

NATURE BASED LANDSLIDE RISK MANAGEMENT PROJECT IN SRI LANKA

**Knowledge Sharing Workshop and Study Tour
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Bangkok & Chiang Rai, Thailand**

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OUTLINE

- ▶ Introduction
- ▶ An insight to the Thailand approach of Disaster Prevention and Risk Mitigation
- ▶ Introductory session on KU slope software
- ▶ Effects of climate changes in Flood and Risk management: Inception Seminar
- ▶ Application of bio - engineering solutions to Landslide risk mitigation
- ▶ Acknowledgement

Introduction

- ▶ The study tour was organized by the Asian Disaster Preparedness Centre (ADPC)
- ▶ The team consisted of representatives from National Building Research Organization (NBRO), University of Moratuwa and Asian Disaster Preparedness Centre (ADPC) participated in the programme.
- ▶ During the tour the team got the opportunity to visit
 1. National Disaster Warning Center (NDWC)
 2. Inception Seminar Effects of climate changes in Flood and Risk management:
 3. Introduction to KU Slope software
 4. Landslide sites in Chaing Mai

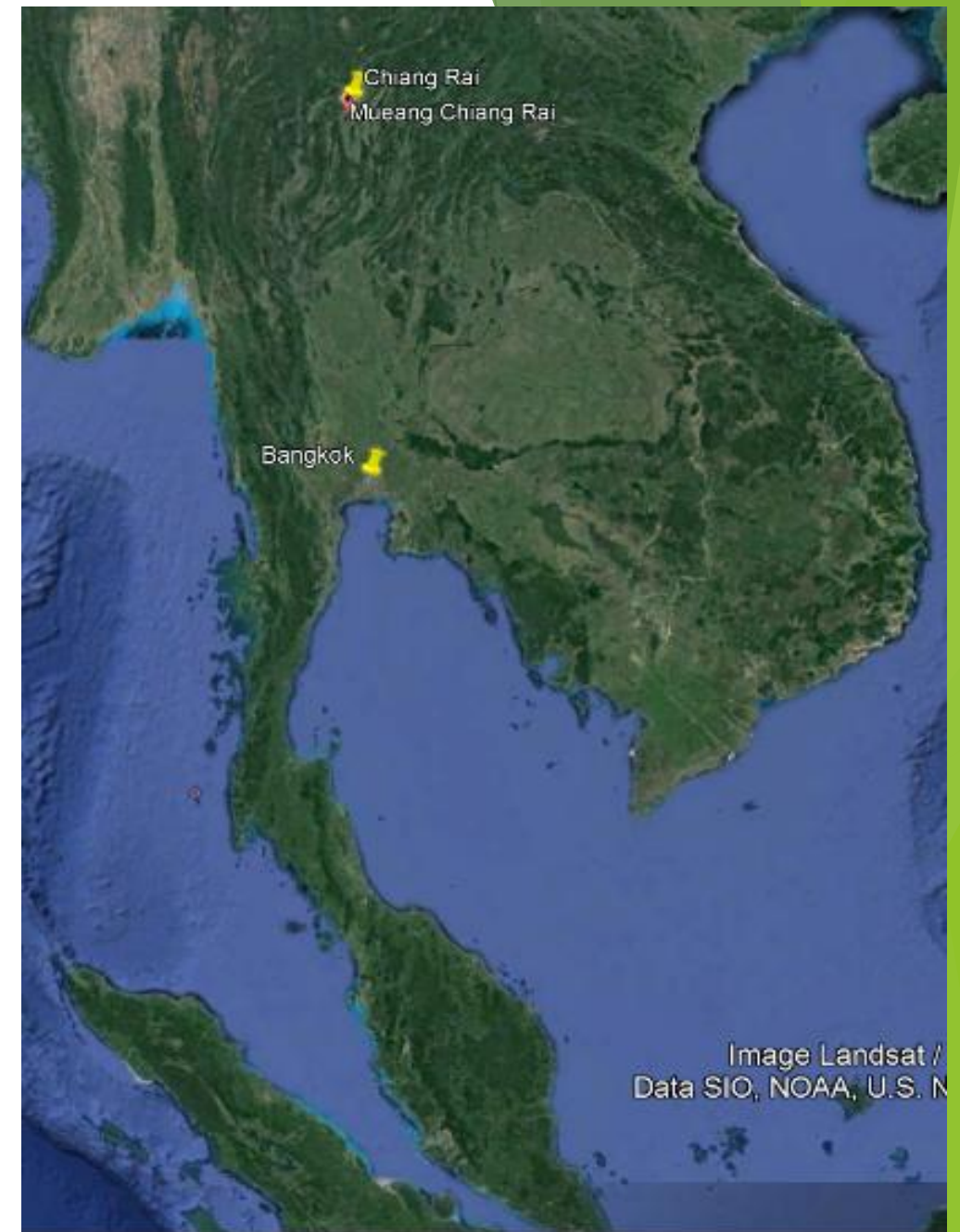


Figure: Places visited

An insight to the Thailand approach of Disaster Prevention and Risk Mitigation

Visit to National Disaster Warning Center (NDWC) DDPM is the

- NDWC functions under the department of Disaster Prevention and Mitigation in Bangkok (DDPM)
- NDWC is the centralized institute in Thailand for monitoring and issuing warning in related to all the catastrophic events.
- NDWC monitors not only the meteorological events such as floods and landslides but all such events which can have negative impacts on day to day lives of the people.
- For an example NDWC monitors:
 - Geological hazards
 - Hydrological hazards
 - Meteorological hazards
 - Forest fires
 - Road Accidents
 - Other man- made disasters



- ▶ Besides, issuing warning NDWC keeps records of all the events that took place and make predictions on possibilities of similar events.
- ▶ Also, they actively involve in guiding , providing information and also policy and decision making with regard to disaster mitigation. For an example they use the road accident data to provide guidance to manage local traffic.
- ▶ They use different ways of disseminating the message, such as: radio signals, short message services (SMS), television and community based systems like in Sri Lanka.
- ▶ Once the disasters are occurred in Thailand, they are being managed by different levels of authorities based on the magnitude of the event.
 - ▶ Extra-large scale disaster is managed by the Prime Minister
 - ▶ Large scale disaster is managed by the Minister of Interior
 - ▶ Medium scale disaster is managed by the provinces and Bangkok metro admin
 - ▶ Small scale disaster is managed by the district itself

Alerts and early warning issued by NDWC

Red:

Denotes the situation where the likelihood of hazardous event is most imminent. It is recommended to remain or stay in completely safe place and follow the advice or instruction of the authorities.

Orange:

Denotes the situation where the likelihood of hazardous is imminent. The government officials are attempting to bring emergency situation under control. Take immediate action to evacuate to designated safety place and follow the guidelines set forth.

Yellow:

Denotes the situation where there has been an increased likelihood of hazardous event. It is advised to be prepared to cope with potential disaster and to confirm to the current advice.

Blue:

Denotes the situation where an activation of disaster surveillance system is needed. Take all required steps to closely keep track of disaster information on a 24 hour basis.

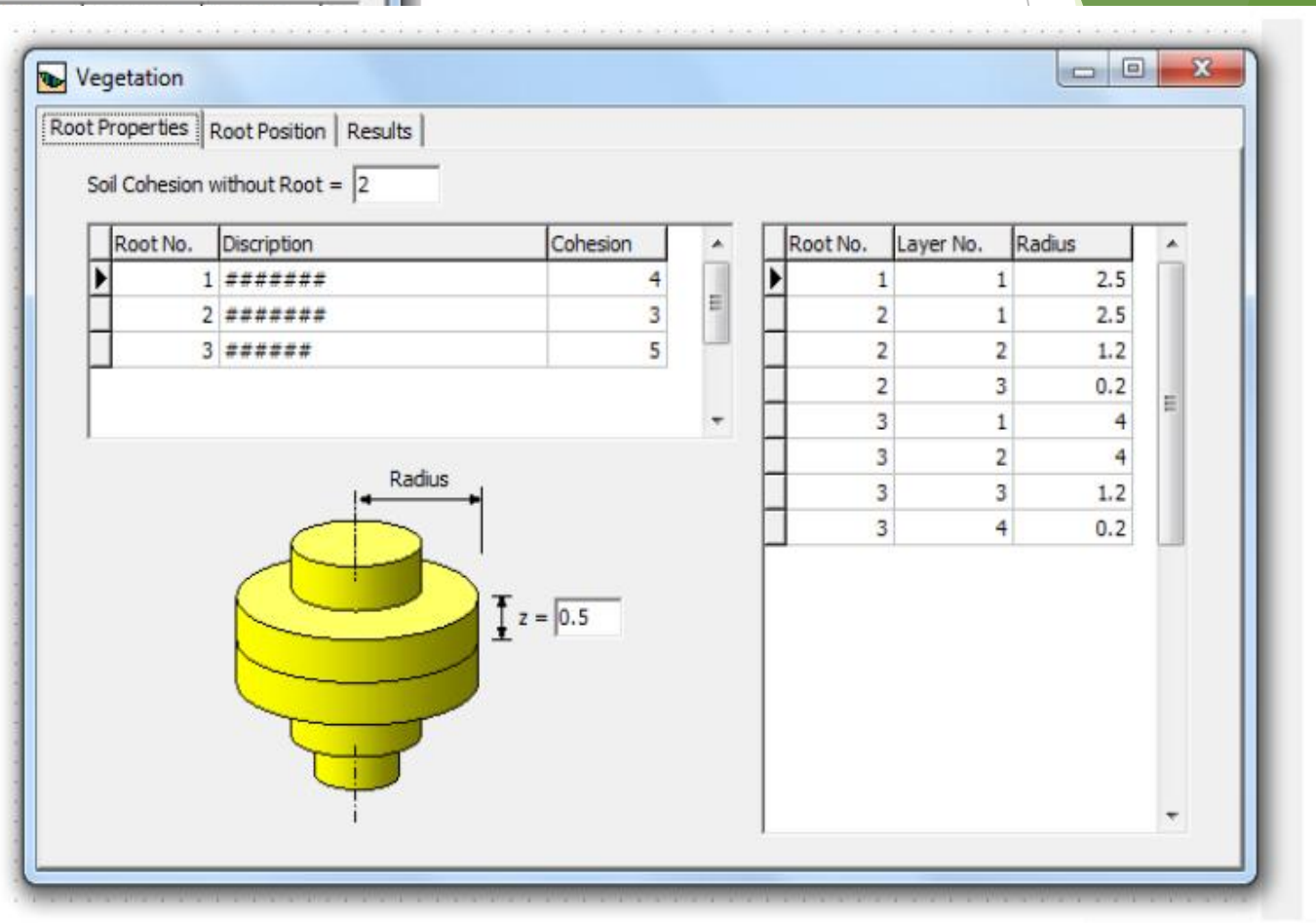
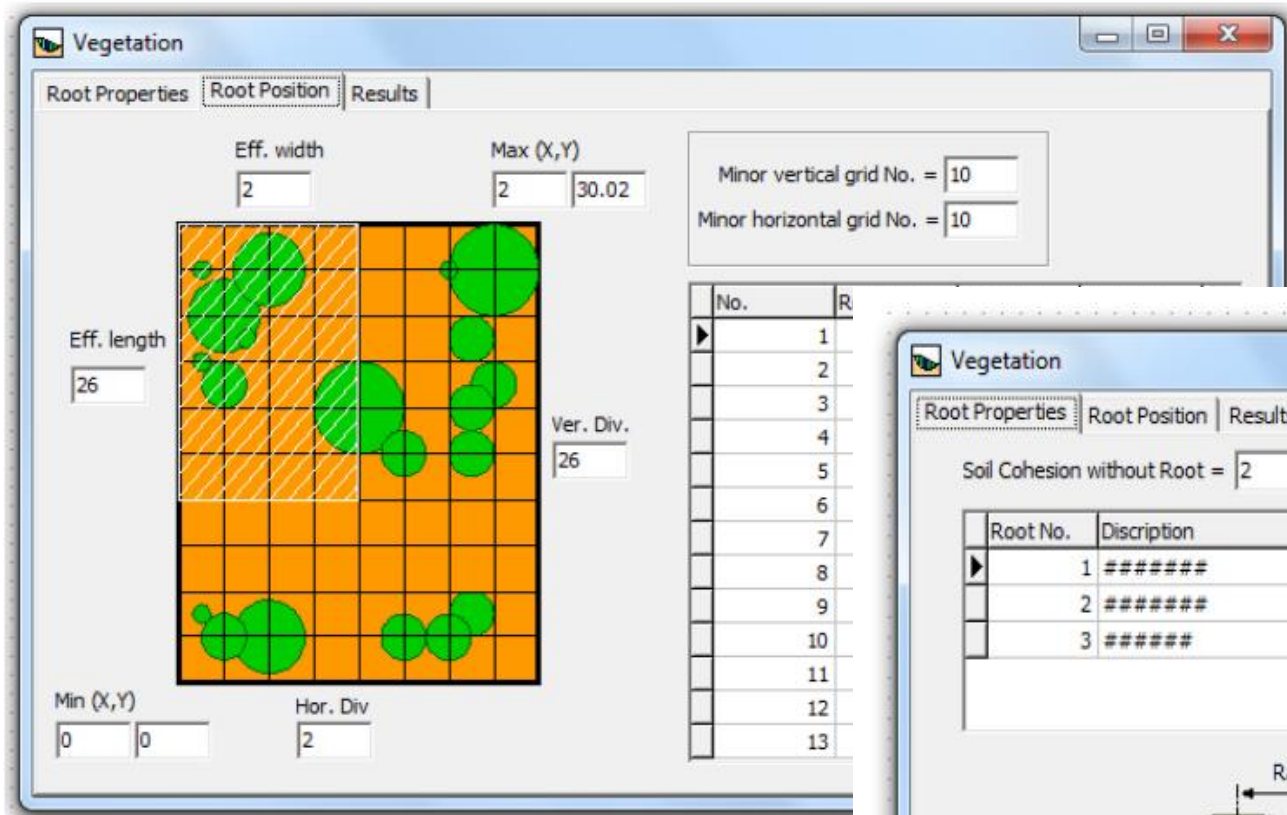
Green:

Denotes non-emergency situation. It is advised to keep track of relevant information on a regular basis.

Introductory session on KU slope software

- ▶ An introductory session on KU Slope software was conducted at the Kasersart University. KU slope is a software developed by the Geotechnical Engineering Research Division (GERD) of Kasetsart University, Thailand
- ▶ Like other commercially available software KU slope is capable of modelling the stability of slopes under different conditions.
- ▶ The most important aspect of this software is that it is capable of modelling shape of the root system. i.e conical, cylindrical and etc.
- ▶ It is a freeware and still at its development stages.





Modelling the morphology of roots using KU slope

Effects of climate changes in Flood and Risk management: Inception Seminar

- The team got the opportunity to participate in the Seminar organized under the ASEAN Project on "Disaster Risk Reduction by Integrating Climate Change Projection into Flood and Landslide Risk Assessment" .
- The seminar is on managing different risks arising from climate changes. It was a good platform for participants to share their views on different approaches used in their countries in managing the adverse impacts of climate changes.
- Representatives from Vietnam, Myanmar, Thailand and other South East Asean Countries presented their experiences in Flood mitigation.
- During the seminar Dr. U.P Nawagamuwa shared Sri Lankan experience in Landslide risk management in Sri Lanka.

- During the discussion session it was observed that Sri Lankan approach in **Landslide risk mitigation** found to be well advanced and all most all the delegates admired it. Specially they were keen on sharing **Sri Lankan experience on using Drone Technology** and as well as **Hazard Zonation Mapping**.



Sri Lankan representatives participating in the discussion

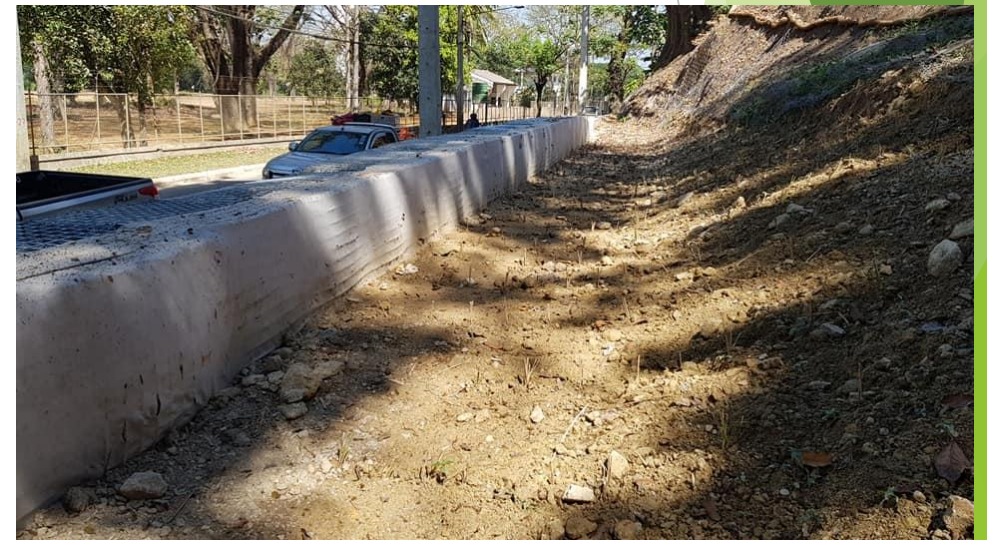
Application of bio - engineering solutions to Landslide risk mitigation

- ▶ Field visits were conducted to sites where some bio - engineering solutions are used in landslide risk mitigation in Chain Rai province of Northern Thailand.
- ▶ All the technical aspects that have been used in these sites were explained by Dr. Suttisak Soralump and his team.
- ▶ Site 01 : Wat Phra That Doi Chom Thong
- ▶ The site is located within Chiang Rai city limit area. The land belong to the temple “Wat Phra Tha Doi Chom Thong”.
- ▶ The failure is stabilized by drilling soil nails with grout of 3m deep. The nails are setup in a rectangular pattern (2.6 m x 2.8 m) covering the unstable slope
- ▶ A native grass type (bushy type) has been planted in order to protect the face of the slope
- ▶ An earth mattress made up of coconut coir is laid over as a temporary measure to minimize soil erosion until the plants grow.

Structural and Bio-Engineering measures implemented at site



Gabion wall acting as a toe support

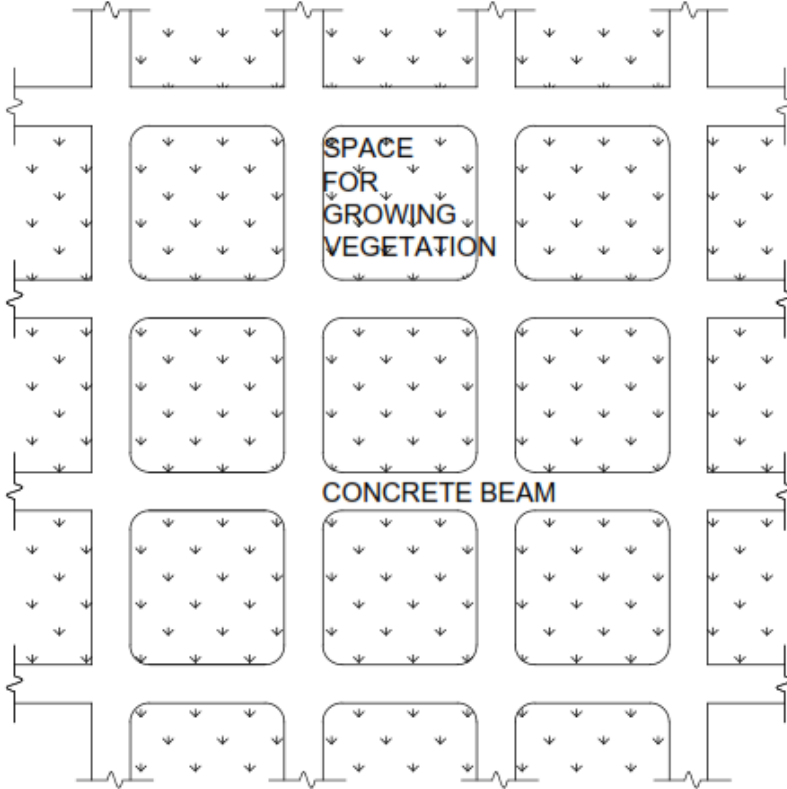


Vetiver grass was planted behind the Gabion Wall which was wrapped with a white color geotextile

Earth mattress, Coconut coir and Soil nail

Site 02 : Mae Sai city site

- ▶ Numerous mitigation measures had been implemented along the Mae Sai city road to reduce landslide risk.
- ▶ A grid beam system had been constructed at the above Mae Sai.
- ▶ At present vegetation have covered the site blending with the natural ecological environment in the surrounding



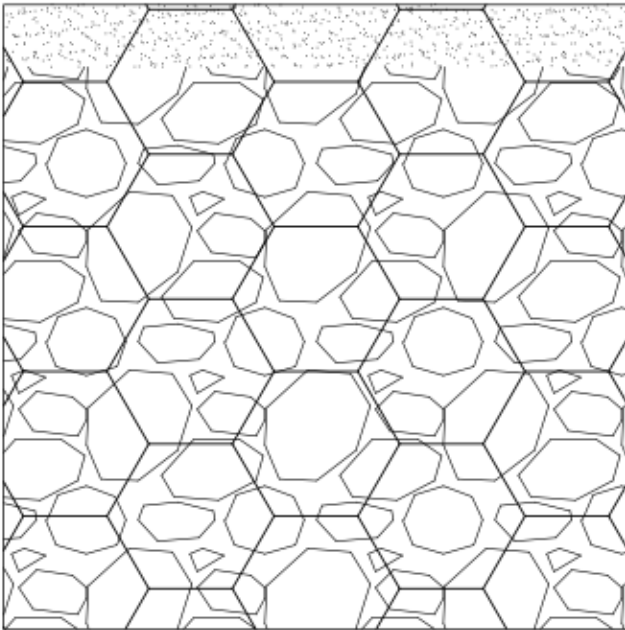
Grid beam system constructed to mitigate the landslide. In between Provisions have been made for growing vegetation. Nutrient rich soil types had been introduced in between the beams to accommodate The growth of vegetation.



Current appearance of the slope which is mitigated using both structural and bio engineering measures.

Site 03 : Site at the Doi Tung Royal Villa Road

- ▶ A Mechanically Stabilized Earth Wall had been constructed at the above locations.
- ▶ It is similar to a Gabion wall but with soil fill (10%) and rock fill (90%). **The soil fill helps vegetation to grow.**
- ▶ At present, many local grasses have been grown on them



SOIL 10%

RUBBLE 90%

Schematic diagram of the combination of a Gabion wall and a soil fill



Current appearance of the wall

Site 04 : Doi Tung site 02

- This location has a gabion wall at the toe of the slope which is reinforced by bamboo treated with boric acid.
- The treatment is done to increase the resistance and durability of bamboo. On the slope face.
- In addition they have tried to plant vegetation by making holes according to a regular grid pattern.



Slope face is drilled for growing plants. The toe of slope is strengthened with a gabion wall

Use of TOR blocks for constructions

- ▶ TOR blocks are made of in- situ soils taken from failed slope mass.
- ▶ It contains a Soil: Cement ratio of 5:1.
- ▶ These blocks are used in constructing retaining walls in landslide mitigation activities.

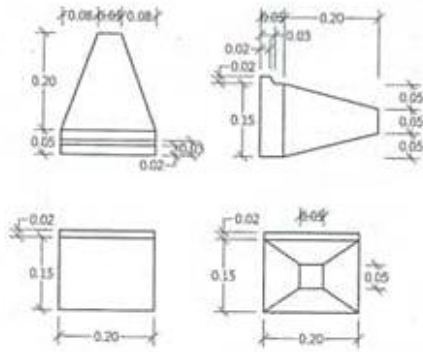
TOR Block



Construction of TOR blocks and use of TOR Blocks in construction

Soralump et al. (2013)

Use of TOR blocks for constructions



TOR BLOCK TYPE 1



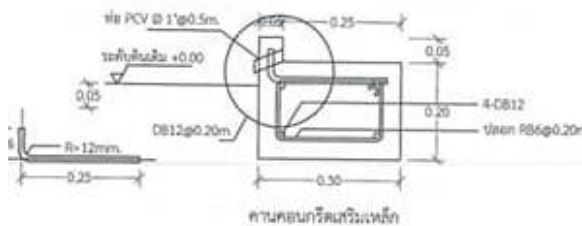
การระบายน้ำในช่องว่างของบล็อก



Walls constructed using TOR blocks

- Drainage is provided by creating weep holes at the toe blocks as seen in the above photos.
- The spacing in between the blocks too serve as drainage paths
- Construction of a 1 sqm using “TOR” blocks costs around \$15.

Some information on TOR blocks



Acknowledgement

- ▶ National Building Research Organization
- ▶ Asian Disaster Preparedness Centre (ADPC), Sri Lanka and Thailand

Thank You