

Vetiver System for Infrastructure Protection in Vietnam: A Review after **Fourteen Years of Application on the Ho Chi Minh Highway (**2000- 2014**)**

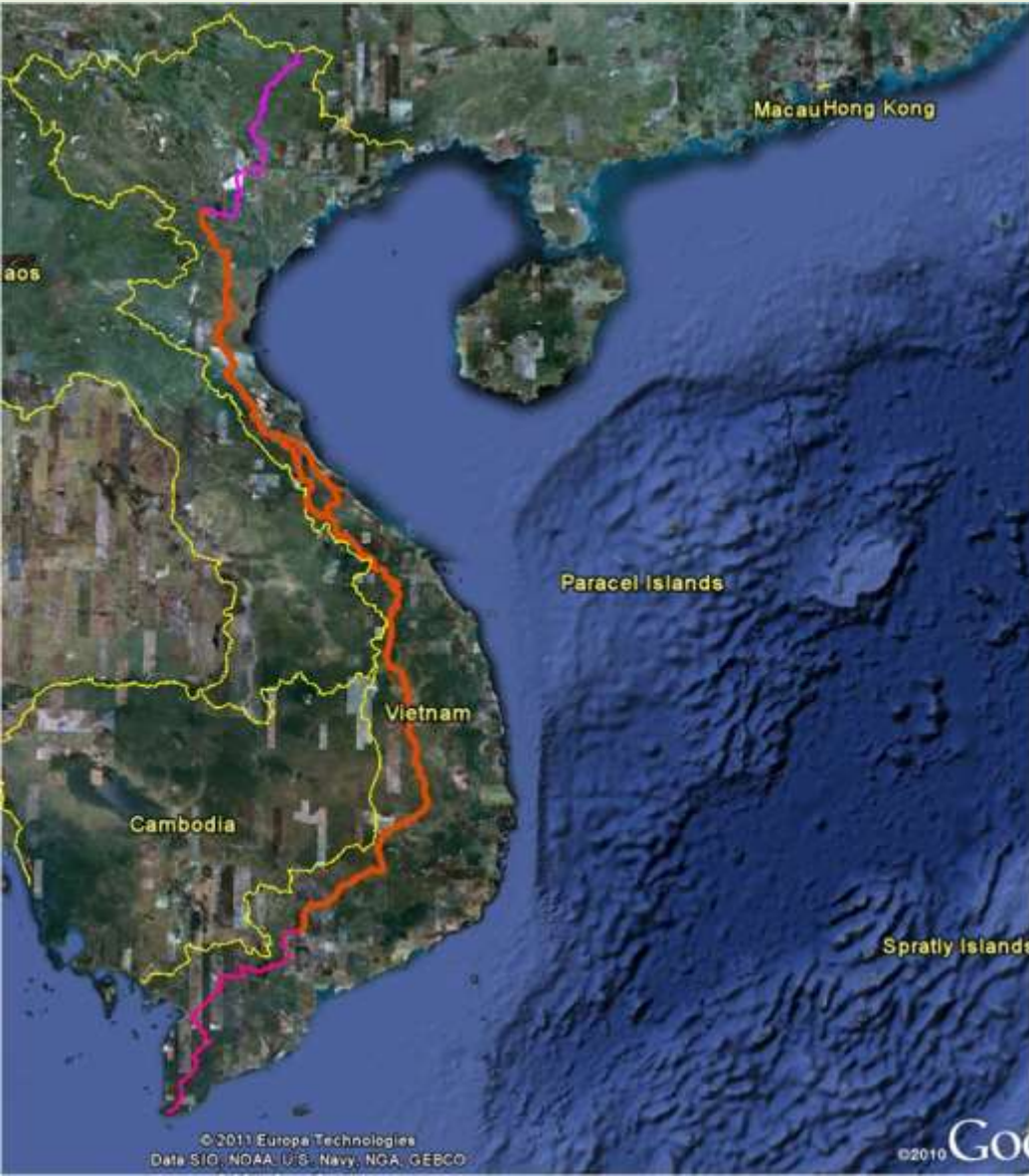
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The Ho Chi Minh Highway (HCMHW)

A brief Introduction



- Master plan approved by Government in 1997
- Construction started in 2000;
- 40-100m wide (2-8 lanes), composed of sections:
 - Section 1 (Hanoi-Quang Binh): 500km;
 - Section 2 (Quang Binh-Quang Nam): 2 branches i.e. East HCMHW, 364km; and West HCMHW, 514km;
 - Section 3 (Quang Nam-HCM City): 825km;
- Connects Cao Bang in the North with Cape Ca Mau in the South, totaling in length 3,200km. Connects with National Route No.1 by 20 traverses totaling 1,700km

The original HCM Trail, started as a goat tract in 1956, then upgraded for bicycles and eventually for trucks and tanks in the 70s. Now further widened for earth moving equipment. Mostly hidden then under a thick canopy of tropical rainforest.



3 2 2002

CONSTRUCTION PHASE

Note the scars on the mountain side. Altogether it was almost 5 000km long, including traverse connecting roads



Very steep cutting and no benches or drainage channels



Collapsed under its own weight in the dry season, 3 months after cutting





Erosion started while bitumen paving in progress





Conventional hard structure solution: Small and large retaining walls





But these massive and costly retaining walls by themselves did not stop erosion during the typhoon season



If unprotected, this was what happened during the typhoon season



OPTIONAL SOLUTIONS

1. Extremely costly conventional hard structure or
2. Vetiver Bioengineering



VETIVER BIOENGINEERING: *APPLICATION PHASE*

Following the obvious failure of the costly conventional measure in controlling the erosion and landslips along the Highway, the Ministry of Transport adopted VS as a preferred erosion control measure on all new sections of the Highway and on eroded slopes of the completed sections.



One to two month old planting on newly constructed batters



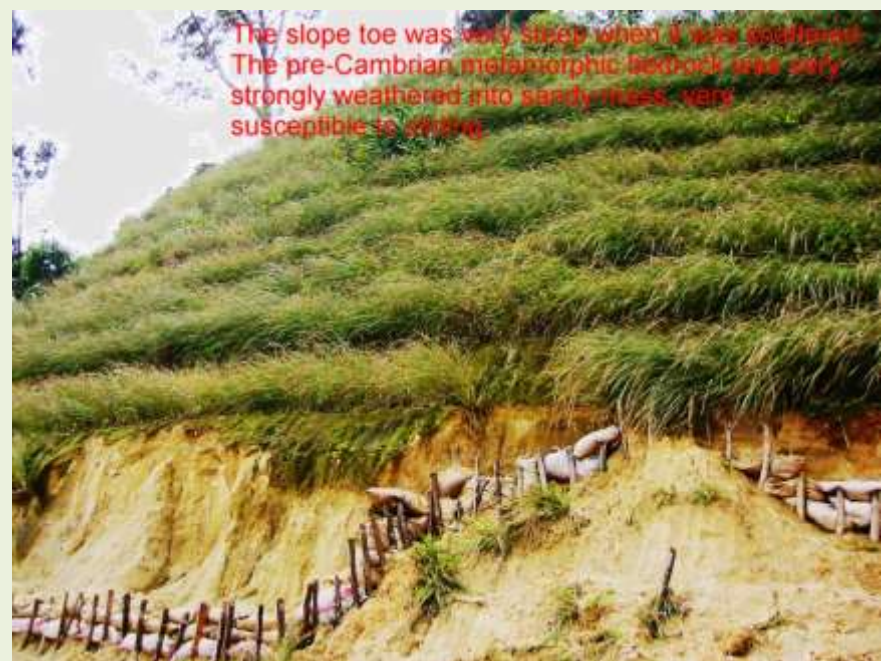
**One to two month
old planting on
old eroded
batters**



The same slope with landslide. Note that the slope toe was damaged and had to be temporarily reinforced with bamboo stick and sand bags.



The slope toe was very steep when I was installed. The pre-Cambrian metamorphic bedrock was very strongly weathered into sandy mass, very susceptible to sliding.



Ten month old planting, good growth but toe slope should be protected



Another look at the steep shattered slope toe.



SPRING PASS DEMONSTRATION SITE

This mountain pass is called Spring Pass (Deo Lo Xo) because it is so winding and twisting like a metal spring. This pass is at 1060m altitude and 2000mm annual rainfall, with torrential rain in summer and occasional typhoons.



Cut batter (1.5:1) 55m vertical drop and about 100m slope length



**Using abseiling method,
contour furrows were
prepared for planting at
VI 1-2m**



Workers

Despite badly designed (no benching and Internal drainage), this very steep batter was successfully stabilized 3 years after planting. Survived several typhoons



With Vetiver

No Vetiver



FAST FORWARD: 14 YEARS LATER

February 2014



Over the distance of about 1 000km of Sections 1 and 2 of the HCMHW, stretching over a wide range of geology, topography, altitude and climate, it was very pleasing to note that the Vetiver System has successfully stabilized this highway in general .





General view along the Highway in February 2014





General view along the Highway in February 2014





Local plants

General view along the Highway in February 2014



Vetiver



SOME BEFORE AND AFTER SCENERY



SOME BEFORE AND AFTER SCENERY

2005



2011



2005



2014



Vetiver

Local plants and Vetiver

SOME BEFORE AND AFTER SCENERY



2005



2011



2005



2014

Local plants and Vetiver

17 1 2005

SOME BEFORE AND AFTER SCENERY



2005



2014



Local plants and Vetiver

SOME BEFORE AND AFTER SCENERY



Vetiver

2005

2014



Local plants and Vetiver

SOME BEFORE AND AFTER SCENERY



2000



2014



Local plants and Vetiver



2014 Some vetiver left but mostly endemic plants



GENERAL OBSERVATION AND SOME CONCLUSIONS

- On the whole there are no serious erosion occurs over the length of about 1000km of Sections 1 and 2 of the HCMHW and VST has successfully stabilized these sections of the highway
- Occasional eroded batters and small slips occurred, partly due to uncontrolled animal grazing and poor internal drainage
- Vetiver has accomplished its mission as a pioneer plant, providing effective erosion control on very steep and hostile slopes, trapping sediment and runoff water, producing a micro environment to facilitate the establishment of endemic plants
- Most importantly, in area where local species did not re-established, vetiver persisted and continue to provide protection

Vetiver planting created favourable condition for local species to come back and faded away due to shading, but it persisted where local species could not come back.

Despite badly designed this very steep batter has survived several typhoons



SOME FOOD FOR THOUGHT

Alternative Options:

- Green and environmentally friendly soft measure
- Sterile conventional hard structure



Equally effective in erosion control but definitely not equally effective in cost of establishment and long term maintenance

THANK YOU