



## Environmental Impact Assessment of Boga Bridge Patuakhali

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### Abstract

The economic development and social unity largely depend on the communication facilities. Improvement of national highway network in Bangladesh has been obstructed due to some rivers. Lohalia is one of the largest rivers in Patuakhali district divides Bauphal and Dumki upazila. The major transport barrier between the Bauphal and Patuakhali, Barisal city is Boga Bridge. The proposed 900 meter long Boga Bridge will be constructed under the supervision of World Bank, ADB, local and international experts. This paper shows the environmental impact assessment of Boga Bridge over the Lohalia River. The aim of the study is to identify the major environmental impact, mitigation measures and environmental impact value of the Boga Bridge. The major impacts of the Boga Bridge are loss of livelihood, loss of land, delta formation, loss of trees and rare species, loss of fisheries, navigational restrictions, surface water pollution, air pollution, soil contamination, river bank erosion, change the river flow. The environmental impact value of this project is “-3” (negative three). The mitigation measures for the Boga Bridge project are cash compensation, relocation, periodic dredging, plant two for one felled, provide new jobs, revetment, provide safe water, good food and sanitation etc. By the proper implementation of these mitigation measures must help to reduce these impacts.

**Key words:** Bridge project, Environmental impact value, Mitigation

### Introduction

Coastal part of a country is always important for the country development. The main reason behind this is the plentiful resources and livelihood opportunity. But in the case of Bangladesh, its coastal part remains deprived. The main reason behind this is the lack of standard communication facilities in coastal parts. For this it needs to develop this part very early by developing communication facilities through constructing bridges, culverts, roads etc. (Kundu, 2011). The economic development and social unity largely depend on the communication facilities. Improvement of national highway network in Bangladesh has been obstructed due to some rivers. Boga is one of the largest rivers in Patuakhali district divides Bauphal and Dumkiupazila. The major transport barrier between the Bauphal and Patuakhali, Barisal city is Boga Bridge. The river poses an impediment to economic development and social integrity between these two parts. There has long been desire to improve the transportation network and the energy transfer to the Bauphal Upazila. By thinking of this, we recognized a river which should have a bridge as this is one of the important place for trade. The proposed project is constructing of Boga Bridge. So for the development of this area it needs to construct a bridge urgently.

EIA is the systematic process of identifying the future consequences of a current or proposed action (Huq, 2002; Krishnamoorthy, 2005; BBA, 2010; Kundu, 2011). This report produces for the evaluation of the Environmental Impact Assessment of the Proposed Boga Bridge. The objectives of the study are- to identify the impacts, and mitigation of the Boga Bridge project, and to calculate the environmental impact value.

### Materials and Methods

Information concerning the EIA of the project is mainly based on the available secondary and primary data. The secondary data pertaining to the study were collected from different sources like Bangladesh Water Development Board (BWDB), Local Government Engineering Department (LGED), Bangladesh Agriculture Development Corporation (BADC), Department of Roads and Highway (RHD), Department of Public Health Engineering (DPHE), Department of Land Record Survey (DLRS) and primary data was collected from Local Chairmen and Members of the Union Boga, Local elites of the project area and Focus Group Discussion with local people. The environmental impact value is calculated by the equation (Wilson, 1998; Saha, 2007):

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

where, EIV = Environmental Impact Value, Vi=Relative change of the environmental quality of parameters, Wi=Relative importance or weight or parameter, N=total number of environmental parameters.

Changes of environmental parameters are severe (+5 or -5), higher (+4 or -4), moderate (+3 or -3), low (+2 or -2), very Low (+1 or -1), no change (0).

### Study area

The project area is located in the southern coastal part of Bangladesh. The project area comprises Boga union in Bauphal upazila in the East bank of Boga River and Muradia union in Dumki upazila on its West bank. The cities, namely Patuakhali and Barisal are located at the distance of 22 km and 40 km respectively from the Boga Bridge. The objective of the Project is to support economic growth and poverty reduction through improved connectivity between Bauphal upazila and other

regions in Bangladesh by achieving the smoother transportation. The Boga bridge project includes the following components: the main bridge (Boga Bridge), the bridge end facilities at the east and west bank of Boga River, the approach road connecting the bridge with national highway and the river training works.

**Results and Discussion**

***Environmental impact and mitigation***

The Boga Bridge project has many potential environmental impacts; from them some major potential environmental impacts and its mitigations are given below (Tables 1, 2, 3).

**Table 1.** Environmental impact and mitigation measures of pre-construction stage

	<b>Environmental Components</b>	<b>Potential Impacts</b>	<b>Mitigation Measures</b>
Ecological Environment	Movement of survey team and project staff	Loss of field crops	Avoid disturbance
	Tree felling	Impact on ecology	Cash compensation
	Disturbance to wildlife	Wildlife migration	Minimization of noise
Socio economic Condition	Apprehended loss of ancestral homes/ lands and properties.	Psychological stress	Inform the real Situation
	Apprehended loss of livelihood	Psychological stress	Inform the actual Situation
	Cultural Resources	Loss of cultural resources	Relocate if inevitable
	Privacy loss	Movement of team	Avoid disturbance

**Table 2.** Environmental impact and mitigation measures of construction stage

	<b>Environmental Components</b>	<b>Potential Impacts</b>	<b>Mitigation Measures</b>
Natural resources	Loss of land	Loss of livelihood Reduced food production	Cash compensation/ Relocation on Khas land
	Hydrology/Flood pattern	Approach roads might Impact on Hydrology	Adequate clearance on Embankment
	Drainage congestion	May cause drainage congestion	Adequate openings on Embankment
	Erosion/Sedimentation	Piers might create Water head difference	Bogha a tidal river carries small volume of sediment load
	Delta formation	Delta formation may Induced at Piers sites	Periodic dredging
Ecological resources	Loss of agriculture	Loss of agriculture land	Cash compensation
	Loss of trees	Impacts ecology and Economy	Cash compensation Plant two for one felled
	Loss of fisheries	Fishing may be affected in Bogha River	Cash compensation
	Wetland	Wetlands may be affected	Avoid wetlands, Cash compensation, dig
	Wildlife	Wildlife might migrate due to noise	Wildlife will return after construction is completed
Socio economic Resources	Loss of income	Jobs at ferry ghat may be lost	Cash compensation, Provide of jobs
	Cultural resource loss	Nothing apprehended	Cash compensation Relocation
	Navigational restrictions	May create hindrance to navigation	Compensation, to maintain navigational clearance
	Public health safety	Workers in camps might pose public health risk	Provide safe water, good food and sanitation
	Occupational Health safety	Workers may meet accidents during works	Periodic health Checkup and vaccination
	Employments	Loss of many jobs and create few jobs	Employ the PAP's in project jobs.
	Women empowerment	Will facilitate women empowerment, Creating jobs for them	Maintain gender equity
	Road accidents	Movement of transports faster may cause road accidents	Enforce the traffic rules, Maintenance of the Automobiles and road
Chemical pollution	Surface water pollution	Water at camp site may be polluted by disposals of solid wastes, faecal contaminants, and noxious chemicals	Avoid wastes, cement, Bentonite, chemicals, etc. disposal in water
	Air Pollution	Emission of SOx, NOx, COx gases from vehicles, plants, etc.	Operate construction plants, vehicles properly. Install

		and dust, dirt, smoke from work sites	plants at safe distance from Locality
	Soil Contamination	Soil Quality may be affected due to solid wastes disposal and spillage of noxious contaminants	Avoid disposing solid wastes on soil, store, transport, handle noxious materials carefully
	Noise Pollution	Movement of vehicles, operation of ballast, concrete mixing, other plants, generator cause sound pollution	Maintain all plants, vehicles, machineries properly. Install plants be at safe distance. Operation time is chosen
	Works with cement and concrete	Cement is toxic for fish, plant and animal.	Cement work sites to be far from open water bodies. Avoid water pollution by concrete washout.
	Contamination by oil and chemicals spillage	Contamination may be due to oil, chemicals and organic wastes	Works with contaminants be carried out away from open water bodies
Accidents	Working at heights	Fall from high place causes injury even death	Can be reduced using PPEs, and with due protection training
	Working on/near water bodies	Drowning incidents occur due to lack of safety measures	Use lifebelt during work time, avoid working on water bodies alone
	Working with electric machineries	Cutting and grinding machines, gears, chain drives, fans etc. may cause lethal accidents	Use safe guards to the plants. Protect workers from contacts of moving machineries
	Accidents at work sites	On lookers out of curiosity may enter the work sites or pass across the work sites	Construct temporary fence around the work sites and post security guards

**Table 3.** Environmental impact and mitigation measures of operation stage

Physical resources	Hydrology and flooding	Bridge induced Obstacles may not impact river hydrology	Changed hydrology can be corrected by RTW
	Drainage congestion	Congestion may be caused by approach roads	Create adequate opening
	River bank Erosion	Lebukhali River shows signs of bank erosion	RTW will reduce risk of bank erosion.
Ecological resources	Tree planting on approach road sides	Trees on approach road sides and distribution of tree seedlings will have positive impact.	Enhancement
	Agriculture	Safe and fast road communication will cast positive impacts on agriculture	Enhancement
	Wildlife	Restoration of environment due to road side tree planting will favor wildlife to return	Enhancement
Chemical pollution	Air Pollution	Movement of land transports will pollute air due to emissions and blowing of dust and dirt	Maintain vehicles properly and roads clean
	Noise and vibration	Project site and command area will be noisy because of movement of larger numbers of vehicles	Maintain the vehicle properly
Socioeconomic Condition	Road accidents	Number of death and injury due to road accident will rise	Proper maintenance of road, vehicles and strict compliance to traffic rules
	Health and sanitation	Health and sanitation conditions at project command area will improve due to induced urbanization rate	Sporadic growth of shops and shanties on approach roads should be checked
	Employment opportunities	Augment work opportunities in the region	Enhancement

**Calculation of environmental impact value**

Environmental impact value is the actual value of impact on the environment. Environmental impact value consists of three assessment of impact, they

are: ecological impact, physicochemical impact and impact on human interest. By using the equation no... (i) Calculation of Environmental Impact Value of Boga Bridge is given below.

**Table 4.** Estimation of ecological impact value

Impact on	Relative Impact Value	Degree of impact	Individual Environmental Impact Value
Fisheries	25	-2	-50
Forest	5	-1	-5
Roadside plantation	10	+2	+20
Wetland habitat	10	0	0
Air pollution	6	-1	-6
Water pollution	8	-1	-8
Sound pollution	9	-1	-9
Soil pollution	5	-1	-5
Ecosystem	15	-1	-15
Extinction of different species	7	-3	-21
<b>Total</b>			<b>-99</b>

**Table 5.** Estimation of physicochemical impact value

Impact on	Relative Impact Value	Degree of impact	Individual Environmental Impact Value
Erosion	15	-3	-45
Drainage congestion	5	-2	-10
Water logging	15	0	0
Flooding	10	-1	-10
Salinity intrusion	12	-1	-12
Waste generation	8	-1	-8
Change the river flow	10	-2	-20
Siltation	10	-3	-30
Dust pollution	10	-1	-10
Obstruct of normal water flow	5	-1	-5
<b>Total</b>			<b>-150</b>

**Table 6.** Estimation of human interest impact value

Impact on	Relative Impact Value	Degree of impact	Individual Environmental Impact Value
Loss of agricultural land	10	-2	-20
Generation of employment opportunities	20	+3	+60
Navigation and boat communication	10	-2	-20
Community up gradation	10	+3	+30
Commercial area build up	15	+3	+45
Land scape change	3	+2	+6
Transportation facilities	27	+5	+135
Aesthetic value or recreation	5	+2	+10
<b>Total</b>			<b>+246</b>

*N. B: Individual Environmental Impact Value = Relative Impact Value \* Degree of Impact*

**Table 7.** Total environmental impact estimation

Sector	Total	Result(EIV) = $\sum_{i=1}^n (Vi) Wi$
Ecological	-99	- 3
Physcio-chemical Impact	-150	
Human Interest	+246	

After observing and estimating all the parameters we are able to identify the Environmental Impact Value (EIV) of our project. The EIV considering both positive and negative, we found -3 (three) negative. On the basis of this result we can say that this project has moderate negative impact on the environment but if we are able to take precautionary measures to eliminate the negative impacts of this project then this project would be a successful one and people get benefits from the project. After considering all the issues we recommend “Bogha Bridge Project” should be constructed. Strict implementation of Environmental Management Plan (EMP) brings the best outcome and success of the project in term of reducing negative environmental impacts of this project. A proper environmental management plan can ensure the environmental sustainability of a project (Ahmad *et al.*, 1994; Daniel *et al.*, 2004). If EMP will implement properly then the negative impacts on environment can be minimized but without EMP the negative impacts on environment of this project will be much more severe that are depicted in the following graphical presentation.

**Conclusions**

The summary demonstrates that there is considerable opportunity for the development of this area by the construction of Boga Bridge. The life style of this area’s people must be change overnight due to the development of this area by the Boga Bridge. This bridge must be treated as the development pill of this area, especially in the Bauphal, Doshmina and Golachipa area. Although this area may face significant environmental change if this bridge construct; such as: river route change, rise of char land, the depth of river may decrease, river erosion, agricultural land loss, loss of trees, loss of fisheries, jobs at ferry ghat may be lost, public health safety, surface water pollution, air pollution, soil contamination, accidents etc. As a result many local people have to be migrated from these places. After properly evaluation of environmental impact, the environmental impact value was found as “-3” (negative three), that means this project has some significant negative environmental impact, but with proper implementation of mitigation measures such as dredging, revetment, relocation, tree plantation, digging of pond, cash compensation, provide new jobs, to maintain navigational clearance, provide safe water, good food and sanitation, avoid wastes, cement, chemicals, etc. disposal in water, install plants at safe distance from locality, avoid disposing solid wastes on soil, using personal protective equipment etc. those impact must decrease. This report briefly describe the pre , during and post construction negative impact and its mitigation measures, many alternatives, environmental management plan, monitoring plan

for ten years, management and monitoring budget which must reduce the environmental impact value. With some negative impact this project has many positive impacts such as generation of employment opportunities, community up gradation, commercial area build up, land scape change, transportation facilities, roadside plantation, aesthetic value or recreation. After all, Boga Bridge is necessary for the economic development of Bauphal, Doshmina and Golachipa region. It also reduces the enormous suffering of transportation of that area's people. After considering the all issue it is strongly recommend that the Boga Bridge should be established.

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