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A STUDY ON THE AEZ BASED ROAD-TRANSPORTATION ENGINEERING ON THE BIO-DIVERSITY AND FOOD SECURITY IN DISASTROUS AREAS OF BANGLADESH

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ABSTRACT

Sarkar SK, Amin MS, Begum M (2012) A study on the AEZ based road-transportation engineering on the Bio-diversity and food security in disastrous areas of Bangladesh. *J. Innov & Dev. Strategy* 6(1), 118-123.

Bangladesh has 30 Agro-Ecological Zones (AEZ) as per its climate and environment by UNDP considering climate change parameters, natural resources and food security for bio-diversity sustenance. A study was conducted with AEZ Based road-transportation engineering on the bio-diversity influencing food security stability. The road transportation engineering integration consists of the bridge designs impacting bio-diversity. It was done with the objectives studying the physical communication systems evaluating the Bridge Maintenance and Management Systems (BMMS) and bio-diversity command area impact information. The works were done thus to develop a non-pillar-bridge avoiding water stagnation. The results indicated that the road-bridge-transport integrated system contributed negatively for food security and bio-diversity indicating environmental degradation. The Bridge-Culvert dimensions were found inadequate to drain out the command area water causing bio-diversity based production found loss. The most structures had middle pillars reducing the water streams. The results showed that about 74% of the bridges lost its full functions increasing water stagnation up to 63%. The food security decreased up to 21% by last 5 years. Having being recognizing the ill effects of unplanned transportation engineering, a model bridge design was developed enabling 24% more water drainage and reduced food oriented bio-diversity destruction by 14%, recommending further studies in other critical areas.

Key words: *Transportation Engineering, Agro-Ecological Zone, Bio-Diversity and Food Security*

INTRODUCTION

The Bangladesh is an Agrarian low-lying country having about 73% of the land consisting medium high, medium low, low, very low and water bodies, the rest only 27% being high land. But the country requires about 57% of its land for upland crops including homesteads, office premises and other plantations. It is obvious that the gap 30% of the land (required 57% minus existing 27%) is to be taken in to the system improving its drainage establishing structures (NCDP 2006).

The communication through all roads is of almost importance and it is essential to integrate the communication and drainage integration for the bio-productivity. Rural roads connect rural areas with the urban marketing, central highways, rail heads, road heads, etc., including Other District Roads (ODRs). It has been reported that expansion of roads and its other drainage and irrigation infrastructures imposed serious congestion due its smaller size than its catchments areas.

The study was undertaken with the aim of assessing on how the Bridges and Culverts had different impacts on access to transport and other services for women and men of rural areas of Bangladesh. As population and land values increases, the effect of uncontrolled runoff become an economic burden and poses a serious threat to health and well being of citizens (FAO 2007).

Fig. 1. Road map showing the rivers, designs of the model bridge and Bridges within 50 meters length

The Figure 1 shows the rivers on which the existing bridges are situated, the designs of the model bridge that is concerned here and the bridges those are situated within 50 meters on different route.

Bangladesh is an Agricultural country. There are a plenty of land by side of the roads and highways, and only for the lack of bridges and Culverts, the production of food grains doesn't achieve the highest level.

The Bridges and Culverts help the farmers for their cultivation and help them to produce lot of food grains (MOA 2008). Watershed of the reservoir and canals, green crops and the trees along the dykes would bring in positive impact on the climate. A vast land in the Southern Region will be transformed into crop land and thus bring in green revolution (MOA 2008).

Transport and Livelihoods:

In a recent participatory cross-sectional study of rural communities in Bangladesh, some livelihood analysis (Davis 2000; OECD 2007) revealed that transport constraints and their impact on rural livelihoods and service provision are of high priority for the rural poor. Due to the lack of detailed elevation data, sometimes it was very hard to measure the actual depth of water logging (OECD 1992).

This process of liberalization has affected subsistence and emergent farmers in all nine Provinces, but has proved most damaging in areas which are extremely remote and lack efficient livelihood strategies with which to alleviate vulnerability in the event of shocks and stresses (World Bank 1974). The condition of the Trunk, Main and District roads are far from adequate, and the feeder roads are extremely dilapidated, and frequently impassable throughout the wet season.

The livelihood constraints experienced by the rural peoples proved to be far reaching. Thus the present research was conducted with the objectives to: i. Asses the AEZ based drainage and transport requirements; ii. Estimate catchments and Bridge-Culvert dimensions; iii. Assess the contributions of road transport system on the bio-diversity, and iv. Finally design a model Bridge for rapid water drainage in disastrous AEZ areas.

MATERIALS AND METHODS

A number of field visits were undertaken in specific areas as per the questionnaire guideline. During the field visits, meetings and Focus Group Discussion (FGD) were organized with key stakeholders to discuss issues, address gaps and explore possibilities for further collaboration (JCE 2005).

The project profiles and project reports on AEZ and drainage and irrigation structures relating to the Roads and Highways and Rural Roads were collected and directly analyzed as per methodological parameters.

The package included: Physical visit and documentation of a few Bridges and Culverts with catchments areas; e-documentation of road and transport status, bio-diversity, and bio-productivity; and Focus Group Discussion (FGD) at different level.

The defensive attitude of responsible authorities related to the problem and their reluctance to provide relevant data has limited the information. Therefore, in some case it has to depend on photograph rather than numeric data to illustrate the causes and effects of the situation.

During the questionnaire survey, some interviewee did not want to make any comments against the responsible development authorities even they know the lack of efficiency of those authorities, because they think that any negative comments can be harmful for them in near future.

Physical Documentation: Name and address of the structure, duration of the structure, total Command area (sq. km), Specific site, area of high land, medium high land, medium low land, low land, very low land, and water bodies-are in acres.

FGD: Assessment of the impact of road–bridge integrals on the bio-diversity, agricultural productivity, business transports, social and business environment.

Site: Upazila-Union-Villages-Road name-Site code-year - Road measurement. Bridge/Culvert measurement, objective of the road, bridge & culvert with present conditions.

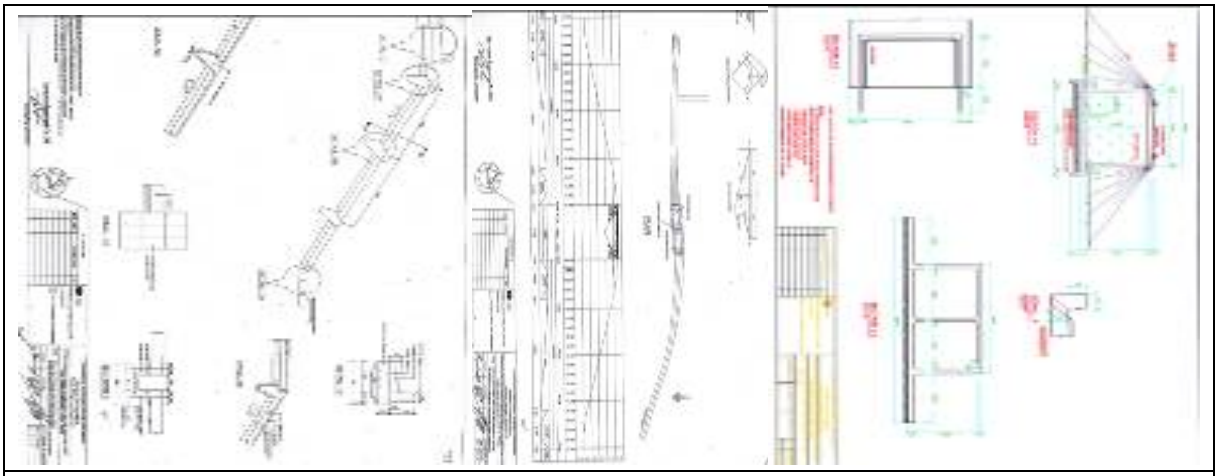

Fig. 2. Design elements of the non-pier model bridge

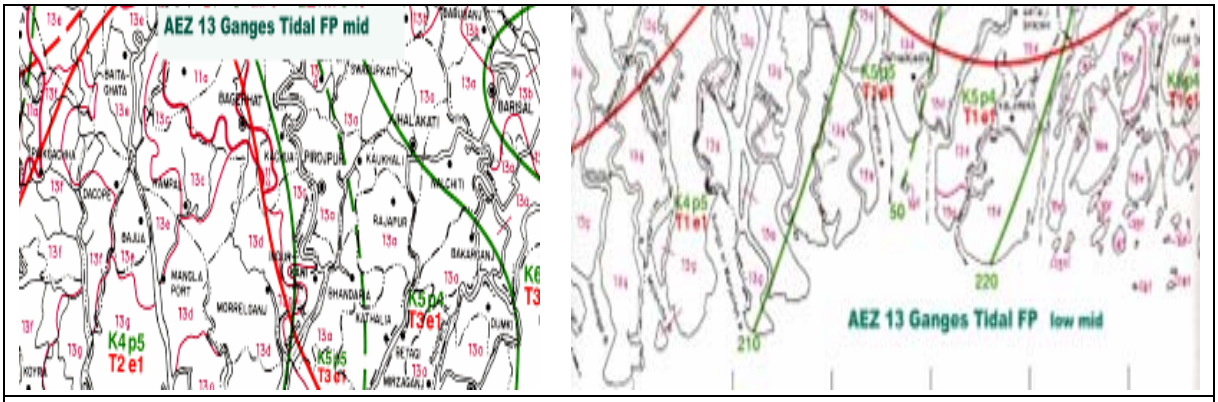

Fig. 3. Area having high transport and roads/bridges-Coastal Floodplain-North

The Figure 2 shows the design elements of the concerned non-pier model bridge and the figure 3 shows the area having high transport and concerned roads/bridges that are situated in the coastal-floodplain of north region.

RESULTS AND DISCUSSION

The results showed that the area studied contained 28% medium low land and 31% lowland covering the districts of greater Khulna. The duration of the structures 5-15 years and the catchments command area- 900-3000 ha per structure.

AEZ 13: Ganges Tidal Floodplain: Greater Khulna

Table 1. Characteristic features of the study area

Land Topography	% Area
High land	7
Medium High land	12
Medium low land	28
Low land	31
Very low land	12
Permanent water bodies	10

Agro-Productivity Status of the Site

The agro-productivity of the sites reveals that both the bio-diversity and the bio-productivity of the sites were degraded than the previous status which may be attributed to the unplanned structure impeding natural water drainage.

The results given in the Table 2 to 5 here show that the functionality of the structures ranges from 9% to 63% and effectiveness from 4% to 42% indicating it incompatibility with the command area requirement which practically degraded bio-diversity and food security.

Table 2. Major Structure group and Total structures

Major structures	Bridges Dimensions	Culverts Dimensions	Sluice gates and dams Dimensions
Length	30-50 m	10-30 m	05-10 m
% of the total structure	33	56	11
% Functioning sites	63	28	9

Table 3. Effectiveness of the structures as per organizations

Items	RHD	LGED	WDB	NGO	Local
No. of Effectives	14	38	3	17	28
% Effectiveness	42	34	4	7	13

The results in Table 4-5 reveal that the smaller Bridges worked more good than Culverts and the structures made by local bodies were found to be more effect.

Table 4. Major Structure group and Total structures

Major Structures	Bridges Dimensions	Culverts Dimensions	Sluice gates and dams Dimensions
Length	**30-50 m**	**10-30 m**	**5-10 m**
% of the total structures	35	51	14
% Functioning structures	48	36	16

Table 5. Comparative Effectiveness of Structures as per Organizations

Items	RHD	LGED	WDB	NGO	Local
% of the total structures	17	48	2	11	22
% Effectiveness of the Sites	42	32	4	9	13

Environmental Engineering and Bio-diversity

Environmental Engineering and Bio-diversity works as referred (Nelson 2000) were stated to be very important as it is significant components of environmental engineering science; systems engineering; water supply; sanitation; low cost technologies; water pollution and control; air pollution and control; solid waste management and environmental impact assessment are covered. Furthermore, the papers that particularly focus on design, methods; environmental biology, inadequate existing drainage channels and their improper operation and management mainly cause these floods (GOB 2007).

The Figure 4 and 5 shows that among food crops, the field crops including cereals, pulse, oilseeds and spices, and wild animals involved in bio-diversity reduction significantly: Bio-diversity Range Status: 1985 (AEZ based index 100).

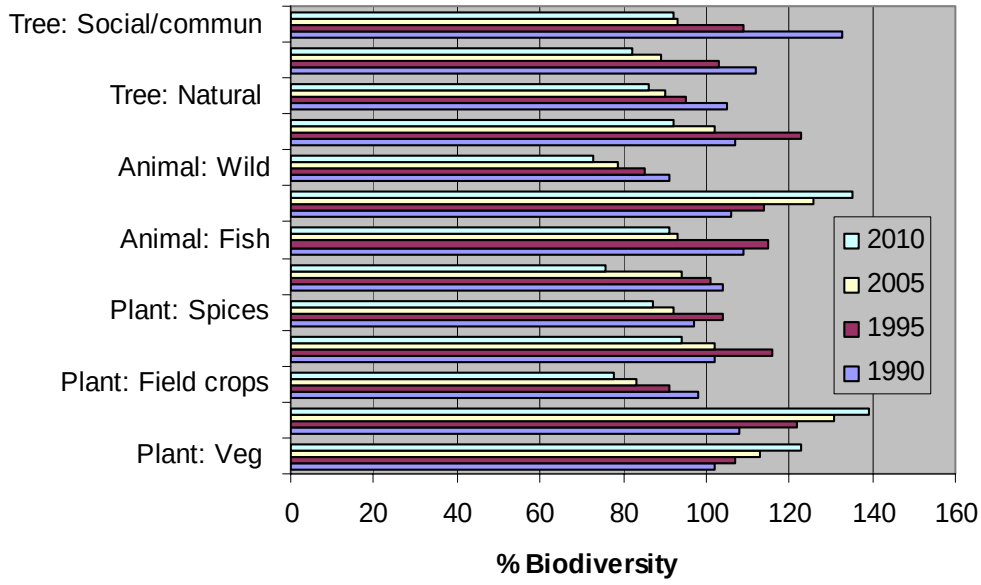

Fig. 4. Bio-diversity as per type of crops and animals

Bio-diversity Assessments

In the context that the food and income supplement of about 60% of the poor people depends on road transport sector, the food security and the poverty reduction of the concerned can not be achieved other than promoting its bio-technical requirements. The administrative integration of the land agriculture, Roads and Highways Department and Local Government are found to be very weak as regards to technical standards and bio-productive environments. The methods of calculating the food supplement and income from RHD and making its inclusion in the GDP is lacking.

Some important street inter sections were inundated for 1996 and many of the important business and Government Offices of the Dhaka City suffered the most from the flooding. The situation was severely aggravated because the natural drainage system, which conveys storm runoff from the areas to the surrounding rivers were not fully operational and surface runoff drainage and sewerage system were blocked due to huge volume of garbage and poly-bags.

Therefore, it was not possible to compare the capacity of present drainage system to drain out the stagnant water with the past, which was needed to enrich the recommendations to reduce the problem.

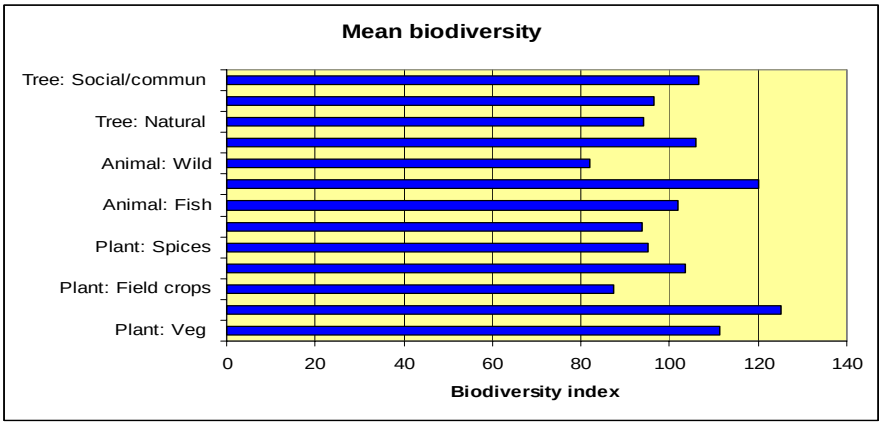

Fig. 5. Mean Bio-diversity index of the study area

Due to the lack of detailed elevation data, sometimes it was very hard to measure the actual depth of water logging.

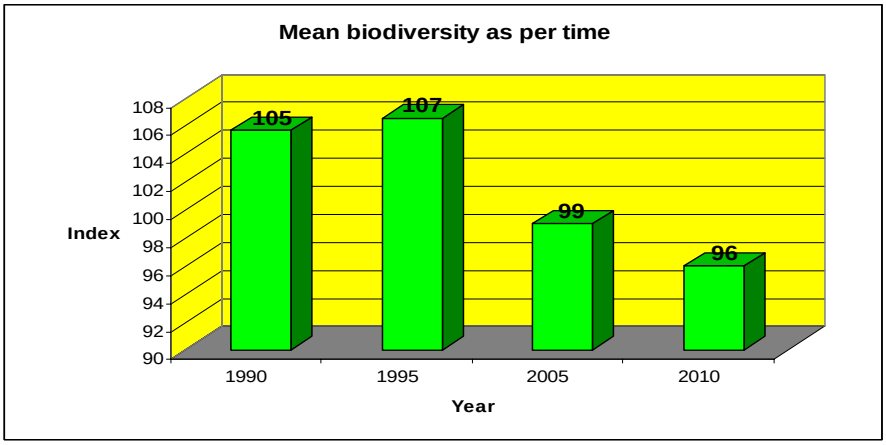

Fig. 6. Mean Bio-diversity of the area as per time (1990, 1995, 2005 and 2010)

The Figure 6 shows the mean bio-diversity of the study area as per time of 1990, 1995, 2005 and 2010.

Table 6. Major Structure group and total structures

Major Structures	Bridges Dimensions	Culverts Dimensions	Sluice gates Dams Dimensions
Length	30-50 m	10-30 m	5-10 m
% of the total structures	26	59	15
% Functioning sites	48	35	17

The Figure 7 shows the different elements of the concerned non-pier model bridge on the route shows in the map.

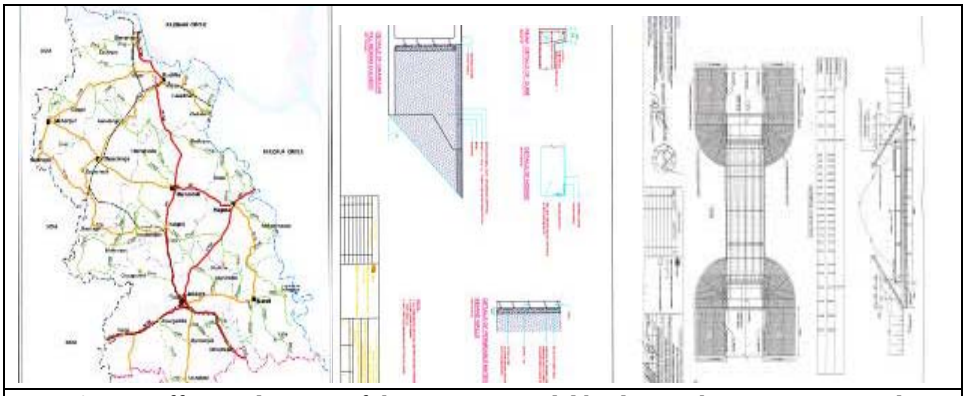

Fig. 7. Different elements of the non-pier model bridge on the route concerned

The Figure 8 shows the developed non-pier model bridge that will increase bio-diversity and reduce poverty & increase food security of the concerned area.

Fig. 8. A Developed Model Non-Pier Bridge

CONCLUSION

All the technical, biological, social and environmental factors must be considered in designing a road transport and bridges for ensuring its sustainability as regards to bio-diversity of the command areas through accurate mapping and designing. The results indicated that the AEZs studied differed in functional interactions.

The Bridges (small) and Culverts were found insufficient to carry the transport type over them and thus lost their effectiveness before the set life of the structures. The Bridges and Culverts dimensions were found volumetrically inadequate to discharge or drain out the catchments water load in time causing water stagnation.

The engineering designs of the structures were found to be less strong relating to the transport load. The total integrated system was found to contribute positively for social welfare but negatively for bio-diversity and agro-bio-productivity as Indicator of environmental degradation and bio-productivity as Indicator of ensured food security.

The reasons of such less effectiveness of the system as spelled out by Focus Group Discussion (FGD) were among others the non-sharing of the work with local beneficiaries specially for the size, site and strength of the structures. It is recommended that more detailed studies are required to refine Transport Engineering and Environmental infrastructure development projects in the light of changed climate and food security need of the target areas considering the roads, transports, land topography, water recession trend and AEZ based catchments/command areas in an integrated way.

Finally, recommendation is made for more detailed researches on the issues specially highlighting the bio-diversity effects of the structures and transport engineering as to ensure its sustainability of the benefits.

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