Analysis on Flood Control Impact Assessment for Linear Project Involving River and Embankment

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Abstract. Aiming at the common problems on flood control impact assessment of linear projects, combined with practical work experience, this paper summarizes and analyzes the characteristics and main impact types of linear projects involving rivers and embankments in recent years, and puts forward the key points of river and embankment impact assessment of linear projects in Zhejiang Province from the aspects of early site selection, construction mode, control factors and remedial measures. It is helpful to improve the quality of flood control impact assessment report, and provide reference for the design, construction, consultation and review of water conservancy department.

1. Background

Building a transportation power is the first field of building a modern economic system and an important support for building a socialist modern power in an all-round way. In recent years, the state and local governments have made great efforts to develop infrastructure construction, further emancipate the mind, forge ahead, and promote the transformation of transportation development from pursuing speed and scale to paying more attention to quality and efficiency, and from relatively independent development of various transportation modes to paying more attention to integrated development. Zhejiang, as a "three places and one window", vigorously promotes the construction of a pilot province with powerful transportation. It has issued the "three year action plan of Zhejiang Province to promote the infrastructure construction of a high-level transportation province (2020-2022)", proposing to build a large channel and build three "one hour" traffic circles. By 2022, three one hour traffic circles will be basically formed in the province, city and urban areas; Through three years of efforts, the investment in comprehensive transportation construction has exceeded 1 trillion yuan.

Highway, railway, rail transit and other linear projects are the main forms of traffic engineering construction, and also important water and embankment related construction projects. Because of the long line, many involved areas and many constraints, linear engineering inevitably occupies water area and has an impact on the construction and operation of water conservancy projects. With the implementation of "Zhejiang Province water area protection measures", Zhejiang Province has put forward higher requirements for water area protection, especially in water area occupation and remedial measures. In 2019, the guidelines for flood control assessment report compilation of river and dike related construction projects in Zhejiang Province (Trial) were issued, which proposed the basic framework and chapter composition of flood control impact assessment report compilation of river and
dike related construction projects, and standardized the main contents of the report compilation. However, in practice, there are still some problems in the flood control impact assessment report of linear engineering, such as uneven content, lack of evaluation content, lack of specification. Therefore, through the summary of the main types, key evaluation contents and common remedial measures of linear projects, the corresponding suggestions are put forward, which is conducive to improving the compilation quality of such flood control impact evaluation report, and providing reference for the construction of such projects and the review of water conservancy departments.

2. Characteristics of river and dike involved in linear engineering

2.1. The workload of flood control impact assessment is heavy.
Due to the long line, the number and types of water and dike involved points in the project are many, and the evaluation contents and methods of different types of water and dike involved are different, which puts forward higher requirements for the evaluation work. It is required that the establishment personnel should have a more detailed and comprehensive investigation and carding on the basic situation of the project, the distribution of river courses and water conservancy projects at water related points, and the impact evaluation and constraints of different levels of river courses and water conservancy facilities should be classified and targeted according to the protection requirements of different levels.

2.2 Coordinate the relationship between the part and the whole.
Linear engineering generally involves multiple counties, cities, and even provinces. The requirements for water conservancy planning, water area protection, and water area management vary from region to region. In particular, the implementation of standard raising and reinforcement of planned river courses and embankments (seawalls) within the scope of linear engineering management, and the selection and implementation of equivalent function replacement projects all need to communicate with local water conservancy departments, According to the local water conservancy planning and demand to determine the specific implementation plan. But at the same time, due to the fluidity of water, water area management should focus on the whole region and basin, and the impact on flood control should also be scientifically evaluated from the whole region and basin, and should be combined with the impact of each wading point and its upstream, downstream and each wading point. Therefore, it is necessary to not only meet the flood control requirements of each wading point, but also strengthen and enhance the flood control capacity of the whole region and basin.

2.3 The project is complex, difficult and technically expensive.
At present, linear engineering is mainly high-speed railway and high-speed railway, and the bridge and tunnel of these two types of engineering are relatively high. In the early docking design scheme, the layout of the bridge span at the wading point may be adjusted, or the important river channel may be crossed by one span, which makes the layout and structure of the bridge span before and after the wading point have corresponding changes, which has higher requirements for the project design and construction. Tunnel usually involves under crossing water conservancy facilities or river course, which requires high buried depth and construction technology. Therefore, flood control impact assessment should be involved as soon as possible, and the requirements of bridge span layout and construction technology should be put forward from the perspective of water conservancy specialty, so as to reduce the impact of engineering construction on flood control.

2.4 Geographical environment, economic and social constraints.
The route selection of linear engineering should not only consider the geographical conditions, ecological environment and other natural factors, but also consider the development needs of local economic and social level, urban and rural resources cooperation, especially in the mountainous area and Pingyuan river network area, it is difficult to achieve the best of both worlds, and the occupation of
river and water conservancy facilities is inevitable. In flood control impact assessment, priority should be given to avoiding. If it is impossible to avoid, the necessity, impact and optimization scheme of the occupied water area should be evaluated.

3. Main types of wading and dyke and their impacts

3.1. Water area occupied by pier and subgrade.
First, the piers occupy the water area, which requires that the piers should be arranged along the current, avoid the main channel, and the bearing platform should be arranged under the riverbed. It mainly affects the flood discharge capacity of the river, so the analysis and calculation of water blocking, backwater and scouring should be carried out to evaluate the impact degree.

The second is subgrade backfilling. Compared with pier occupation, solid subgrade backfilling occupies more water area and has greater impact on water blocking and scouring. It should try to replace subgrade with bridge and box culvert. The connectivity of surrounding water system should be considered in backfilling river course to reduce the occurrence of beheaded river.

Fig. 1. Linear project crossing water system.

Fig. 2. Water area occupied by subgrade.
3.2. Crossing and occupying water conservancy facilities and management scope.

One is to occupy the management scope of water conservancy facilities. In order to reduce the occupation and influence of piers on water area, piers are usually arranged in the management scope of water conservancy facilities. The influence on the structural stability of water conservancy facilities should be analyzed through the stability calculation of project construction and operation period.

The second is under the water conservancy facilities. Underpass water conservancy facilities are mainly the disturbance that may occur during the construction and operation period of the project, which will affect the safety and stability of water conservancy facilities. At the same time, it may also restrict and affect the implementation of the later bid raising and reinforcement of water conservancy facilities. Safety assessment and other measures can be taken to fully demonstrate the impact and optimize the design scheme.

4. Key evaluation contents

4.1. The impact on the implementation of relevant plans.

First of all, it is necessary to evaluate whether the construction of the project meets the general requirements of the relevant water conservancy planning, and evaluate the planning compliance according to different plans on the basis of analyzing the relationship between the comprehensive planning, flood control planning, shoreline planning, river (estuary) Regulation Planning and other water conservancy planning of the river and dike involved areas and the river reach, Analyze whether the project construction will have adverse effects on the implementation of water conservancy planning and increase the difficulty of planning implementation; If there is an approved planned water conservancy
project at the place involving rivers and embankments, and its task, scale, project grade and other contents have been clearly defined, the conformity of the construction task, scale, design standard, location, operation and dispatching management of the construction project with the planned project shall be analyzed and evaluated. In practical work, it mainly involves the impact evaluation of the implementation of the planned river course and the enhancement and reinforcement of water conservancy projects. The implementation requirements of the planned river course (water conservancy project) and the current situation of the river course (water conservancy project) should be explained at the places involving rivers and embankments, the impact of the project construction on the planning implementation should be analyzed and evaluated, and the requirements and suggestions for the advance or synchronous implementation of the affected parts should be put forward.

4.2. Impact on flood discharge capacity of river.

According to the flood standard, structural type and engineering layout adopted by the construction project, it is necessary to evaluate whether the fortification standard adopted by the construction project conforms to the current situation and planned flood control standard, flood control and typhoon prevention requirements and relevant technical standards of the river section. According to the analysis and calculation results of water blocking and backwater, the impact of water blocking and backwater generated by project construction on flood discharge capacity of river course and flood control capacity of embankment should be evaluated. If the existing drainage facilities may be affected, the impact of the project on the drainage capacity shall be analyzed and evaluated according to the relevant calculation results. It is necessary to calculate and compare the water blocking and backwater under different conditions (before project construction, during construction, after construction, after the implementation of compensation measures, etc.). The backwater should be divided into general backwater and local backwater, and the impact of the project on the flood carrying capacity of the upstream and downstream dikes and piers of the river section should be analyzed and evaluated respectively.

4.3. Impact on project safety.

The impact of the project construction on the scour of the embankment foot or bank slope should be evaluated according to the results of the analysis and calculation of the change of nearshore velocity and flow direction and the analysis and calculation of erosion and sedimentation. The impact on the flood control capacity of the embankment and the anti scour of the revetment should be evaluated according to the results of the analysis and calculation of water blocking and backwater, and the scope and extent of the impact should be clarified. If the dam is constructed within the scope of dam management and protection, the safe distance between the building and the dam toe, the discharge and delivery structures should be analyzed and calculated, and the impact on the safety of the dam body and its ancillary buildings, project management and emergency rescue work should be evaluated. For construction projects that occupy water sources such as reservoirs and ponds, it is necessary to evaluate the impact of water storage volume changes on water supply and irrigation. For tunnel underpass and other crossing projects, it is also necessary to analyze and evaluate the possible adverse effects on water conservancy projects, such as elevation, settlement and displacement, during and after crossing operation and maintenance.

4.4. Impact on flood prevention and rescue.

It mainly involves the influence of embankment crossing project on flood control road and the safety of temporary buildings. According to the plane layout, cross-section structure and main design dimensions of the buildings (structures) crossing the embankment and adjacent to the embankment of the construction project, the impact on the normal traffic of flood control and emergency vehicles, materials and personnel shall be evaluated. For those with impact, the clear height requirements for vehicle traffic shall be put forward or remedial measures such as building flood control roads shall be taken. Generally, the construction period of linear engineering is long, and it usually needs to cross the flood season. In
addition, we should evaluate the flood prevention and rescue, safe flood and other contents in the process of engineering implementation, and put forward the flood control requirements.

4.5. Other evaluation contents.
Include the impact on the legitimate rights and interests of the third party, the impact on tidal bore and so on.

5. Prevention and remedial measures
According to the "water area protection measures of Zhejiang Province", the water area occupied can be compensated in the form of resource compensation fee. According to the principle of "no reduction of water area and no decline of water function", functional remedial measures or equivalent alternative water area projects should be taken, and "synchronous implementation, synchronous acceptance and synchronous operation" should be implemented. The remedial measures should mainly include project scale, building layout, engineering quantity, investment and source, construction project and corresponding drawings, etc., and put forward the feasibility conclusion of the scheme. As compensation measures may involve land occupation, land nature and policy implementation, their feasibility has become an important evaluation content in flood control impact report. The compilation unit is required to put forward feasible and local compensation measures according to the calculation and evaluation results, so as to avoid the situation that compensation measures are approved but not constructed or inconsistent with the approved construction.

5.1. Equivalent alternative water area project.
If the function of water area is seriously reduced or the area of water area is seriously reduced due to the project construction, the principle of "nearby and local construction" should be followed, and the equivalent alternative water area project should be constructed, mainly in the form of new water area, widening river course, changing river, retreating dike, etc. According to the river grade and flood discharge capacity, the linear engineering should concentrate the compensation of the dispersed equivalent alternative water area projects on the backbone river which is helpful for flood discharge and drainage as far as possible. At the same time, it should combine with the water system planning to meet the needs of local ecological environment and landscaping as far as possible; If the reservoir water area is occupied, compensation should be made in the basin, and measures such as increasing the volume of the occupied water area should be taken to ensure that the flood control capacity of the reservoir will not be weakened; If the reservoir and pond are scrapped due to the project construction, the equivalent alternative water area project should be built in the county in principle to ensure that the water area in the county will not be reduced.

5.2. Functional remedies.
If the project has little adverse impact on the area, volume and function of water area and the construction conditions of equivalent substitute water area project are insufficient, the principle of "local compensation" should be followed and functional remedial measures should be taken, mainly in the form of repair, reinforcement of water conservancy projects, water clearing and so on. In case of backwater, the dike can be strengthened or the water blocking area of buildings can be reduced; Riprap can be used to prevent scour and reinforce embankment (revetment) in case of scour; In case of siltation, dredging measures should be taken, and the cost should be included in the construction cost of the main project; If the operation and maintenance of water conservancy projects such as sluices and pumping stations are affected, the measures of displacement, upgrading and reinforcement can be taken according to the planning and influence degree of sluices and pumping stations.

6. Conclusion & Suggestion
Flood control impact assessment of linear projects involving rivers and embankments has the characteristics of heavy workload, needing to coordinate the relationship between local and overall,
complex engineering, high technical difficulty, and many geographical environment, economic and social constraints. The main types of water and dike involved are piers, water area occupied by subgrade, crossing and occupying water conservancy facilities and their management scope. In view of the impact of linear engineering implementation on river course and embankment, the prevention and compensation measures of equivalent replacement of water area engineering and functional remedial measures are mainly adopted. At the same time, the following suggestions are put forward for the implementation of linear engineering:

6.1. Land use should be practical and economical.
In the actual work, when reviewing the flood control impact assessment report, the construction of "local and nearby" equivalent alternative water area project is not considered, and the land use index is not implemented, which leads to the temporary need to increase the workload and investment, and delays the progress of the project. Most of the linear projects are located in urban suburbs and rural areas, involving demolition and land acquisition, especially permanent basic farmland, so it is difficult to apply for approval for agricultural conversion. In the process of preliminary investigation and fund collection, the compilation unit should fully grasp the land nature and demand that may be involved in the compensation measures, effectively protect the cultivated land, save and intensive land use, optimize the layout form of compensation measures, construct equivalent alternative water area projects within the scope of project expropriation as far as possible, and report the specific land demand with the project owner as soon as possible, It is convenient for the owners to consider and carry out the land acquisition work, and promote the project progress scientifically and efficiently.

6.2. According to the scope of project management, implement the planning in advance within the scope.
Linear engineering mainly includes highway, railway, pipeline, etc. according to relevant laws and regulations and industry standards, most of these projects have corresponding management and protection scope, and have restrictive requirements for construction activities within their scope. This has a great impact on the implementation of water conservancy planning, river dredging, water conservancy project construction and operation and maintenance along the linear project. The compilation unit shall investigate and analyze the impact in detail, require the implementation of relevant planning and construction contents in advance, and put forward specific requirements for operation and maintenance.

6.3. Strengthen docking and join in advance.
The linear project has a long line and spans many provinces, cities and counties (districts), with heavy workload and heavy docking tasks. The demands and requirements vary from place to place. The preliminary investigation, demonstration of river and dike related points of the project, report review and other links should be conducted with water conservancy departments at all levels in various places for multiple rounds of communication and docking, and the county (District) water conservancy department should issue preliminary review opinions before the approval, Including whether to agree with the river and dike and the arrangement of compensation measures. In order to ensure the scientificity, effectiveness and feasibility of the flood control impact assessment report, the compilation unit should carry out the flood control impact assessment at the feasibility stage, and complete the review and approval of the report before the preliminary design.

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