

Environmental Impact Assessment: Implications of Bridge Construction Venture in Bangladesh

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Abstract

This study was conducted to assess the environmental impacts of the proposed Kashil Bridge over the river Jhinai at Basail upazila of Tangail district in Bangladesh during January to September 2019. The environmental impact assessment (EIA) is a mandatory process to assess the environmental consequences of an existing or proposed project and to delineate any environmental management measures that must be integrated into the plan to ensure that the project is technically, economically, socially and environmentally acceptable. The EIA preparation led to the identification of potential environmental and social impacts due to proposed bridge pre-construction, construction and operation activities on the Jhinai River and feasible remedial measures as included in the Environmental Management Plan (EMP). A field mobilization was conducted in project area to find out the environmental baseline (surface water, groundwater, soil, sediments, air, noise and ecology) information and identification of possible impacts. The focused group discussions (FGDs), questionnaire survey (QS) and key informants interview (KII) were conducted to collect relevant information. Secondary data were collected from Local Government Engineering Department, Upazila Agriculture Office, Upazila Fisheries Office, Department of Environment (DoE) and published relevant articles. Analyzing overall impacts, EIA study found that these possible negative impacts are considerable if some mitigation measures are applied. This new bridge will not only increase the communication facilities but also increase the economic flow together with other facilities. Finally, the EIA study suggested some defined EMP which will help to minimize the probable adverse impacts of the bridge construction site over the Jhinai River.

Key words: Bangladesh, EIA, EMP, Impacts, Mitigation measures, Tangail

Introduction

Environmental Impact Assessment (EIA) has widely proven an effective tool of sustainable environmental planning and management (Toro *et al.*, 2012). The EIA is a very crucial part of any construction and considered as a new planning and decision making tool which was first established in the United States under the National Environmental Policy Act of 1969 (Islam and Saiful, 2007; Saha, 2007; Islam *et al.*, 2017). Bangladesh is a major developing country that is particularly vulnerable to different type's environmental change due to climate change and anthropogenic causes (Hasan *et al.*, 2017; Majumder *et al.*, 2017). Since independence in 1971, Bangladesh has initiated a number of environmental rules and regulations that is prominent in the global push for sustainable development goals (Islam *et al.*, 2020; Ahammed and Harvey, 2004). The proposed bridge is located over the Jhinai River on Basail-Karatia via Vatpara Kashil road under Basail upazila of Tangail district which belongs to the middle part of Bangladesh. This area deprived of the modern communication facilities; as a result, the economic condition in the project area is not satisfactory. There has long been a desire of the people of this area to improve the transportation network among Basail-Karatia via Vatpara Kashil road under Basail upazila of Tangail district. The proposed Bridge will save both time and money for transportation of people and goods. New employment opportunities will be generated. After the

completion of the bridge, the commercial vehicles will be able to give more trips and people will be able to reach their destination within a short time. The construction of bridges may impact upon the local environment and river dynamics particularly where in stream span supports are required (EA, 2002; EPA, 2002). The main purpose of this study is to find out the adverse environmental impacts during the construction, operation and maintenance phase of the project site and suggest an effective environmental management plan. The precise purpose of the study is - to identify the environmental baseline (surface water, ground water, soil, sediment, air quality and noise) condition of the study area; to identify and predict key environmental and social impacts at pre-construction, construction and operation phase; to find out the beneficial role of the proposed bridge for sustainable development; to find ways and means to minimizing adverse impacts. According to the green category project do not require initial environmental examination (IEE) and EIA. On the other hand, red category projects, which require both IEE and EIA. The red category project includes the bridge over 100 m in length, and orange B category project include the bridge less than 100 m in length (DoE, 2010). The proposed Basail-Karatia via Vatpara Kashil Bridge is more than 108 m long. So, it is included in the red category. That's why Environmental Impacts Assessment should include the prediction, evaluation, and mitigation of environmental impacts based on the characteristics of the project and an environmental management plan shall be prepared. The objectives of

the study were: i) to observe the potential environmental impacts in the course of pre-construction, construction and operation phase of the project, and ii) to propose the effective management measures for mitigating adverse impacts associated with the bridge construction in the implantation area.

Materials and Methods

Study area

The study was conducted at Kashil union of Basail upazila in Tangail district of Bangladesh. The proposed 108 m bridge would be constructed over the Jhinai River on Basail-Karatia via Vatpara Kashil road under Basail upazila of Tangail district. The bridge is located at chainage 3+950 m. The physical setting around the proposed project site is portrayed as: i) east: agricultural land (Kashil, Basail, Tangail); ii) west: approach road (Karatia, Sadar, Tangail); iii) north: Jhinai river and iv) south: Jhinai river. The site coordinates of the proposed bridge are east end corner- 24°13'0.43"N 90°01'33.15"E

and west end corner- 24°13'0.57"N 90°01'27.70"E (LGED, 2019).

Data collection

The data were collected from primary and secondary sources. The primary data were collected by household questionnaire survey, consultation meeting of expected affected people at project area, focus group discussions (FGD) with the local community, and key informants interview with upazila Fisheries, Education, and Agriculture officer at Basail in Tangail. The secondary data were collected from Bangladesh Bureau of Statistics, bridge construction authorities, construction manager, project manager, chief engineer of this bridge construction project, local government and engineering department (LGED) and from relevant articles. On the other hand, the baseline environmental situation of the project place was drawn according to the information accumulated from secondary and primary information sources via literature review, field investigations, and consultations with different stakeholders.

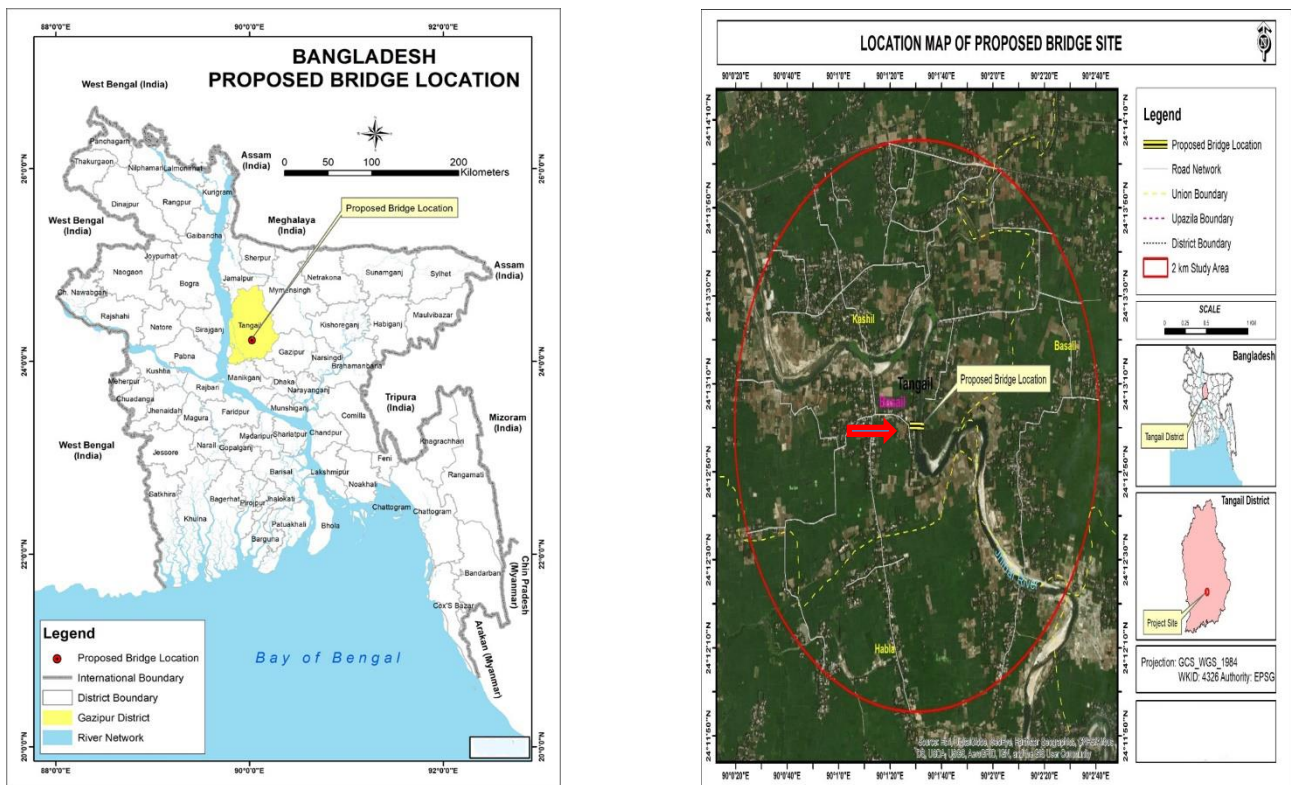


Fig. 1. Map showing the study area in the Basail upazila of Tangail district (Source: EQMS, 2020)

Quantification of environmental impact

Impact assessed based on different environmental impact parameter was evaluated assigning score ranging from 0 to ±5 for both positive (+) and negative (-) impacts. Changes of environmental parameters consider as i) severe (+5 or -5), ii) high (+4 or -4), iii) moderate (+3 or -3), iv) low (+2 or -2), v) very low (+1 or -1), vi) no change (0). Method of assessing environmental impact value (EIV) are estimated and calculated by

using following equations (RPT-NEDECO-BCL, 1989; Wilson, 1998) as follows.

$$EIV = \sum_{i=1}^n (vi)wi \dots\dots\dots (1)$$

Results and Discussion

Impacts assessment

The environmental impact assessment (EIA) components were considered to include the physicochemical, ecological, sociocultural and human interest in the study area. These components are divided into different parameters for identifying key and significant impact during different stages of the project, which need to be thoroughly addressed for proper mitigation and management and finally overall value are calculated for each component (Tables 1, 2, 3 and 4). The EIV calculation showed that the induced development has both negative and positive impacts on the environment. The positive impacts are sociocultural

parameters (+43) and human interest parameters (+71). The negative impacts are ecological parameters (-46) and physicochemical parameters (-65). Major of these adverse negative effects are mainly construction related and it can be properly mitigated. The EIV calculation found the total environmental impact assessment value is +3 (medium). This result represents that the project is medium positive impact on the environment and it is socially and environmentally acceptable. The results give the clearance to go ahead with the project. The project have also negative impact but if we can take precautionary measures to eliminate the negative impacts of this project then this project will be succeeded and people get more benefits from the project.

Table 1. Calculation of value of ecological impact in the bridge construction site

Ecological parameters	RIV*	DoI**	Individual EIV***
Loss of vegetation	23	0	0
Water pollution	16	-3	-48
Soil pollution	7	-2	-14
Loss of fish habitat	12	-2	-24
Plantation	20	+2	+40
Total value of ecological impact			-46

Note: *RIV = Relative Impact Value, **DoI = Degree of Impact, ***EIV = Environmental Impact Value.

Table 2. Calculation of value of physicochemical impact in the bridge construction site

Physicochemical parameters	RIV*	DoI**	Individual EIV***
Erosion and siltation	18	0	0
Surface and ground water	20	-1	-20
Sound pollution	20	-2	-40
River excavation	15	+1	+15
Air pollution	10	-2	-20
Total value of physicochemical impact			-65

Note: *RIV = Relative Impact Value, **DoI = Degree of Impact, ***EIV = Environmental Impact Value.

Table 3. Calculation of value of sociocultural impact in the bridge construction site

Sociocultural parameters	RIV*	DoI**	Individual EIV***
Health facilities	15	+1	+15
Population and communities	30	+1	+30
Socioeconomic conditions	18	+1	+18
Current use of lands/ resources	20	-1	-20
Cultural heritage	8	0	0
Total value of sociocultural impact			+43

Note: *RIV = Relative Impact Value, **DoI = Degree of Impact, ***EIV = Environmental Impact Value.

Table 4. Calculation of value of human interest impact in the bridge construction site

Human interest parameters	RIV*	DoI**	Individual EIV***
Land use change	5	-1	-5
Loss of agricultural land	15	-1	-15
Road communication	30	+2	+60
Employment opportunity	6	+3	+18
Economic development	13	+1	+13
Total value of human interest impact			+71

Note: *RIV = Relative Impact Value, **DoI = Degree of Impact, ***EIV = Environmental Impact Value.

Total environmental impact value, $EIV = \sum_{i=1}^n (vi)wi = (-46-65+43+71) = +3$

In Baga ferry ghat due to construction of superstructure and road structure, the local economy will be impacted but the overall impact is very low. There is a very less probability of accidents during construction (Hasan *et al.*, 2018). The significance of impacts on ambient air quality during the construction phase activities can be assessed as medium-high. The construction equipment and vehicles will use fuel and contribute to air pollution releasing hazardous air emissions such as NO_x, SO₂, CO, PM_{2.5}, and PM₁₀ and SPM. During the construction phase of the bridges, a huge quantity of earthworks is to be required. Dust raised from access roads by moving trucks during transportation of construction materials will also pollute the air of the immediate local environment. Various construction activities and movement of construction vehicles and machinery will affect ambient air quality at the proposed bridge site in Kashil area and its approach road. A high negative impact will observe at the time of construction of bridge substructure especially during pile driving, which generates high underwater and air noise levels that affect the aquatic life. Groundwater at the proposed bridge site may be polluted due to seepage from cement

concrete mixing, piling activities, accidental spillage of chemicals and hazardous liquid from working sites and seepage of untreated waste from construction camp (Islam *et al.*, 2020; Kabir and Momtaz, 2012). The surface water in the Jhinai River will be polluted due to improper management of construction waste, disposal of wastes into the water bodies from the construction camp and construction site and accidental spillage of hazardous liquids into the river. The bridge alignment and its approach are selected in such a way that no trees will be affected by the proposed project implementation. Where Environmental Impact Assessment on Galachipa bridge construction over the Galachipa River the floral biodiversity impact on highly negative (Faisal *et al.*, 2018; Kabir and Momtaz, 2013).

Environmental management plan (EMP)

Environmental management plan is prepared to identify all environmental impacts during pre-construction, construction and operation/ maintenance stages due to implementation of different types of project activities (DETR, 2000).

Table 5. The mitigation measure of potential negative impact during the construction of the proposed bridge over Jhinai River in Tangail.

Negative impacts	Proposed mitigation measures
Solid and liquid waste from the labor camp	i) Labor camp should be constructed at a distance from the water body, ii) Avoid productive land and away from the settlement during the selection of land for the setup of labor camp, iii) No solid and liquid waste discharge into the water bodies, iv) Instruct workers to maintain a clean environment in the camp and its surrounding area.
Air pollution	i) Fit vehicles with appropriate exhaust systems and emission control devices, ii) Maintain vehicles and construction equipment in good working condition including regular servicing, iii) Operate the vehicles in a fuel-efficient manner, iv) Impose speed limits at 20 km/hour on vehicle movement at the worksite to reduce dust emissions, v) Construction equipment causing excess pollution (e.g. visible smoke) will be banned from construction site immediately prior to usage, vi) Water spray to the dry earth/ material stockpiles, access roads and bare soils as and when required to minimize the potential for environmental nuisance due to dust, vii) Stored materials such as: excavated earth, dredged soil, gravel and sand shall be covered and confined to avoid their wind drifted, viii) Restore disturbed areas as soon as possible by vegetation.
Noise pollution and vibration	i) Create noise barrier and consider the minimum noise levels at sensitive receptor sites (e.g. school, mosque, temple, health center etc.), ii) The stone breaking machine should be confined within a temporary shed so that noise pollution could be kept in minimum, iii) Protection devices (ear plugs or ear muffs) shall be provided to the workers operating in the vicinity of high noise generating machines during construction, iv) Construction equipment and vehicles shall be fitted with silencers and maintained properly, v) Instruction to the drivers to avoid unnecessary horn.
Surface and groundwater pollution	i) Any wastes should not be throwing into the river other than dump into the designated waste dumping area, ii) Construction work should be preferred during dry season, iii) Store the oil and petroleum product in a separate location cover by a concrete structure.
Soil pollution	i) Avoid the productive land, agricultural land, archaeological sites, protected area, forest area, natural habitat etc., ii) Soil from the fallow land should be used in earthwork in approach road or by dredge soil from the river bed, iii) Re-vegetation the exposed area as early as possible to reduce the soil erosion.

Conclusions

The Kashil Bridge was proposed by the Government of Bangladesh and the GoB has also given authority to LGED to plan on Kashil Bridge for increasing the communication system in the middle part of Bangladesh. The Environmental impact assessment (EIA) reveals that there will be both potential positive and negative environmental, social and economic impacts due to the construction of the bridge over the Jhinai River. The momentous negative environmental and social impacts will have been noticed when the land, air, water, and noise quality, flora and fauna diversity, aquatic habitat waste plantation, top soil loss. Still then the project will have also some significant positive impacts for precedent; at the time of construction, a huge number of people will get short-term employment opportunity, vegetation by resettlement of agricultural land, reuse of top soil, gender promotion, change in land use and the vehicles will get more trips, so the people will easily reach their destination. Moreover, the economic condition in this area will be rapidly developed.

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