Cases of Bridge Damages caused by Floods and some Countermeasures

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Google Earth® (Pro) is a Powerful tool for Analysis of Rivers.

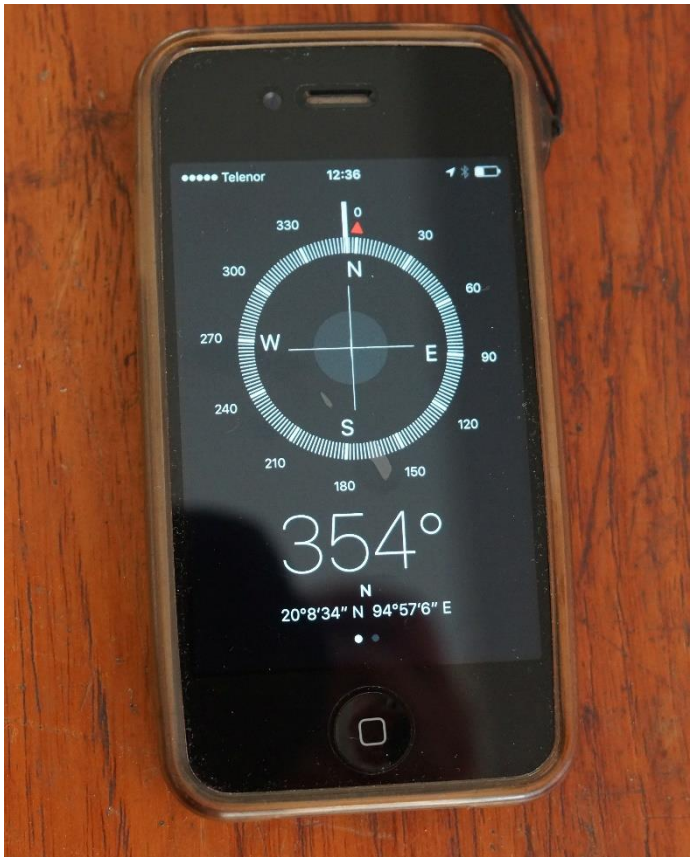
- History of Changing River Course is Seen through its “Past Images” Function.
- Catchment Area, Length of River Channel, Slope of River bed are “Basic parameters” of rivers for planning submersible bridges.
- Google Earth® Pro can give us these parameters with simple mouse operations.
- Longitude and Latitude are also available on the Google Earth display.

How to get Longitude & Latitude

Garmin's E-trex VISTA

- Pocket GPS is good enough to get longitude and latitude.
- We can get more precise values through more sophisticated apparatus, but high precision values are not necessary at the planning stage.

How to get Ordinates



Free applications for Smart phones have been provided.

Some cameras have GPS functions.

Fast Degradation of the River Bed

(Tanzania)

Though Investigation of the Historical Floods is advisable, it is often difficult.

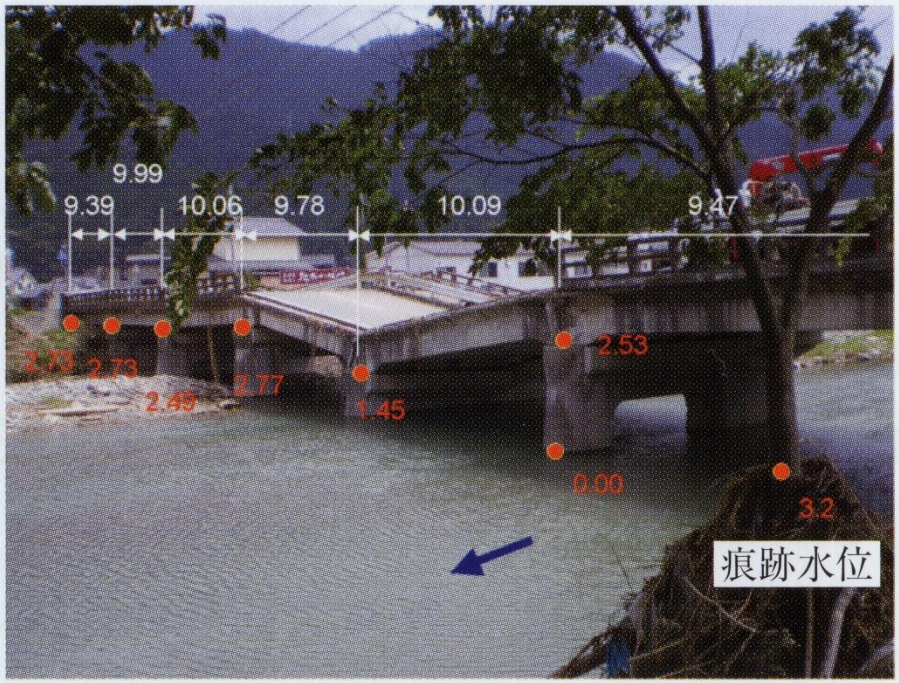
Erosion around Abutment caused by the Shift of the Main Channel (Japan)

Analysis of River Morphology and Two-dimension Calculation of Water Flow may guide the Design around Abutments. Proper Revetment works are necessary.

Subsidence of Piers (Tanzania)

Scouring around Piers should be analyzed.
Piles should be placed down to enough depth.

Subsidence of a Pier (Japan)



After Flood

During Flood
Floating Timbers are also remarkable.

Accumulation of Debris

Accumulation of debris will amplify the Lateral Force against Bridge Structures.
Bridge slab should be rigidly fixed to the piers and to the foundation.

Timbers floated down by a Flood

Some Preventive Measures had been taken, still timbers were accumulated.
Slab and piers should have enough strength to resist against the shock force of the floating timbers.
In case of JIP's submersible bridges, minimum of 50 cm is maintained.

Lateral Force against Piers

Piers should be Rigidly connected to the Foundation.
This collapse was caused by the Accumulation of Timbers.
In case of JIP's submersible bridges, Top slab, Piers, Footing, and Foundation Pile are rigidly connected with steel bars.

Without Steel Bars!

Steel was so expensive in early Japan, that occasionally design of massive concrete structures was made without steel bars.
The timber in this photo has length of 12 m: longer than the bridge spans.

Accumulation of Debris at the Handrail

In case of the Yoma Bridge JIP's first submersible bridge ,
Handrails are to be dismantled during Flood Season.

Collapse of Revetment

This Failure was caused by River bed Degradation:
Riverbed will change with Floods.

Another example of Revetment Failure

Revetment with Rigid Structure is Vulnerable to Change of Boundary Conditions.

Revetment of Stone-fill Type

Stones should be large enough to resist Dragging Force of Flood Water.
This type of revetments will easily follow the river bed change, and still effective for bank protection.
Stone-fill type revetment will not harm the riverine scenery so much.

Stone-fill Revetment of Myanmar

Along the Left Bank of the Ayeyarwadi at Magway
20.134525 deg. N, 94.925002 deg. E

Stone-fill Type of Revetment (USA)

This type of Revetment is widely used: On the Left Bank of the Mississippi.

Thank you for listening.

If you should have any question, please access via e-mail.

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