THE WAY IN DOCUMENTARY COLLECTION AND HYDROLOGICAL INVESTIGATION FOR BRIDGE AND HIGHWAY CONSTRUCTION PROJECT

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Abstract. The documentary collection and hydrological investigation are very important to each project. It can be used to check the waterway opening, road crossing, highway elevation and bridge structure.

This article mainly describes the way of documentary collection and hydrological investigation and survey.

Preface

The artery system is considered as the blood vessel of the human body in many nations in general and Vietnam in particular. The artery constructions over the river, stream are the key sites to ensure continuous thoroughly operation of each road. In our country, most bridges over the river, stream are built and operate at the natural rivers; many segments of road in the routes locate on the flood-influenced areas, that is, they are annually suffered from one or many floods (the random, complicated factors in nature). According to the general world's statistics, the specific problems caused by flood to bridge occupy commonly 70%. Thus, this demands the designers ought to have the correct method and lots of experience in collecting and dealing with information in such a scientific, objective way in order to receive reliable and suitable results.

This article hopes that the project managers, especially the engineers specializing on bridge and highway can systematize the general principles and the method of guiding, organizing and conducting the documentary collection and propose the survey outline for the bridge and highway construction project.

The way in documentary collection and hydrological investigation

I. Collecting topography map and meteorological, hydrological and sea-hydrological document

1. Collecting topography map

To gather the topography maps on a scale of 1/100000, 1/50000, 1/25000 and 1/10000.

2. Collecting meteorological, hydrological and sea-hydrological document

Rely on the topography map (every scale), determine the preliminary design route, the site of bridgework (big, medium and small bridges) on the route. Then, choose the

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meteorological, hydrological and sea-hydrological stations which involve in the project in order to collect the document.

Depending on each specific work, to gather meteorological, hydrological and sea-hydrological factors for hydrological analysis and calculation.

a. Meteorological document

- Temperature, humidity, cloud, rain, storm and some other meteorological factors of the stations.

- The data of maximum rainfall of 1, 3, 5, 7 days in all the observed years at the stations.

b. Hydrological document

- The maximum, average and minimum water level of month, year in all the observed years.

- The hourly water level of some heaviest floods of the stations.

- The yearly maximum discharge and velocity in all the observed years.

c. Sea-hydrological document

- The maximum wind speeds in 16 directions in all the observed years.

- The maximum wave heights in 8 directions in all the observed years.

- The monthly, yearly water level of the tide's highest and lowest peak in all the observed years.

3. Collecting the design data of current and future planned reservoirs and dams, which involve in project

- The coordinate, the site and the manage unit of the dam (corresponding with the station on route)

- The dam structure.

- The scale of dam (dam level, design flood frequency).

- The highest water level in the reservoir.

- The dam's downstream lowest water level.

- The reservoir's free surface area corresponds with Hbackwater-max

- The design inlet discharge.

- The design outlet discharge over dam.

- The size of dam: the dam's longitudinal section, cross section, should show the size of drainage constructions (weir, culvert).

- The used elevation system.

4. Collecting the data of the current water resource constructions and future planned water resource system, which involve in project

It is necessary to gather the data on the present hydraulic agricultural constructions as well as the plan of future hydraulic agricultural system (channel, irrigation canal) in the project area and design-technique parameters of these water resource constructions.

II. Route hydrological investigation

1. Investigating on current road

- It is necessary to survey the current road with the maintaining, upgrading project.

a. Conducting area

The current road is on which the route is coincided or next to.

b. Conducting content

- Flooding state

+ The length of flooding segment (station, initial point, end point)

+ The depth of the maximum flooding (hmax) and the depth of average flooding

+ The reason of flooding

- Erosion and washout road state: To survey the road segments that are damaged by flood (pavement, talus road bed).

+ The length of erosion segment (station, initial point, end point)

+ The level of damage

+ The reason

- To investigate the karst caves near the road area. With the karst mountains which have many karst caves and caverns, have to survey the karst caves and caverns, which involve in the rivers and streams in the area of the current road.

+ The cave's average diameter (attached the illustration)

+ The year that has the maximum absorbed capacity and the year that has the maximum drained capacity

+ The yearly average absorbed and drained capacity

+ To investigate the rivers and streams in the area, which involve in the caves

- To tabulate the statistical table for flooding, erosion segments and the caves, caverns

2. To investigate water level along the route

a. The water levels need to survey at one site (the cluster of investigated water level)

- The maximum flood water level of three years that had the maximum historic flood

- The annual average flood water level

- The frequent water level (maintained over 20 days)

- The water level of tidal peak (with the road segment that is influenced by the tide)

- Time and reason of flooding

b. The investigation site

Besides the locations at the drainage constructions, to survey one cluster of water level at every kilometer with the feasible study report step; and at every 500 meters with the design-technique step. To the segments that have the flooding length less than 1 km, need to investigate 2 clusters of water level (the initial and end segments).

III. Hydrological investigation in the drainage constructions

1. Surveying the drainage constructions on the current road

With the maintaining, upgrading project, need to survey the drainage constructions on the current road.

a. Conducting area

The current road is on which the route is coincided or next to.

b. Conducting content

+ Determine the drainage opening

+ Determine the bridge drainage opening, measure the longitudinal section of center bridge

+ Determine the culvert drainage opening

+ Determine the length of the underground construction

+ Determine the length and the average height of the weir

- Which year the construction was built

- Which year the construction had the problem (drifted, broken, damaged), the reason

- The maximum water level of the historic flood at the upstream, center and downstream of the construction

- The erosion, washout and alluvium road state at the construction area

- Evaluate preliminarily the drainage capacity of the construction (sufficient, insufficient)

2. Investigating the hydrology of the big bridge

a. Investigating the historic flood water level

- With each cluster of water level, to consider the following water levels:

+ The historic flood water level of three years that had the maximum flood

+ The annual average flood water level

+ The reason caused that historic flood water level

+ The minimum water level at the center bridge

- The number of the cluster of investigated water level: from 6 to 8 clusters

- Determine the site of cluster of water level on the bridge topography map

- Determine the state of drifting tree and boat

b. Measuring the longitudinal section of river bottom and historic flood surface profile

- The height scale: 1/50-1/100; the length scale: 1/500-1/1000

- Measuring area: in the area of the bridge topography map

c. Measuring the discharge section

- The height scale: 1/50-1/100; the length scale: 1/500-1/1000

- The chosen area is higher 1 m than the historic flood water level (not including the broken-dike water level)

- On the discharge section, represent sufficiently the clusters of investigated water level

- Determine the distance from the discharge section to bridge center (in the case, the discharge section is not in the bridge topography map; attached illustration)

- The number of section: 02 (the upstream and downstream section of bridge)

d. Surveying the influenced tide area (with the river's location is influenced by tide area)

e. Surveying the influenced overflow area of the big river (with the big river is influenced by overflow)

3. Investigating the hydrology of the medium bridge

a. Investigating the historic flood water level

- With each cluster of water level, to consider the following water levels:

+ The historic flood water level of three years that had the maximum flood

+ The annual average flood water level

+ The reason caused that historic flood water level

+ The minimum water level at the center bridge

- The number of the cluster of investigated water level: from 3 to 4 clusters

- Determine the site of cluster of water level on the bridge topography map

- Determine the state of drifting tree and boat

b. Surveying the influenced tide area (with the river's location is influenced by tid area)

c. Surveying the influenced overflow area of the big river (with the big river i influenced by overflow)

d. Measuring the longitudinal section of river bottom and historic flood surface profile

- The height scale: 1/50-1/100; the length scale: 1/500-1/1000

- Measuring area: in the area of the bridge topography map

e. Measuring the discharge section

- The height scale: 1/50-1/100; the length scale: 1/500-1/1000 in order to show the main

- The chosen area is higher 1 m than the historic flood water level

- On the discharge section, represent sufficiently the clusters of investigated water level

- Determine the distance from the discharge section to bridge center (in the case, the discharge section is not in the bridge topography map; attached illustration)

- The number of section: 02 (the upstream and downstream section of bridge)

4. Investigating the hydrology of the small bridge

a. Investigating the historic flood water level

- With each cluster of water level, to consider the following water levels:

+ The historic flood water level of three years that had the maximum flood

+ The annual average flood water level

+ The reason caused that historic flood water level

+ The minimum water level at the center bridge

- The number of the cluster of investigated water level: 3 clusters (upstream, center and downstream bridge)

b. Surveying the influenced tide area (with the river's location is influenced by tide area)

c. Surveying the influenced overflow area of the big river (with the big river is influenced by overflow)

d. Measuring the longitudinal section of river bottom and historic flood surface profile

- The height scale: 1/50-1/100; the length scale: 1/500-1/1000

e. Measuring the discharge section

Measuring the discharge section at the center bridge (if the center bridge is perpendicular to the river and stream bed, consider center bridge as the discharge section).

- The height scale: 1/50-1/100; the length scale: 1/500-1/1000 in order to show the main flow and river plain

- The chosen area is higher 1 m than the historic flood water level

- The number: 01 section

5. Investigating culvert

Base on the large-scale map, carry out to surveying and measuring the watershed of each culvert, make the water concentration topography and collate with the field.

a. To the maintaining and upgrading project

- Determine the location of the old and proposed culvert

- Survey the old culvert:

+ Which year it was built

+ The type of culvert

+ The opening

+ Survey the historic flood water level at the upstream and downstream of the culvert

+ The erosion, washout and alluvium state

- Evaluate the drainage capacity of the current culvert (sufficient, insufficient)

- With the site that is supplemented more culvert, determine the location and proposal opening

- Express the location station, the opening and route longitudinal-section on the topography map

b. To the new route

- Determine the culvert location, the opening and route longitudinal-section on the topography map

6. Investigating other concerned constructions to the project

a. Survey reservoir, dam at the upstream and downstream the drainage construction

- Geographic name and the location of reservoir and dam

- The distance between the dam and the construction

- The dam structure

- The maximum backwater level in the reservoir

- The minimum water level at the dam downstream

- The free surface area corresponds with Hbackwater - max

- The maximum outlet discharge over dam and the corresponding water level of dam's upstream and downstream

- The dam's longitudinal section and cross-section, need to express the size of the drainage constructions (weir gate, culvert) over dam

- The elevation of dam crest

b. Survey water resource construction (channel, canal)

Water resource constructions (channel, canal) affected by the project (across or over), need to investigate the factors as follow:

- With the upgrading channel and canal:

+ Measure topography map area of upgrading, moving channel and canal.

+ Measure the channel and canal cross-section (the height scale: 1/50-1/100; the length scale: 1/00-1/200)

- With the channel and canal which the route across

+ Measure the channel and canal cross-section (the height scale: 1/50-1/100; the length scale: 1/00-1/200)

To submit the proposal to the concerned offices and branches about the design parameters of the drainage constructions on the route across the irrigation channel and canal; or upgrading, moving channel and canal such as: opening, culvert elevation, cross-section, bed elevation and the slope of channel and canal bed.

Conclusion and proposal

The hydrology study as well as terrain, geology investigation and measurement play an important role to decide the size, elevation, mass and investment total for the bridge and highway project.

This article emphasized on documentary collection and bridge-highway hydrological investigation.

We propose that the transport and communication branch should issue the procedure "bridge-highway hydrological design investigation" in order to create the scientific and legal basis for each construction.

References

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