

Another Malaysian Experience
Debris Flow Barrier Along North - South Expressway
(Along KM 261.75 to KM 302.5)



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The Debris flow Barrier installed to protect the columns of the bridge with retaining volume of approx. 3,000 m³.

Site investigation had observed soil condition about 30 meters upstream along the riverbed. It was a dense jungle. At the bottom of the riverbed is mainly fine sand. The rims of the valley consist of dark brown soil and stones of various sizes. The bottom of the gully is mainly rock outcropping consisting of dark schist and light shale. In some parts are quartz veins as a result of the granite intrusion. The overburden or weathering zone is of different thickness. The overburden is very blocky with sizes up to 4 meter in diameter.

Based on the map forwarded by the client(km 301.0 - 304.5) we observed a catchment area at location 0.112 km². Short term precipitation of e.g. 30 mm/m² results to a total water amount of 336'000 litres. There appears to be possible landslides at rainy season causing destabilisation of the colluviums. Transport medium of water is available.

The situation allows a barrier length of 23 meters and 6 meters high. The calculations led to a design energy of 2'744 kJ. The calculations and taking a safe view to mitigate future debris flows we proposed our strongest debris flow barrier type UX-300 (3'000 kJ)

The input parameters are as follows:

- Width of flow channel (centre field) 10 m
- Estimated flow volume 3'000 m³
- Inclination of river bed ~ 10°
- Density of debris material 2'300 N/m³
- Resistance coefficient n_d 0.11 sm³
- Time of impact (max.) 4 sec.

North - South Expressway (Malaysia) KM 302.3



The debris flow barrier is to keep the culvert clear with retaining volume of approx. 1'100 m³.

Walked about 300 m upstream along the riverbed. The bottom of the riverbed is mainly rock with minor layer of sand and various sizes of stones and blocks approximately 0.5 meter in diameter. The rims of the valley consist of dark brown soil with stones of different sizes with some blocks as big as 3 meter in diameter.

From maps received (Km 301.0 - 304.5) has a catchment at location 0.174 km². Short term precipitation during rainy season with e.g. 30 mm/m² results to a total water amount of 522'000 litres. Rainy season destabilises the colluvium and leading to landslides. Transport medium of water is available.

The situation allows a barrier length of 23.5 meter and 6 meter in height. The retaining capacity of this barrier is about 1,100m³. The calculations revealed a design energy of 2'338 kJ. Because of the calculations and the best possible mitigation proposal recommended our strongest debris flow barrier type UX-300 (3'000 kJ). This value was used for dimensioning of the barrier according to the "Dimensioning Concept for Geobrug Flexible Debris Flow Barriers". Debris flows with higher volumes can go over the barrier.

The input parameters are as follows:

- | | |
|---|------------------------|
| - Width of flow channel (centre field) | 8 m |
| - Estimated flow volume | 1'100 m ³ |
| - Inclination of river bed | ~ 10° |
| - Density of debris material | 2'300 N/m ³ |
| - Resistance coefficient n _d | 0.11 sm ³ |
| - Time of impact (max.) | 4 sec. |



Debris flow Barrier above the Expressway

The upper section of this picture you can view a landslide. Moving direction seems to be to the bottom left side of the valley. The situation in general is relatively critical because of a higher thickness of overburden below the sliding area.

At site visit we viewed the gully uphill about 300 - 400 meter. At the initial stage we viewed outcropping rock with a thin layer of overburden and several boulders, presumably remnants of ancient debris flows. Further up the layer of overburden increases to several meter thick with slope inclination increasing drastically. Thus there is high potential of failures in this area

The retaining capacity of this barrier is about 700 m³. This value was used for dimensioning of the barrier according to the "Dimensioning Concept for Geobruge Flexible Debris Flow Barriers". Debris flows with higher volume can go over the barrier.

The calculations lead to a design energy of 2'248 kJ. The derived calculations proposed our strongest debris flow barrier type VX-300 (3'000 kJ) of 16 meter in Length and 5 meter in Height

The input parameters are as follows:

- | | |
|--|------------------------|
| - Width of flow channel (centre field) | 5 m |
| - Estimated flow volume | 700 m ³ |
| - Inclination of river bed (at barrier location) | ~ 10° |
| - Density of debris material | 2'300 N/m ³ |
| - Resistance coefficient n _d | 0.11 sm ³ |
| - Time of impact (max.) | 4 sec. |



The Debris flow Barrier is to keep the culvert clear with retaining volume of approx. 1'100 m³.

Trap volume approximately 180 - 230 m³ for the material. This value was used for dimensioning of the barrier according to the "Dimensioning Concept for Geobrug Flexible Debris Flow Barriers". Debris flows with higher volume are going over the barrier. Length of Barrier 5 meters and Height is 3 meters.

Section of the riverbed with boulders up to 2 m in diameter. Beneath the cover of gravel and boulders is solid rock. The origin of debris flow material is upstream and from the flanks of the valley.

The input parameters are as follows:

- | | |
|--|------------------------|
| - Width of flow channel (centre field) | 5 m |
| - Estimated flow volume | 230 m ³ |
| - Inclination of river bed (at barrier location) | ~ 40° |
| - Density of debris material | 2'300 N/m ³ |
| - Resistance coefficient n_d | 0.11 sm ³ |
| - Time of impact (max.) | 4 sec. |

The calculations lead to a design energy of 1'035 kJ. We proposed our debris flow barrier type RX-150 (1'500 kJ).

North - South Expressway (Malaysia) KM 261.75



Debris flow Barrier to protect downstream of the North South Expressway

Approximately 200 m above the highway is a sliding area with a now remaining volume of about 500 to 800 m³. In there are several blocks with size up to diameter 1 m. Sliding of the material is still possible.

Failure at km 261.7. A layer of approx. 1 m thickness slides down slope. Blocking of the stream with trees stones and soil material is possible. A breaking of this dam can cause a debris or mud flow which picks up material while rushing down stream and can cause devastating damages

The calculations lead to a design energy of 2'541 kJ. GEOBRUGG type UX-300 (3'000 kJ) to stop an eventual debris or mud flow. Height of Barrier 5 meter, Length 16 meter. Assumed retaining capacity of 500 - 800 m³.

Sediment trap at the end of the stream. Storage capacity is approx. 15 - 20 m²

The input parameters are as follows:

- | | |
|--|------------------------|
| - Width of flow channel (centre field) | 4 m |
| - Estimated flow volume | 800 m ³ |
| - Inclination of river bed (at barrier location) | ~ 5° |
| - Density of debris material | 2'300 N/m ³ |
| - Resistance coefficient n _d | 0.11 sm ³ |
| - Time of impact (max.) | 4 sec. |