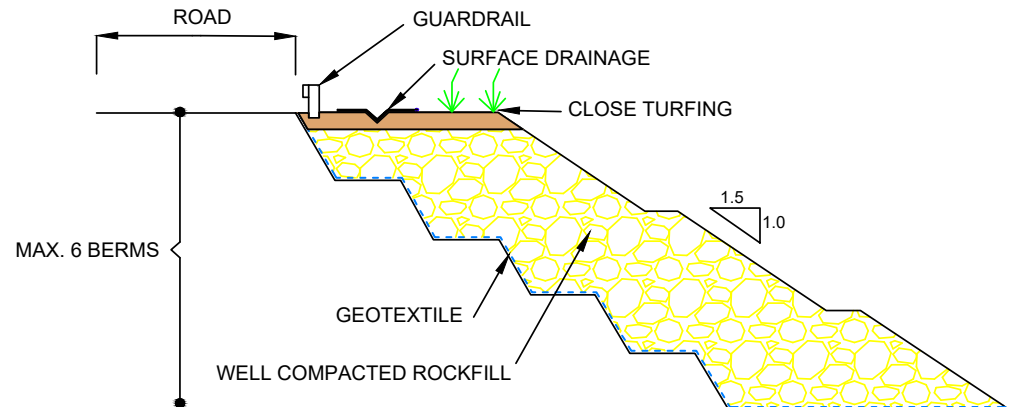
SURFACE PROTECTION

Jalan Aring 8 - Kenyir - Kuala Jeneris (FT36)





# TYPICAL CROSS SECTION OF ROCKFILL



TYPICAL SECTION VIEW

Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)



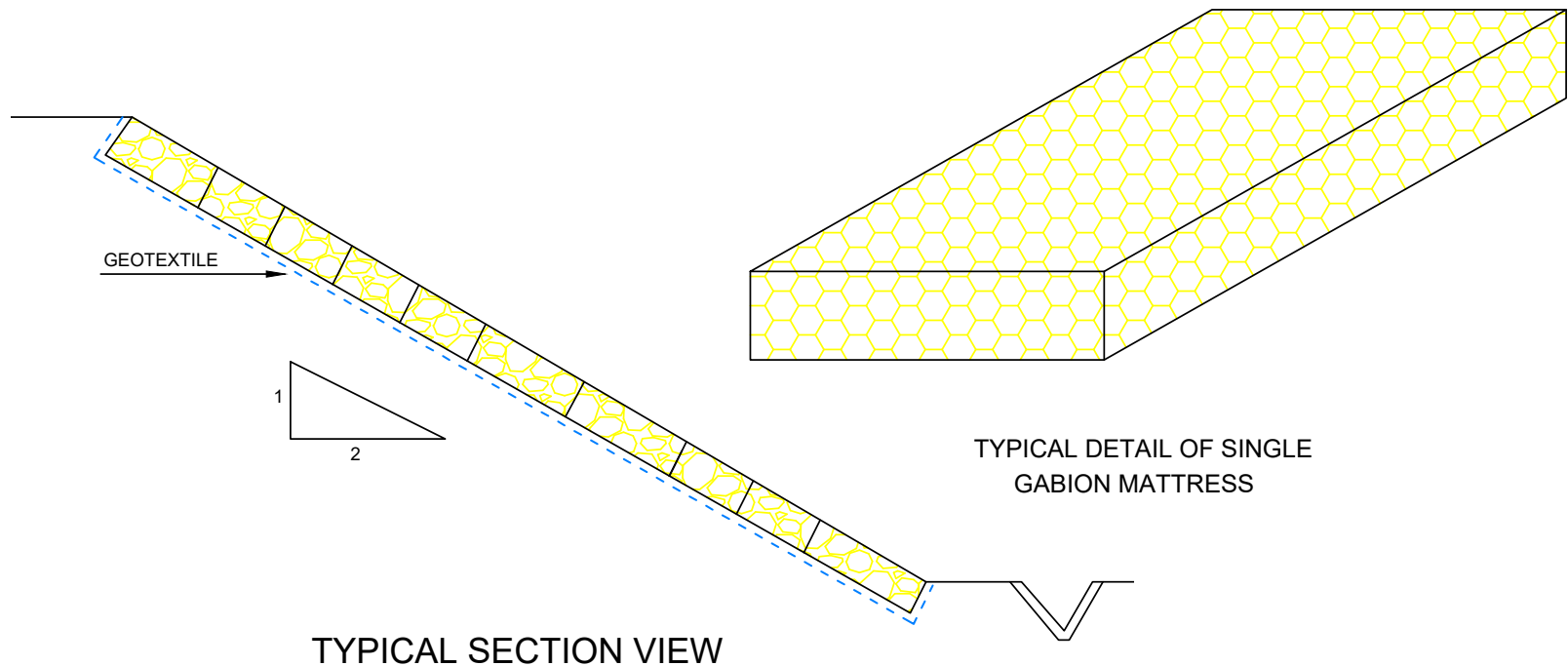
# GABION MATTRESS

SURFACE PROTECTION



Lebuhraya Utara - Selatan (E2)

# TYPICAL CROSS SECTION OF GABION MATTRESS







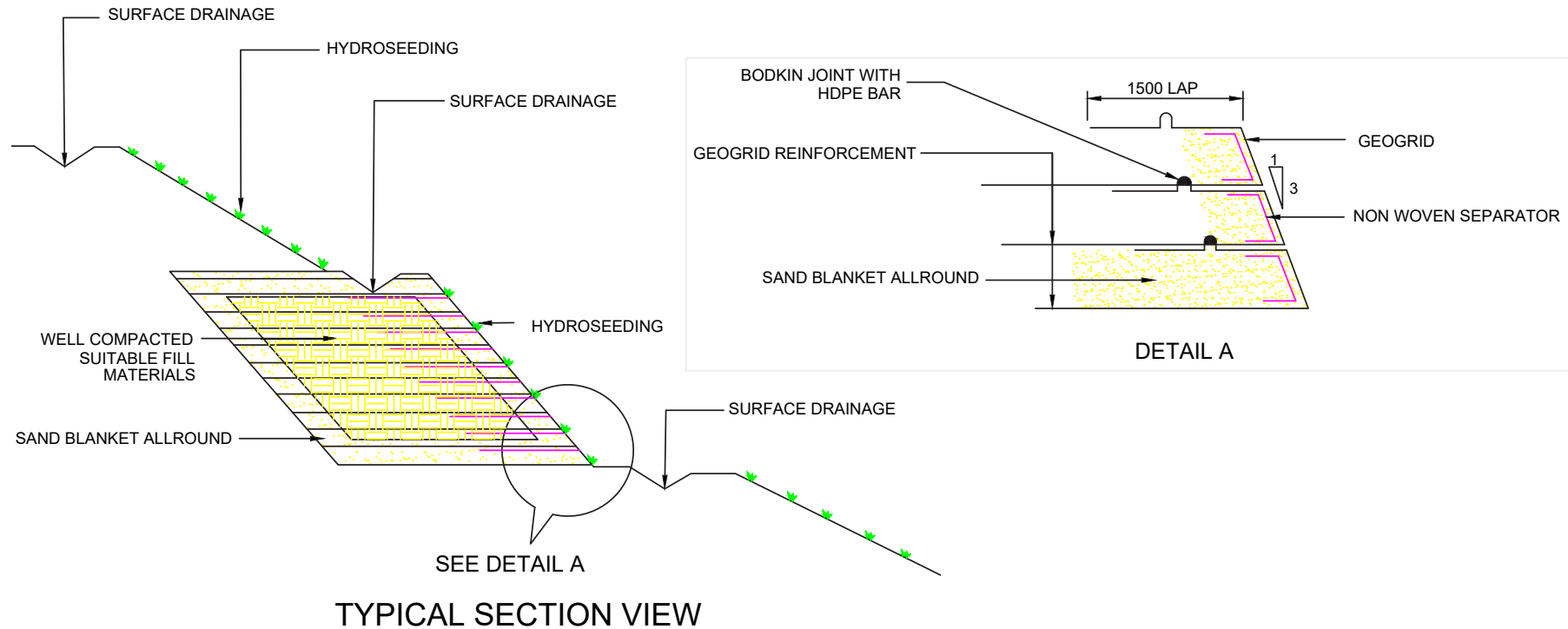
# GEOSYNTHETICS

SURFACE PROTECTION



Jalan Aring 8 - Kenyir - Kuala Jeneris (FT36)

# TYPICAL CROSS SECTION OF GEOSYNTHETICS





# HYDROSEEDING

SURFACE PROTECTION



Jalan Gerik - Jeli (Lebuhraya Timur Barat) (FT4)



SPRM Kuantan, Pahang





Jalan Aring 8 - Kenyir - Kuala Jeneris (FT36)

# CLOSE TURFING

SURFACE PROTECTION



Jalan Felda Kechau 1, Kuala Lipis

SMK Clifford, Kuala Lipis



SMK Dato' Sheikh Ahmad, Seremban



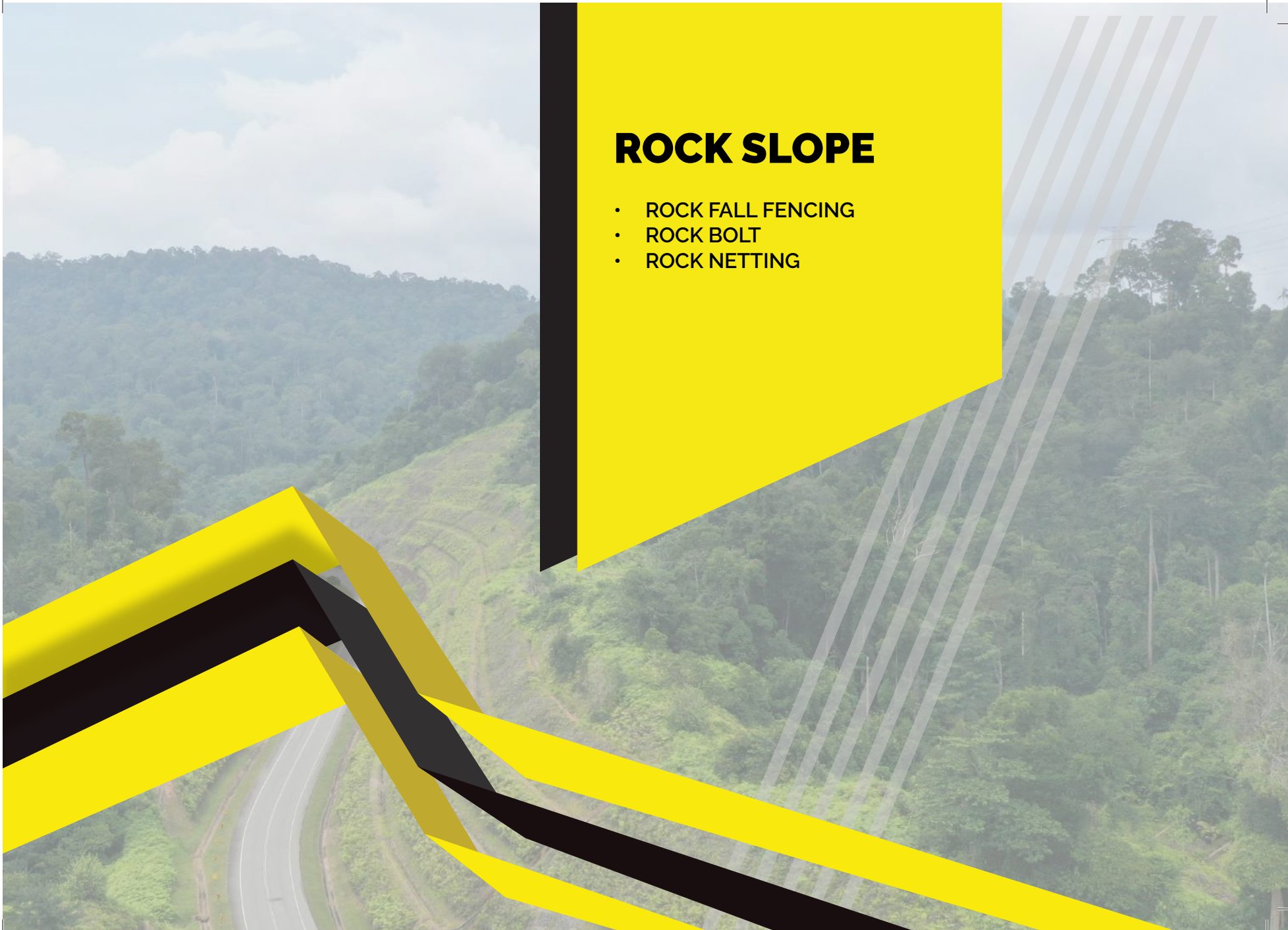
22.01.2019





# ROCK SLOPE

- ROCK FALL FENCING
- ROCK BOLT
- ROCK NETTING







Jalan Lojing - Gua Musang (FT185)



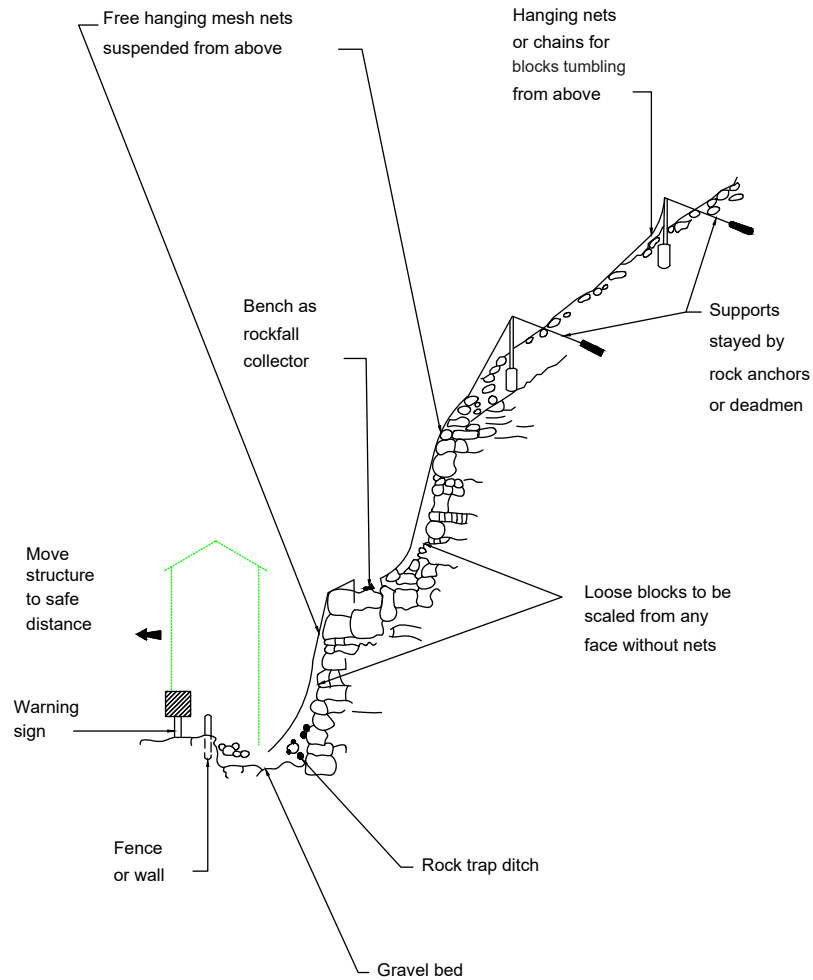
Lebuhraya Pantai Timur (E8)



# ROCK FALL FENCING

ROCK SLOPE

# TYPICAL ROCK FALL FENCING



Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)



# ROCK BOLT

ROCK SLOPE

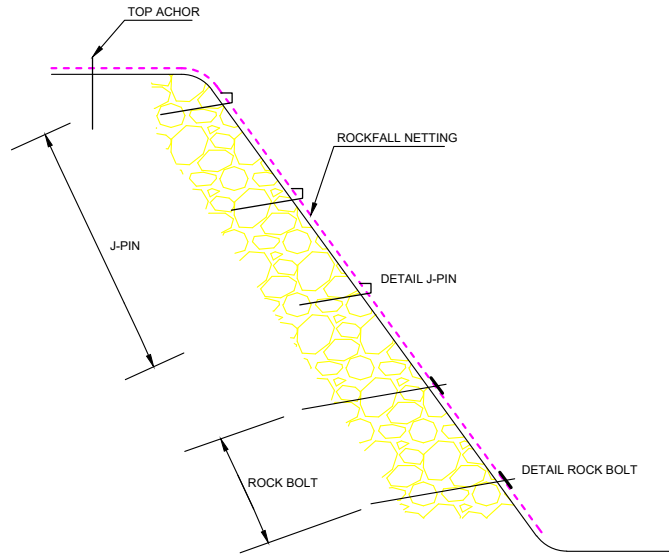


Jalan Lojing - Gua Musang (FT185)

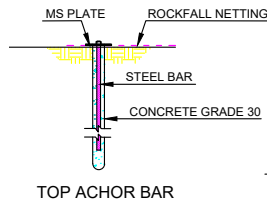




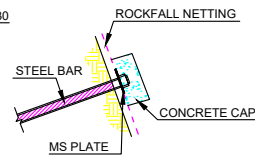
# TYPICAL ROCK BOLT



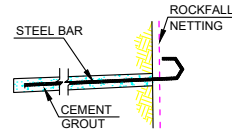
TYPICAL SECTION VIEW



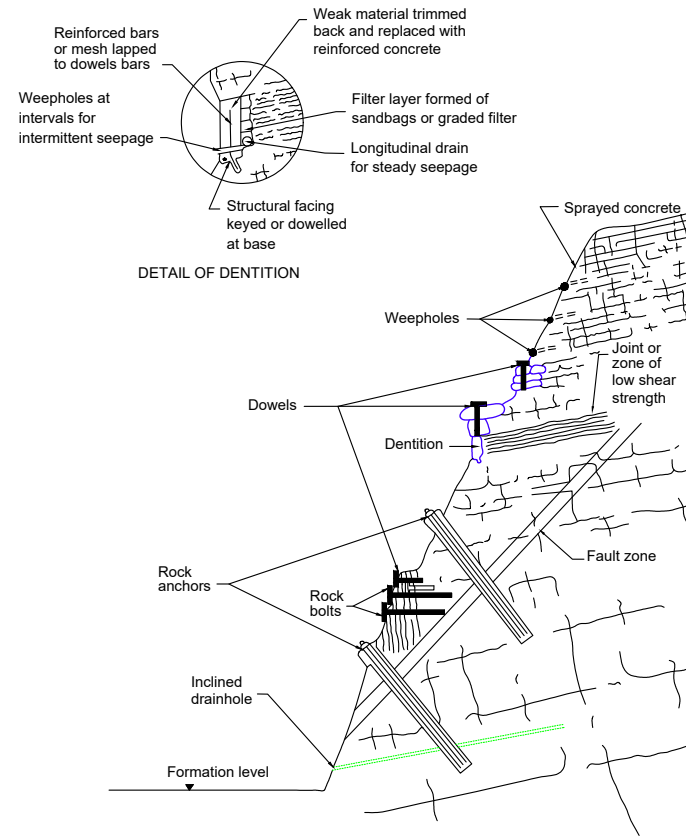
TOP ANCHOR BAR



DETAIL OF ROCK BOLT

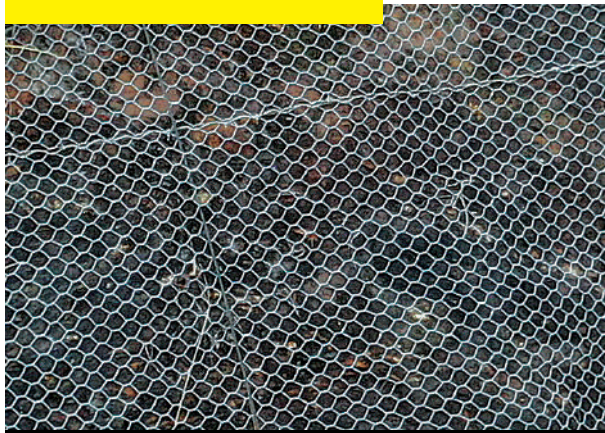


DETAIL OF J-PIN



Source: Guidelines for Slope Design, Slope Engineering Branch, PWD (2010)





Lebuhraya Pantai Timur (E8)



# ROCK NETTING

ROCK SLOPE





# OTHERS

- SABO DAM
- ROCK SHED

AWAS  
SELOM TELUK  
DI BILAPAN  
KUBANGKANG (L.A.B)



# SABO DAM

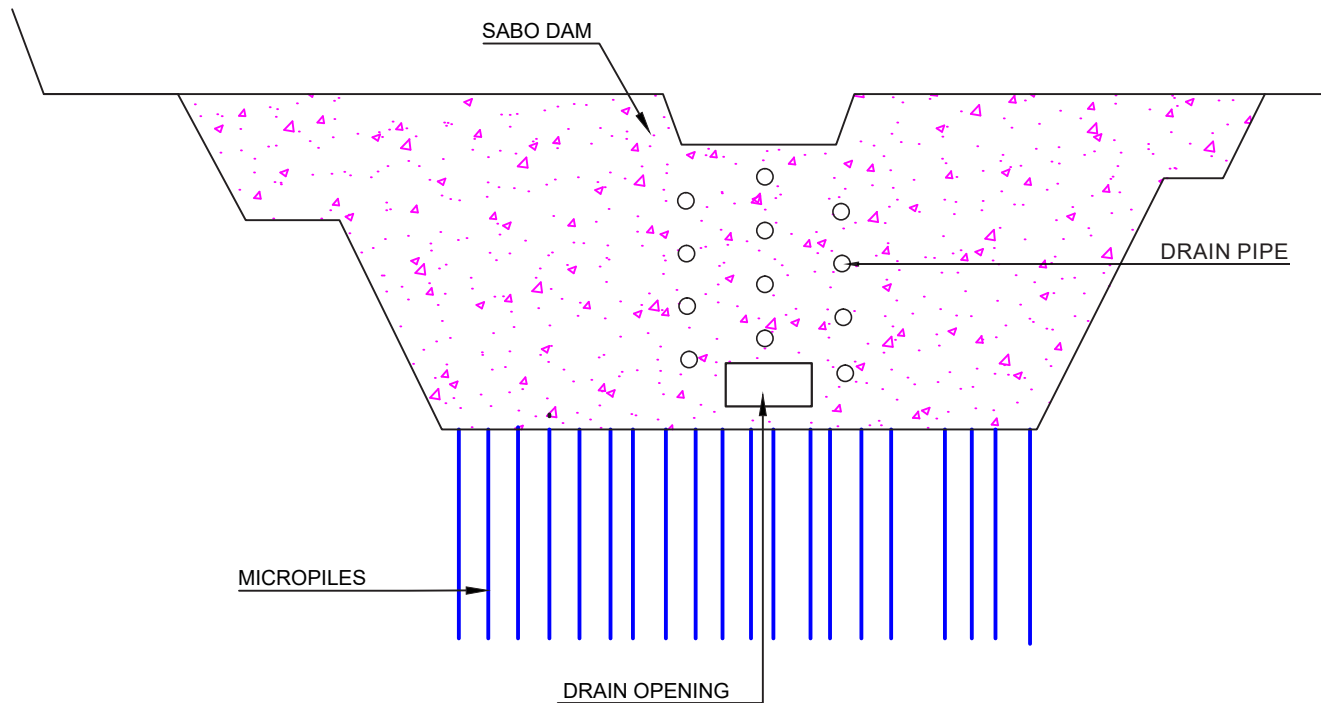
OTHERS



Jalan Kuala Kubu Bharu - Gap (FT55)



# TYPICAL FRONT VIEW OF SABO DAM



TYPICAL SECTION VIEW

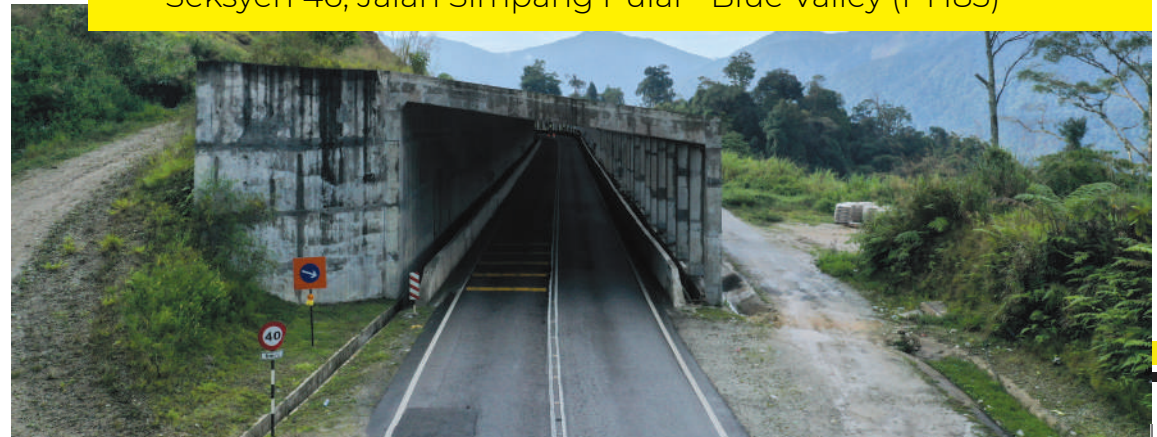


# ROCK SHED

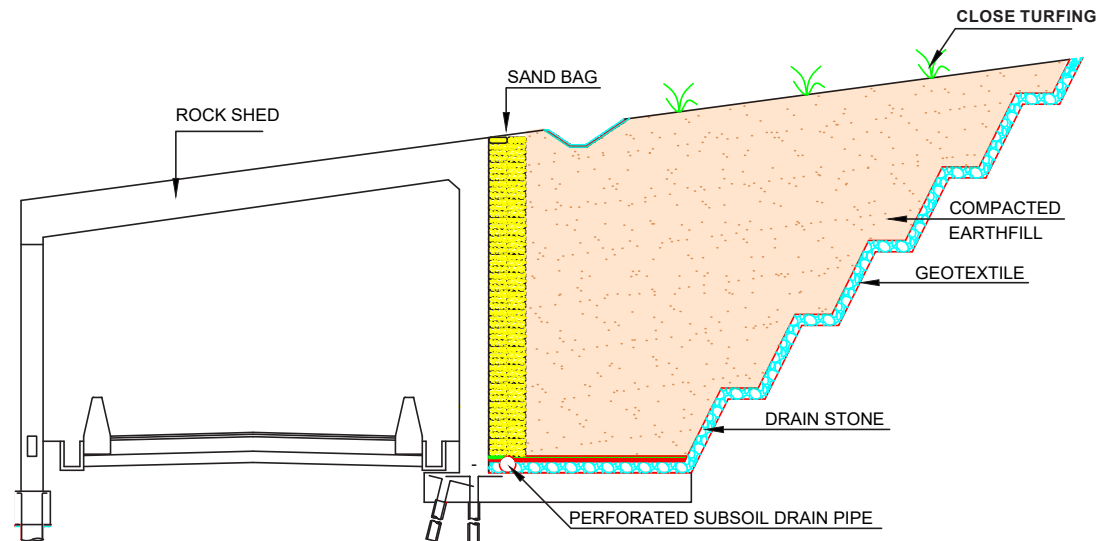
OTHERS



Seksyen 46, Jalan Simpang Pulai - Blue Valley (FT185)



# TYPICAL CROSS SECTION OF ROCK SHED



TYPICAL SECTION VIEW



