

**VIETNAM INFRASTRUCTURE DEVELOPMENT
AND FINANCE INVESTMENT JOINT STOCK COMPANY**

**MONITORING REPORT ON
AGGRADATION OF RIVERBANK, LAND
EROSION AND FLOODING RISK**

**THE EXPRESSWAY HA NOI – HAI PHONG PROJECT
The Third monitoring of locations of packages**

**Address: 8th-9th-10th floors, LILAMA 10 Building, Le Van Luong street,
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Hanoi, September 2012



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INTRODUCTION

The Ha Noi - Hai Phong Expressway Project has many bridges where is needed to construct pier abutment. While the composition of the soil and rock on the surface of the Red river delta where the flow and roads cut through has a low durability, which are easily destroyed by the effect of flow. Therefore, the erosion and of river sediment is inevitable happens, the issue is the degree of the scale and location of that. That poses to monitoring the erosion of sediment is relatively mission diversity with major budget, if we want to get the full results of a comprehensive response to the forecast problem. However, with request for assess impact of the current environment of residential areas causing by the construction.

During building of the bridge, there is appearance of the pier abutment on the cross-river surface, which will minimize section of hydraulic fow leading increase fow velocity, change direction and fow status. Therefore, at the time of construction and during the beginning of the process on using, that occurs erosion and sedimentation of rivers, including the major erosion in the downstream and aggradation mainly in the upper route. The level of position scale and course of erosion, aggradation was predicted when the project based on consideration of dependent factors such as characteristics, the content of silt in the flow, the physico-mechanical properties of bank and base river and valley terrain. However, the cost estimate problems have always assuming ideal. To have the sensitive forecasts, it need to have the results of aggradation monitoring.

I. THE GENERAL ISSUES ON EROSION MONITORING OF THE RIVER BANK

I.1. The affecting factors to the aggradation and erosion process of flow

I.1.1. The element of flow affecting as following:

The erosion and aggradation are two opposites in the presence of flow on the river, which is the premise of a balanced sectional view. The speed, size and characteristics of aggradation and erosion depends on the factors as following:

- The greater the content of alluvial and others substances in the flow at cross section is, the greater the aggradation is and the lower the erosion is.

- The flow capacity: The greater the flow capacity through section is, the greater the scale of erosion is.



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- The shape of the flow surface is characterized by curve factors such as the curve radius will determine the chavelocityristics, location of erosion or aggradation.

- The greater the slope and height of two shores of flow is, the greater the sliding is. That making the cross section follows by expansive while the depth is increased.

- The structure and physico-mechanical properties of rock and vegetation in two shores and bed of flow are important factors, sometime they decide on the erosion of flow which is caused by erosion does not depend on other factors.

In summary, the cross section of flow depends on many factors whose stabilization will form a balanced sectional view. If we change any factor, the balanced erosion will be changed, establishing a new sectional view with certainly delay. The construction of the pier abutment is one of reasions to change these factors.

1.1.2. The elements of the construction process altering the balance of erosion and aggradation of the flow

The building bridge causes a change in cross the river. Those factors include:

- Impound provisionally to construct. The impoundment can be all or a part of flow. After the construction of the pier abutment finishes, it will be returned to the original status. However, the flow having great kinetic energy in flood season will creat a new process of erosion and aggradation to achieve balance section view although the closure dam was digged, relating to delay of balance erosion and aggradation.

- The endless appearance of the pier abutment on the flow will narrow area of the flow section. That causes the cross intrusion and deep intrusion to the flow achieves balanced section view. On the process of achieving section view, not only there is the change in velocity relating the destructive kinetic energy but there is also appearance of set, especially, there is a change in properties of flow from lamellar to turbulence. Therefore, the erosion and aggradation not only appear in upper and downstream section but the scope of erosion and aggradation also can develops futher toward upstream and downstream.

- While the construction process, the transport of materials and leveling process, along with the load of the vehicles, construction equipment can cause slope failure shore.



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In summary, these factors not only directly alter the terrain of river at building, but it is also reason causing a process of a change in flow for establishing a new balance.

I.2. The purpose of content requires monitoring method of the erosion and aggradation in the Ha Noi – Hai Phong Expressway project

The erosion and aggradation on the flow are natural phenomenon always happens. When the erosion and aggradation develops to large scale, it will become a geological hazards affecting the social and economics. However, to evaluate the formation and development of the erosion and aggradation as the basis of prediction risks may occur is extremely complex problem. Thus, whether in the design and evaluation of environmental impact, the erosion and aggradation are calculated and forecasted which is dependable, ignore the error because of assumption ideal of the problem. Only by the comparing the current of the terrain in different times is the most thorough method to eliminate the errors. Therefore, to improve the accuracy of the predictions and forecasts for the work to have practical significance, it need to monitor the content, mode, time, object method and location. In principle, before monitoring, we have to assess environmental impacts, including monitoring network must be set on the basis of the results predicted erosion and aggradation follows by scenarios.

Following by the characteristics of expressway project from Ha Noi to Hai Phong, the condition and reality situation of project implementation, especially the results of environmental impact assessment in this project have not designed monitoring plan. That set for this monitoring requirements, content and general methods as following:

+ Demand: Show a change in the element causing by the erosion and aggradation and the current of terrain.

+ The monitoring content:

- The change in velocity of flow
- The change in alluvial content
- The change in the physical properties and vegetable coat
- The change in terrain due to the construction process

+ The carrying on method, using synthetic methods as follows:

- Sampling water and soil analysis in the material composition of flow and



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physical properties of rock at the shore and bed of flow.

- Determining the relatively high bias of some points are assessed more likely to erosion and aggradation, as well as coordinates and distances between points. These points are kept by the concrete columns for the next monitoring cycle.

- Considering the description by image as a basis for changing terrain and other factors affecting erosion and aggradation.

II. THE RESULTS OF MONITORING IN THE CROSS SECTION RIVER

Between the building bridge position having the difference in scale, characteristics of building and terrain, flow, especially in mass, the construction schedule. Therefore, the erosion and aggradation due to the process of building in the area is characterized by different scale.

As a basis for assessing the erosion and aggradation bed river while building pier abutment, the process on monitoring worked with results as follows:

- Assessing the velocity of flow
- Building permanent concrete benchmark and determining their coordinates to evaluate the change in terrain, in addition, it is as well as a basis to consider the change in terrain.
- Measure the depth of bed river at some points in the network node to determine relatively the flatness of the river as basis for assessment the erosion and aggradation in the next monitoring cycle.
- Sampling soil in two shores and bottom of the river to analyse the grain composition and physical properties as a basis for assessing and forecasting the development law of the erosion and aggradation.

1. The results of monitoring in the cross section Bac Hung Hai river

At the crossover area of the Hanoi - Hai Phong expressway belonging section Cuu Cao - Van Giang district, Hung Yen, the period from the second monitoring to the third monitoring, the project has been going construction activities of pier abutment. These activities have significantly changed the landscape and terrain for 2 Bac Hung Hai riverside. While monitoring, the general view of these changes is showed as follows:



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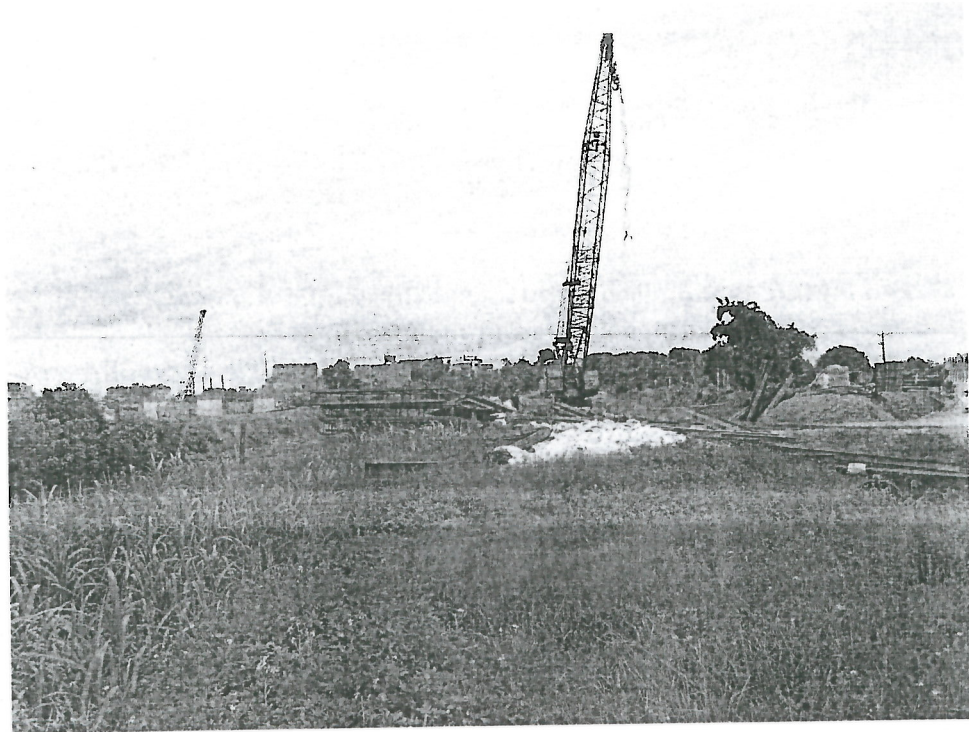


Figure 1.1. Overview of the overpass construction sites in the Cuu Cao

In which, the river is deformed strongly from the south of the village (Figure 1.2). Here, the obstacles is diaphragm wall with steel piles which is located in middle of the flow. Beside, construction material (gravelly soil) is run down the river (Figure 1.3, 1.4).





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Figutr 1.2. River is view from the field (the South)

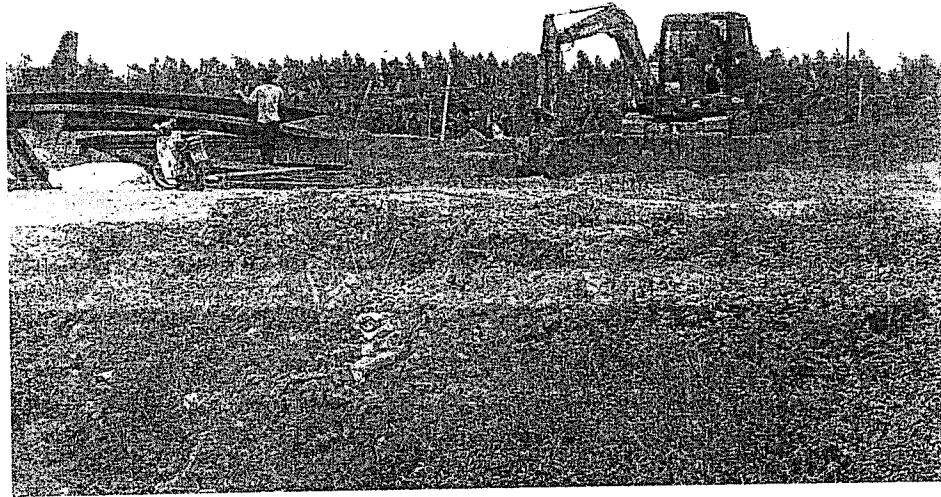


Figure 1.3. Construction material is run down the river

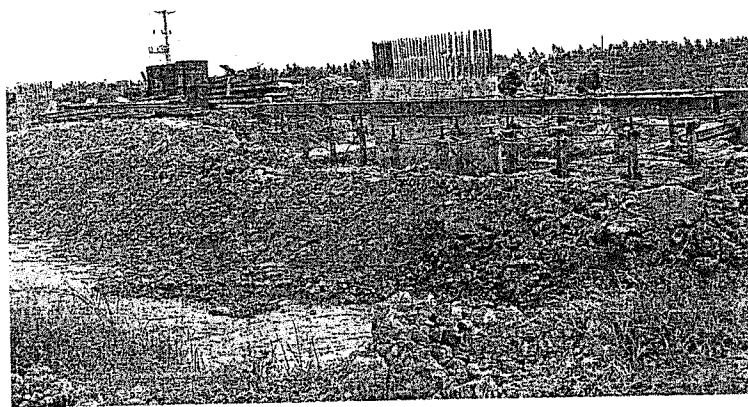


Figure 1.4. Flow of the river is narrowed by abutments and construction material

In the Northern shores of the river, piers located far from shore, the influence of the construction in this period to cross the river is negligible (Figure 1.5). Mainly the topography surface changes take place in the previous cycles.



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Construction processing has effected to the flow of the Bac Hung Hai river. State of the flow is changed, in which velocity of the down stream flow is very small compared to the bridge area (Figure 1.6).

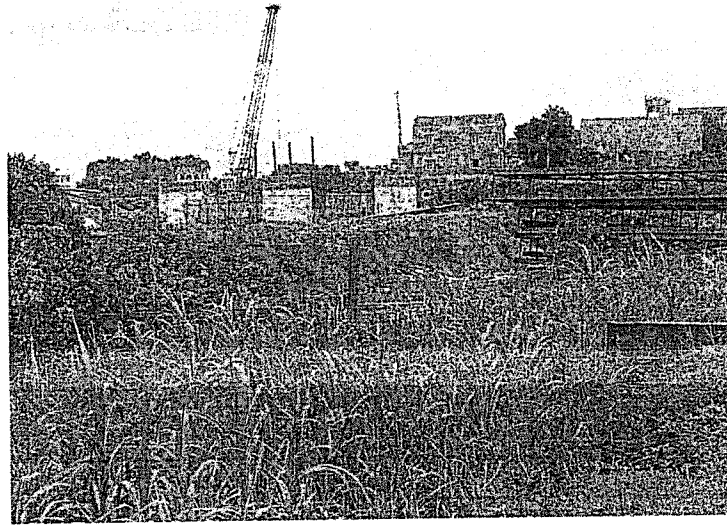


Figure 1.5. Abutment construction in the North

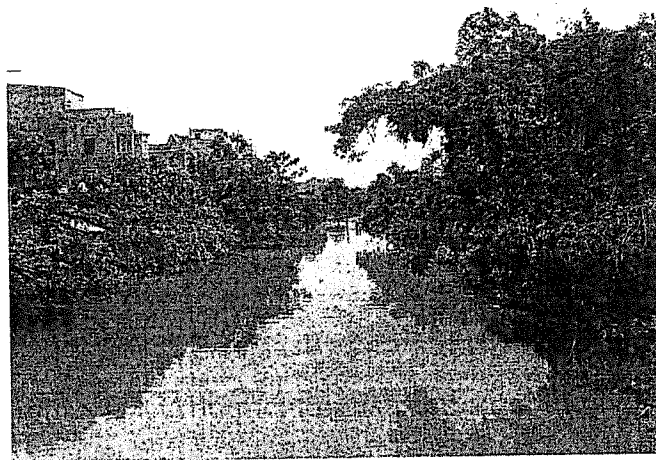


Figure 1.6. Flow after the rain

The results of measurement, surveying and experiments to determine the composition and physical properties of soil samples as follows:

+ The speed of flow:

At the monitoring time, after ended rain which occur on a large scale, it



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will make flow velocity greater than normal. The results of the low velocity measured in many different positions on the water show that at the narrowest cross – section by wall piles, the flow velocity is 2-3m/s, while the downstream velocity less than 0.1 m/s.

+ To explore the terrain of river - bed

- At the time of measurement, water level higher than before time (0.6m).

At cross section, the depth of the bed river comparing with water level 1m.

- Topography of river bed and two river shores are changed while slope terrain in the South is completely changed compared to the previous monitoring cycle.

- Revetment wall which is built by steel sheet piles that still exists on the river surface. The shortest distance between the two riverside is 6m.

- Materials in river bed are almost construction refuse and larger than the previous monitoring time.

+ The results of analysis the content of silt, the grain composition and physical properties of soil in the slope of shore and river bed.

- The results of analysis some water samples taken in different depths by the dried mud method show that the content of silt is very low, less than 0.15g/l. However, components coarse sand and gravel at the river bed is increasing. It shows that the flow is happening sedimentation process.

2. The results of monitoring in the cross section of Bo Xuyen river

The results of monitoring in the third time show that during from the second monitoring to the third monitoring, the construction of pier abutments took place at the shore of Gia Loc (Figure 2.1). However, almost work takes place mainly in the Southern Gia Loc shore.

At South Gia Loc, construction activities of road – bed handle are implementing far away from the riverside. These activities have effected the landscape and terrain riverside that mostly living activities take place near the shore.



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For with pile construction activities are implemented in the flow of the river on the floor and floats. So the fill line to gather material occurs in (2.2). However, in the process of drilling and pouring concrete (Figure 2.3) drilling waste material and humus partially filled flow down.

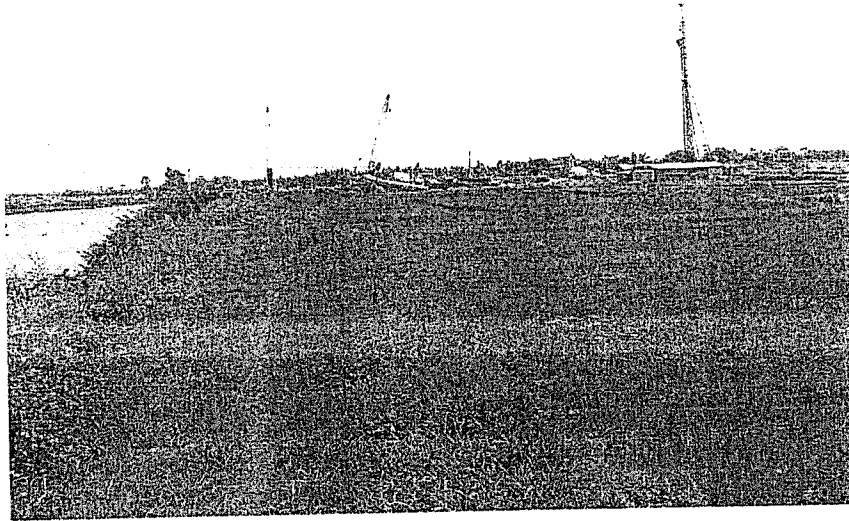


Figure 2.1. Overview on the Bo Xuyen bridge construction site

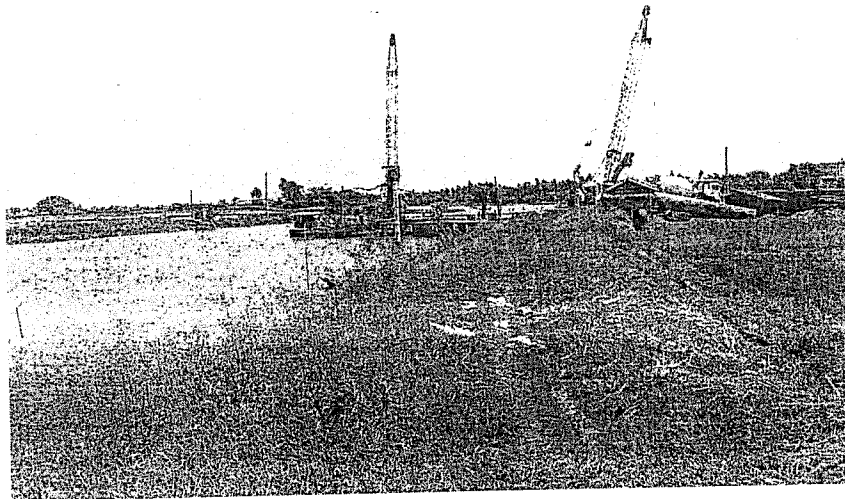


Figure 2.2. Boring bridge foundation



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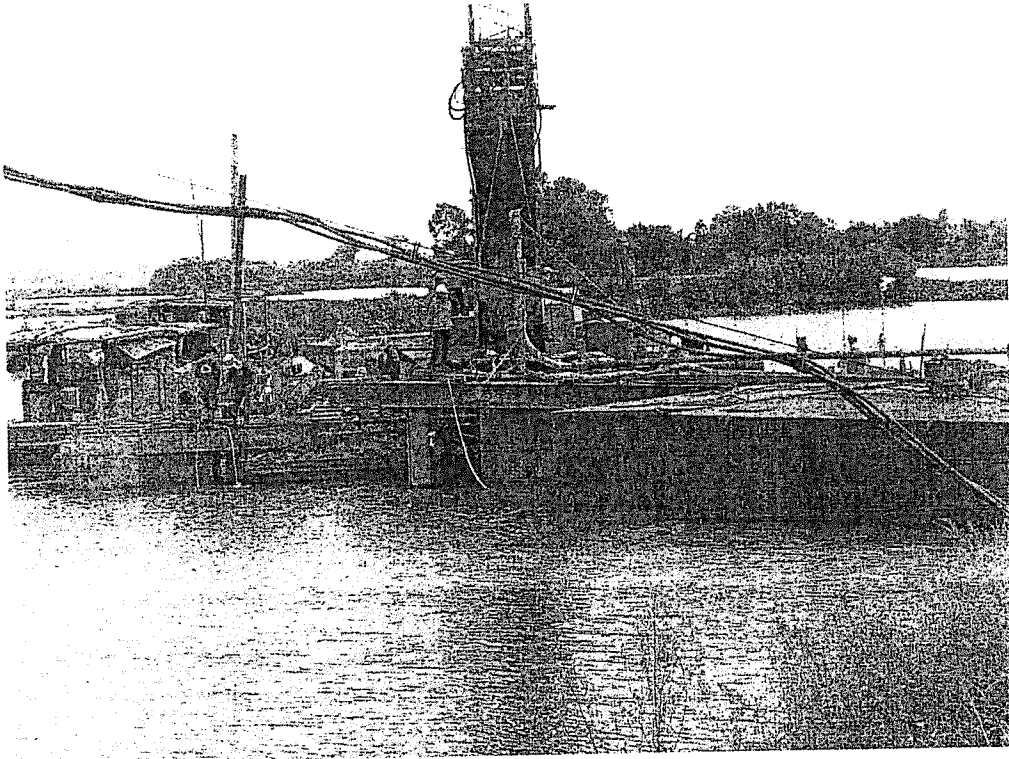


Figure 2.3. Concrete pier foundation pile

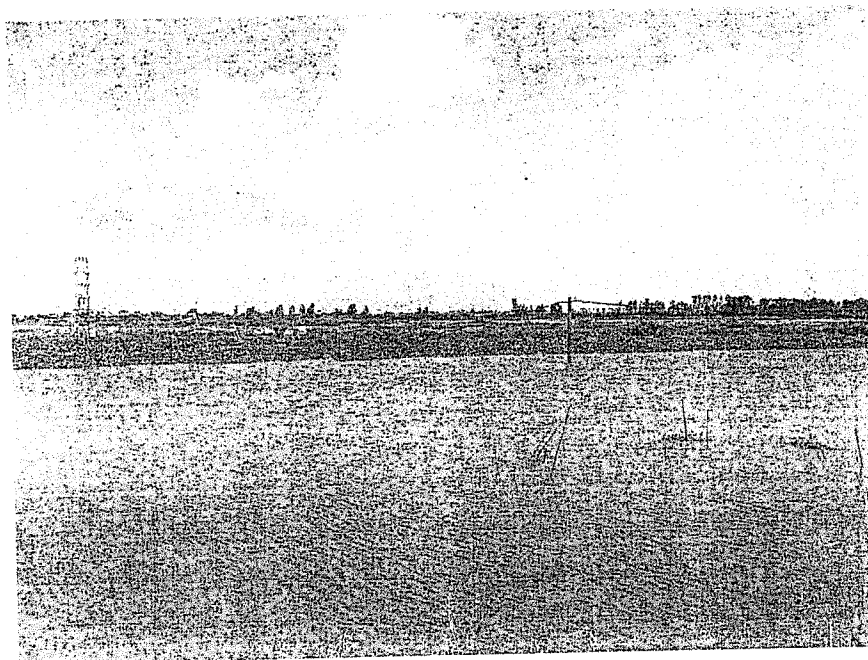


Figure 2.4. Bo Xuyen river is viewed from Binh Giang coast

For the northern, the main construction of the road ground haven't been



built abutment piers. Therefore, terrain of coast in the northern does not change (Figure 2.4).

The results of measurement, surveying and experiments to determine the composition and physical properties of soil samples as follows:

+ The speed of flow:

The results of the low velocity measured in many different positions on the water surface show that at all of measurement points are the flow velocity less than 0.02m/s, with the different direction. Almost there isn't movement of the flow or erosion due to the kinetic of the flow that is not happened.

+ To explore the terrain of river bed.

The results of the depth of bed river measured show that, at the moment, the water level is higher than the before monitoring about 0.3m. Therefore, if the long column of water level is standard, the river bed has relatively flat terrain with the measured average depth is about 1.5m; Particularly, in the abutment construction location, riverbed surface changed strongly by dust and waste components in the process of filling down.

Results of measuring the height and roof slope show that almost there isn't changes due to the effects of the construction as well as human activities.

+ The results of analysis the content of silt and determining the grain composition and physical properties of soil in the slope of shore and river bed.

- The results of analysis some water samples taken in different depths by the dried mud method show that the content of silt is very low, less than 0.5g/l, indicating the erosion and aggradation by condensation of flow is low.

3. The bridge across Ba Na river

At the third monitoring time, surveying result show that the butment piers and girders were completed period from the second cycle to third cycle (Figure 3.1).



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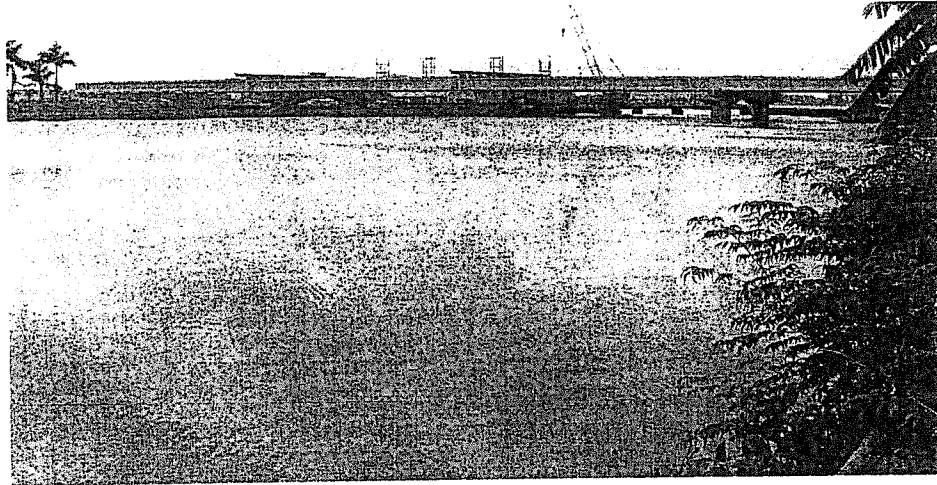


Figure 3.1. Bridge construction area

Comparing with the before cycle, at the monitoring time, landscape and terrain on both riverside significantly changes. Especially, bridge and temporary road construction have not been lifted by construction activities of abutment piers. These changes can see when comparing to photo which is taken in 2 cycle.

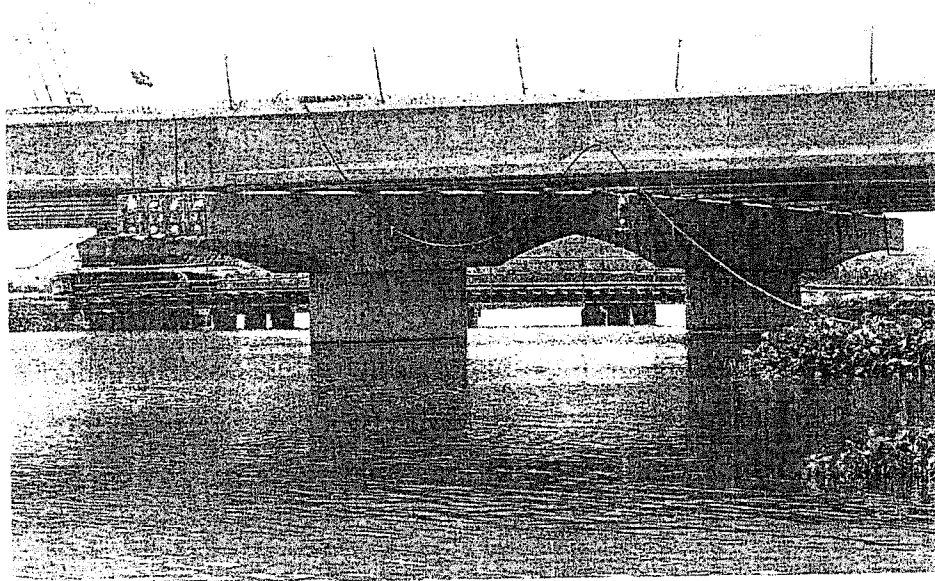


Figure 3.2. Bridges, temporary road



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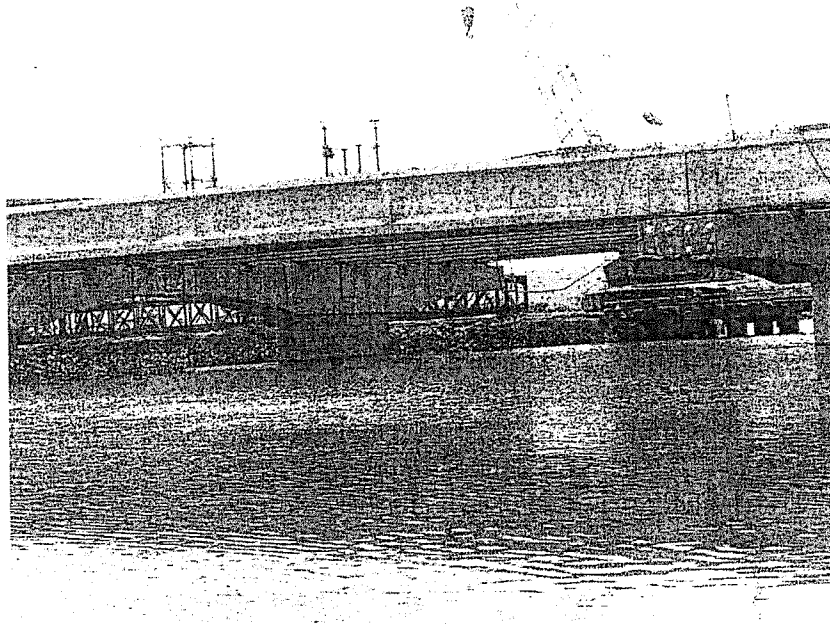


Figure 3.3. Downstream coast of the Tan Vien was completed the bridge span

In the Tan Vien shore, the land fill in the construction process, although not very high above the water level but appeared landslides phenomena for land falling into the flow and make the cliff (Figure 3.3).

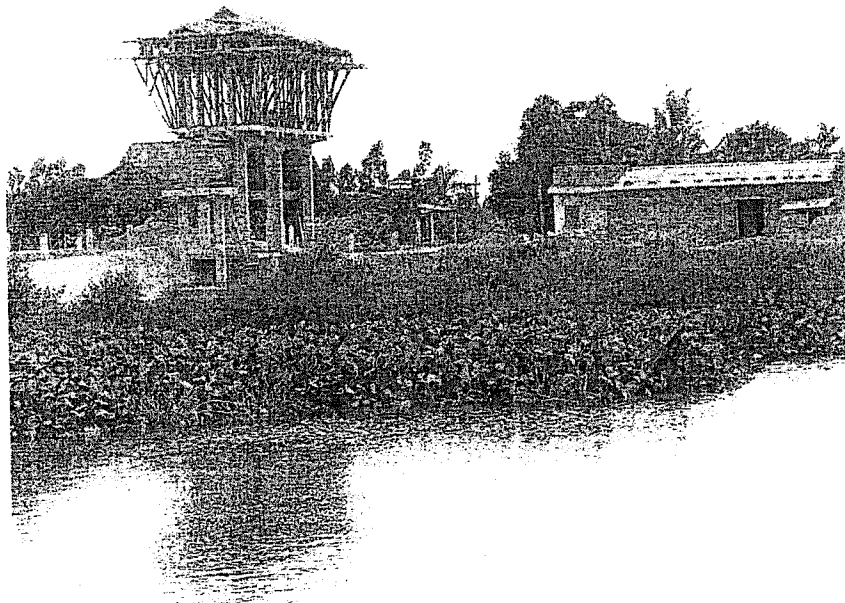


Figure 3.4. Drain construction

At the upstream area flow is far from bridge approximately 200m, at the time of monitoring, an irrigation drain has been completed, but not yet use.



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Drainage adit which across the drain that still filled.

Comment on the impact of bridge construction activities:

- River bed is narrower, flow area is smaller and change direction continuously by backfill from upstream to downstream. Formation of alluvial material include waste rock and significant amount of domestic waste.

- Along with the cross section through bridge position, at the time of monitoring in the upstream of the river about 200 meters is going closure to build the pier abutment for provincial roads that also contribute to topographic variation of flow.

- The speed of flow:

The results of the low velocity measured in many different positions on the water show that at all of measurement points are the flow velocity less than 0.02m/s, in which many positions don't determinate direction of flow.

The observing results showed that the flow surface in two shores upstream covered by dense hyacinth, which shows that the erosion of shore by affecting of wave is limited.

+ To explore the terrain of river bed

The results of the river bed depth and the shore terrain show that the surface of river bed was changed significantly, in which the river bed is not flat causing by waste of building materials. The cross section river is narrowed in many positions making the flow on the plane is deformed.

+ The results of analysis the content of silt, the grain composition and physical properties of soil in the slope of shore and bed river.

The results of analysis the content of silt in samples taken in different times in shore and in flow, including samples in the flow between pier abutments showed that the characteristics of the content of silt are very low.

These results affirmed that the pier abutments are not reasons altering the balance of erosion and aggradation. The emergency bridge and material dump in



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construction site are major reason of the forming of the erosion and aggradation with large scale.

4. The bridge across Lach Tray river

At the surveying in the third cycle, construction activities is carry out in the two coast of Kien Thuy and Dinh Vu.



Figure 4.1. Status of riverside in the west Kien Thuy

The coast of the Kien Thuy is carrying out bustling construction activities, the abutment piers are in the final phase with the beginning phase of the construction process the mast body (Figure 4.1 and 4.2).



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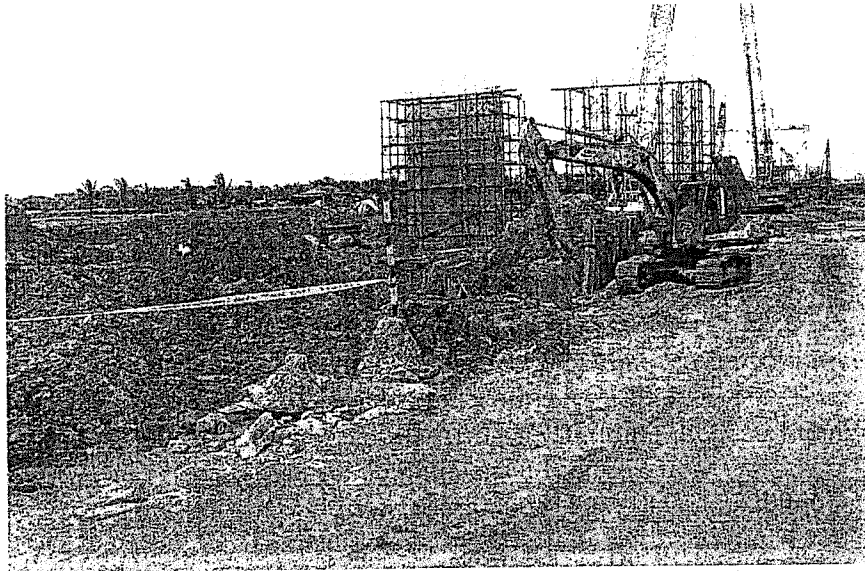


Figure 4.2. Construction of the abutment piers on the banks of Kien Thuy
The side of the Dinh Vu (Figure 4.3) are deployed drill in the piers in the flow, namely the floor construction to take drill down location in the flow.

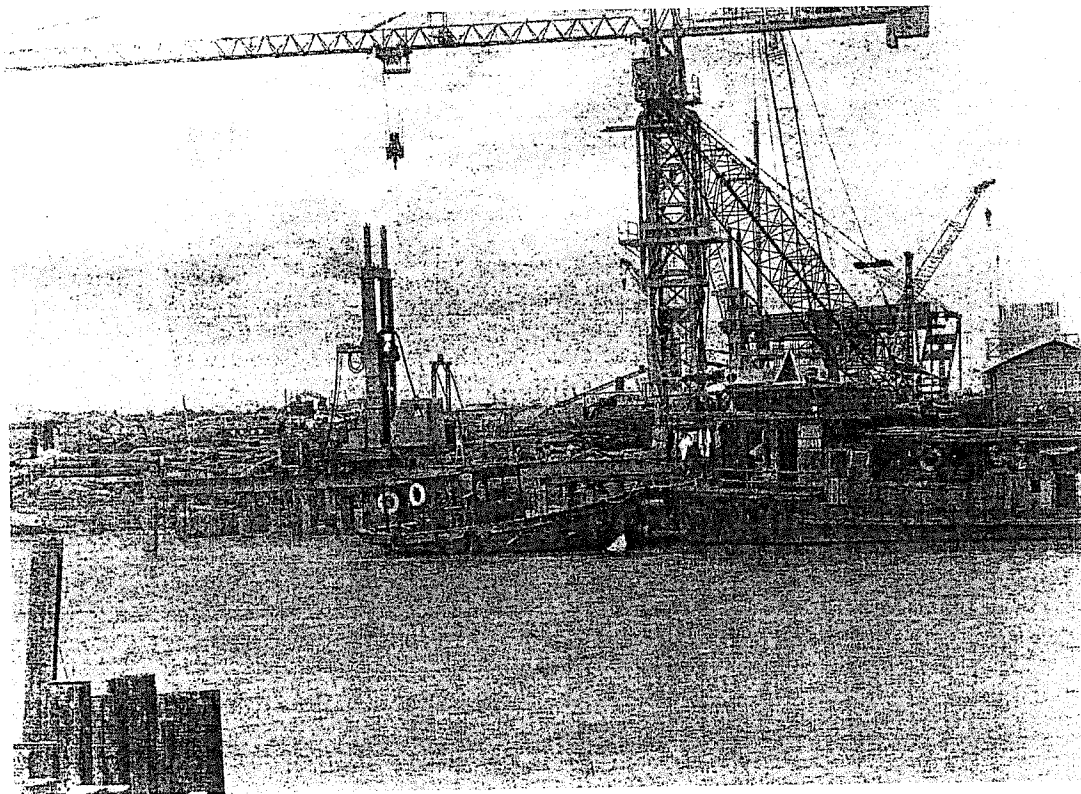


Figure 4.3. Construction sites on the east of the Dinh Vu
In general, the river bed has been a change and is narrowed by by the



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waste material in the shore of the Kien Thuy (Figure 4.4) and crowd flow as well as construction equipment in the shore abutmentline of the Dinh Vu.



Figure 4.4. Status of spoil area in the Kien Thuy shore

Closure condition has greatly increased compared to the previous cycle, at the time of observation, length was filled with flow increased by more than 10 meters.

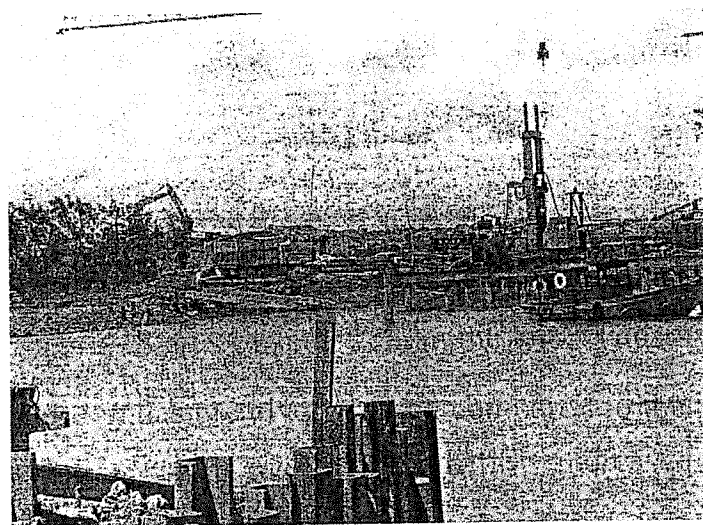


Figure 4.5. Overview on closing of dam in two riverside

+ Comment on the terrain and flow changes as follow:

- The construction activities have taken in the middle of flow, in which



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terrain in two riverside is strongly modified by filling. Flow area is narrowed a long section.

- Flow speed along the axis of riverside is higher than the before cycle.

+ Some of the measurement results as follow:

+ The speed of flow:

The results of the velocity measured in many different positions on the water show that the flow velocity changes complexly, especially in the narrowest cross, the velocity is higher than 3m/s.

+ To explore the terrain of river bed

The measurement results of the river bed depth and shore terrain show that the surface of river bottom is not flat in the cross section, with a average depth from 4m to 7m. On the riverside, the river bed terrain is sloping.

+ The results of analysis the grain composition and determining the physical properties of soil in table as follows:

The results of analysis samples taken in different times in shore and in flow show that the content of silt is very high, higher than 7-15 g/l.

The results of analysis the grain composition and determining the physical properties of soil show that clay sand component is main in soil.

In summary, the influence of pier abutment made flow velocity increasing that can lead to a change in the characteristics of river bed by geological cross.



CONCLUSION

From the results of monitoring of 3 cycles, initial evaluations are as follows:

- There have been 4 position building bridges with the change towards narrow the river section.

The most impact is the cross bridge over the Bac Hung Hai River on the territory of Cuu Cao commune, but the most change is the bridge cross section in the Lach Tray and little change is bridges cross section over the Bo Xuyen river. Most notable is bridge cross section over the Tan Vien river, My Duc. Although the bridge was completely but the terrain was not still yet returned to original state. River control works was built by sewerage system in the upstream. Therefore, flow change in the future will be extremely complex.

- In which, the most obvious change is in position of bridge across the river, so that the river sediments have different characteristics. If the section of Ba Na river, construction activities have changed in this cross section is severely thus in the future, the risk of sedimentation of two upstream and downstream will be largest with bridge cross Bac Hung Hai river, vice versa, there will be erosion of the upper and lower sections of Lach Tray river bridges.

- The results of monitoring the flow of sediment due to bridge construction showed that the scenarios to assess sediment erosion model based design as well as environmental impact assessment is certainly not fully addressed accurately. Hence, the need to continue monitoring before a decision on measures to protect the coast against erosion damages.