

## **ENVIRONMENTAL IMPACT ASSESSMENT OF THE MURADPUR TO LALKHAN BAZAR FLYOVER BY LEOPOLD MATRIX & BATTELLE METHOD**

M. R. H. Kauser\*, M. M. Rahman, H. S. Alam, F. G. R. Lopa & M. S. G. Adnan

*Department of Urban and Regional Planning, Chittagong University of Engineering and Technology,  
Chittagong, Bangladesh*

*\*Corresponding Author: mdrhkauser@gmail.com*

### **ABSTRACT**

An efficacious transportation system is one of the pivotal prerequisites for the development of any sort of fast growing city like Chittagong, which is the commercial capital of Bangladesh. To foster the development as well as to ease the traffic congestion problem of this second largest city of Bangladesh, the Chittagong development Authority (CDA) has taken the initiative to construct Muradpur to Lalkhan Bazar Flyover. In this regard, the study focuses on the assessment of possible impact of the flyover on environment in order to promote sustainable development. The study is based on primary data which are analysed by using Leopold Matrix and Battelle Method to assess the possible impact of the aforementioned flyover. The findings show that the project will have the negative impact on the environment i.e., increased CO<sub>2</sub>, sound pollution, vibration, dust particles emission, traffic congestion etc. during construction and to mitigate those impacts some measures are recommended.

Keywords: Environmental Impact Assessment; Leopold matrix; Battelle method

### **INTRODUCTION**

The frequent improvement in city infrastructure and rapidly increasing vehicular traffic, the infrastructure of road is severely affected. So, the vehicular speed is decreased significantly in the various roads, while put its junctions in serious pressure (Wilbur Smith Association, 2010). Where round about is not feasible due to space constraint than the construction of flyovers over congested traffic roads is considered an effective way of ensuring smooth traffic flow and avoiding unnecessary delays (Goyal et. all, 2008). The traffic congestion along the large circles such as GEC circle, 2 no gate, Muradpur and WASA are facing sever traffic congestion. So, cutting this congestion the Chittagong Development Authority (CDA) is built this Muradpur to Lalkhan bazar flyover (CDA, 2014). Environmental impact assessment (EIA) is done to assess the effects likely to arise from a major project (like flyover, road construction) significantly affecting the environment. It will ensure the sustainable development through sustainable form of development with several key issues (Glasson et al., 2005). The study will examine the impact of the flyover on environment impact in order to promote sustainable development with the help of Leopold matrix and Battelle method.

### **METHODOLOGY**

The flyover project has several environmental impacts on its surrounding environment, society and wildlife. To assess the range of impact participatory approach has been applied so that, the affected groups can be easily identified. Further the causes and effect diagrams have been created using the perception of the respondents using these diagrams the primary and secondary affected group has been identified (Kumar, 2001). The Leopold matrix has been used to predict the impact on environment due to project activities. The matrix constituted is two dimensional for cross referencing. The project activities are kept in one axis and the environmental parameters were kept in another axis. The environment and social conditions are divided in three major groups. These are physical, biological and social environment. Physical environment are soil, water, air, noise and waste. Biological environment are birds, forest, wetland habitat and nuisance plant and the social environment are streetscape, employment, navigation, commercial facilities, service and utilities, industrial activities, land value, landscape and occupational safety. Environmental impacts due to flyover construction from start to

finish, has been evaluated on project planning and design phase, construction phase and operation and maintenance phase. To assess the environmental impact there three steps has been followed. The boxes mark the corresponding boxes in the matrix with a diagonal line then the boxes with supposed significant interactions are slashed, the author evaluates each box by applying a number from 1 to 10 (1 is the minimum and 10 the maximum) to register the magnitude of the impact. In the final step is to calculate the real importance of the phenomenon. By this way the connection with the environment and which particular elements are particularly significant has been evaluated. The data has been collected through the questionnaire survey from the project spot and got them input on Microsoft excel for data processing to calculate environmental quality for indicator ‘i’ with project and without project then relative weight for the indicators has been calculated. The environmental impact unit values has been further calculated by using The Batelle method where the environmental impacts is split in major three categories. Which are Biological, Physio-chemical and Human interest (FAO, 2016)

$$EIU = \sum_{i=1}^m (Vi)_1 W_i - (Vi)_2 W_i \quad (1)$$

Where,

$(Vi)_1$  =environmental quality for indicator “i” in the project conditions

$(Vi)_2$  =environmental quality for indicator “i” without the project

$W_i$  =relative weight of the indicator “i”

m =total number of indicators

### STUDY AREA

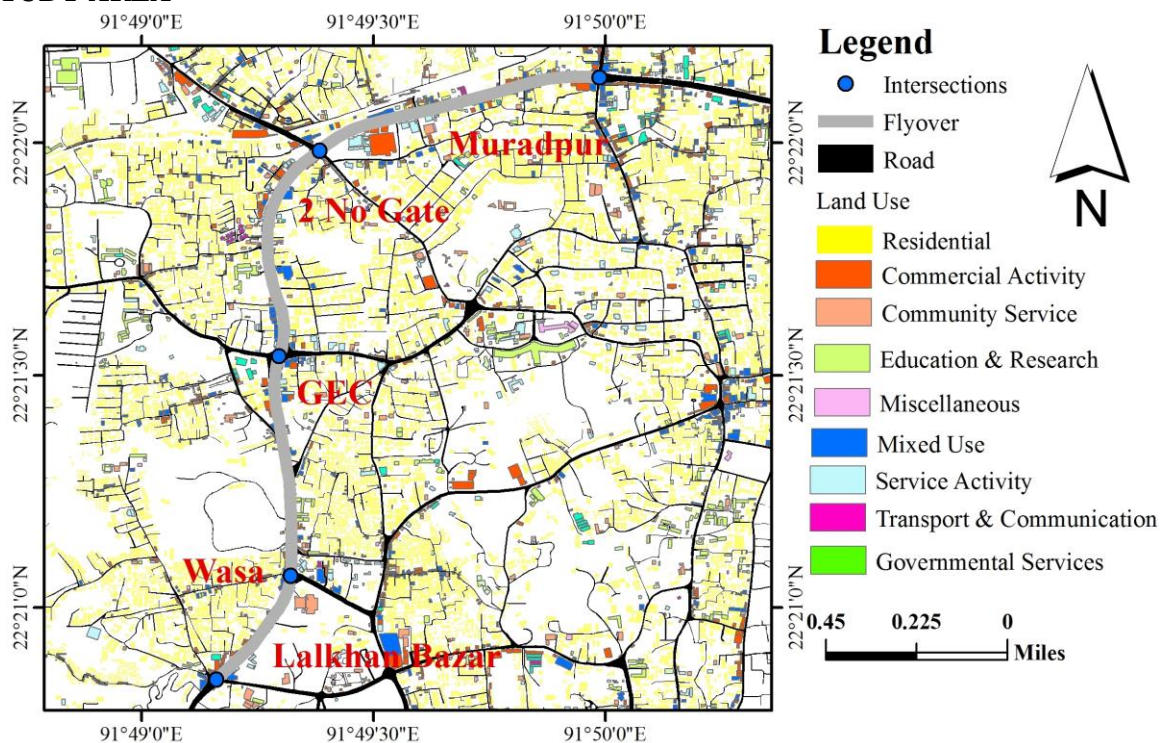


Fig. 1: Study Area Map

The flyover project named as Akhteruzzaman flyover which length is 3.5km and width is 17.5 meter with four lanes. The length of the loop is 1.7km and width designed as 7.5m, two lanes. The proposed construction cost has been declared as 15070.57 lakh taka founding partially by GOB, CDA. The project construction starter on july 2010 and estimated to be finished was 2013. The construction work has been seen ongoing process. According to the declaration of DOE, the project falls under Orange-B category with having several negative impacts on environment.

## RESULTS AND DISCUSSIONS

### Overall impact identification and prediction on environment

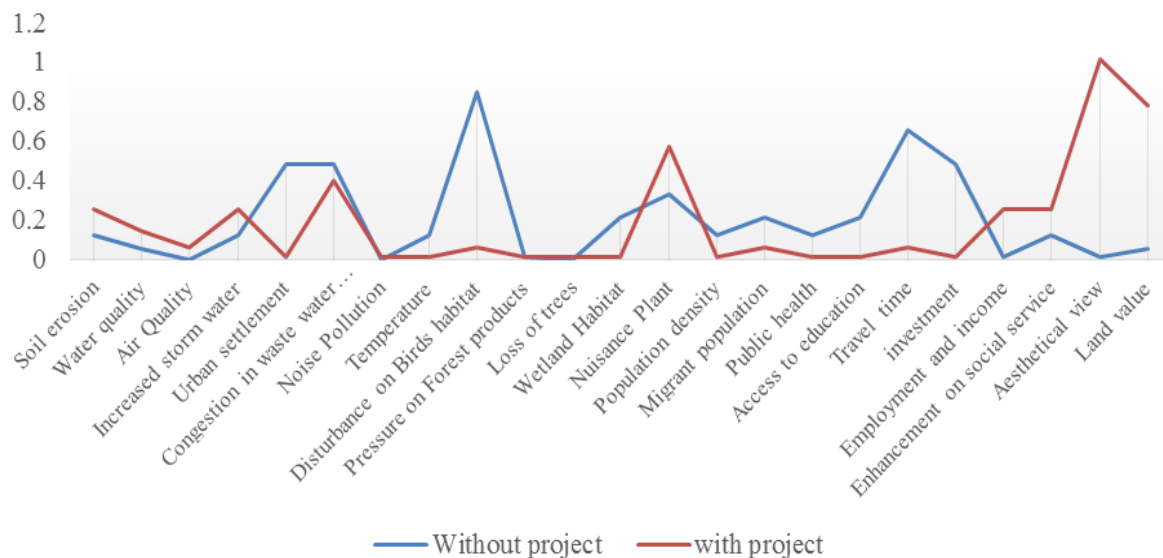


Fig. 2: Overall impact on environment by with project and without project

To assess Impact of the project, questionnaire survey has been conducted in study area. The survey data has been compiled with the help of Leopold metrics and further got input on Microsoft excel software. The value for with project and without project has been calculated by impact value metrics where positive signs are used for positive impact and negative sign indicates negative impacts. The value of  $V_i$  is achieved by summing up the impact values from the Leopold metrics. The value of  $W_i$  has been gained by multiplying the values of  $V_i$  by its corresponding weights. The value of  $V_iW_i$  is further plotted on the graph where two different  $V_iW_i$  value has been gained. One for with project and another from without project. These were outputs from Leopold metrics and further used as the input in Battelle method where the value of overall impacts is been found as negative (- 0.45333). This means that the project has overall negative impact on environment.

$$EIU=4.333-4.786667= -0.45333$$

On observing overall impact on environment due to project implementation the soil erosion has been increased, air quality degraded, more storm water entered into the drainage system, caused several disturbances on existing urban settlements, temperature has been increased, bird's habitat has been destroyed, public health also deteriorated due to project construction. When construction has been finished, employment and income enhancement in social services, aesthetical values and land value has been increased.

### Causes and effect diagrams

On the way of construction of flyover, air pollution has been raised up due to several project activities. Burning of fossil soils, more carbondioxide and emission of sulfur dioxide, household cleaning etc has been working as the source of air pollution which causing the significant effect on vegetation growth, human health and wild life on the hills where human health causing short term and long term effects by causing several diseases on human body such as heart attacks, respiratory heart problem, asthma, pneumonia etc.

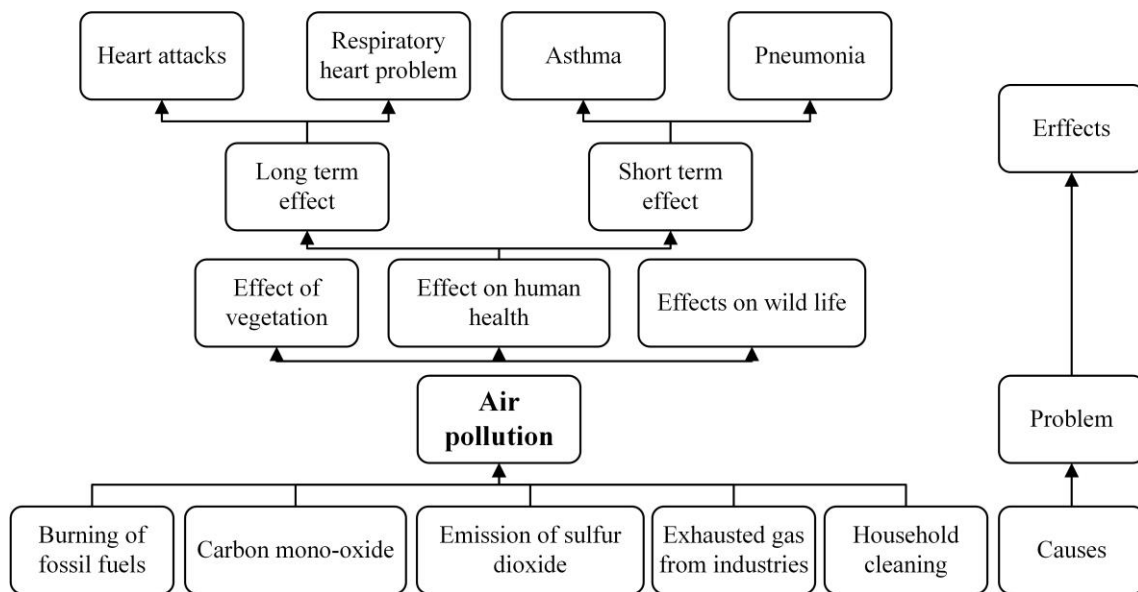


Fig. 3: Cause effect diagram of Air Pollution

Another significant environmental pollution has been raised up known as noise pollution. For several construction activities, transportation, social events, household chores etc are worked as the source of noise pollution which created the effect on human health and wildlife by causing hearing problem, sleeping disturbances, blood pressure level, psychological problem, trouble communication etc.

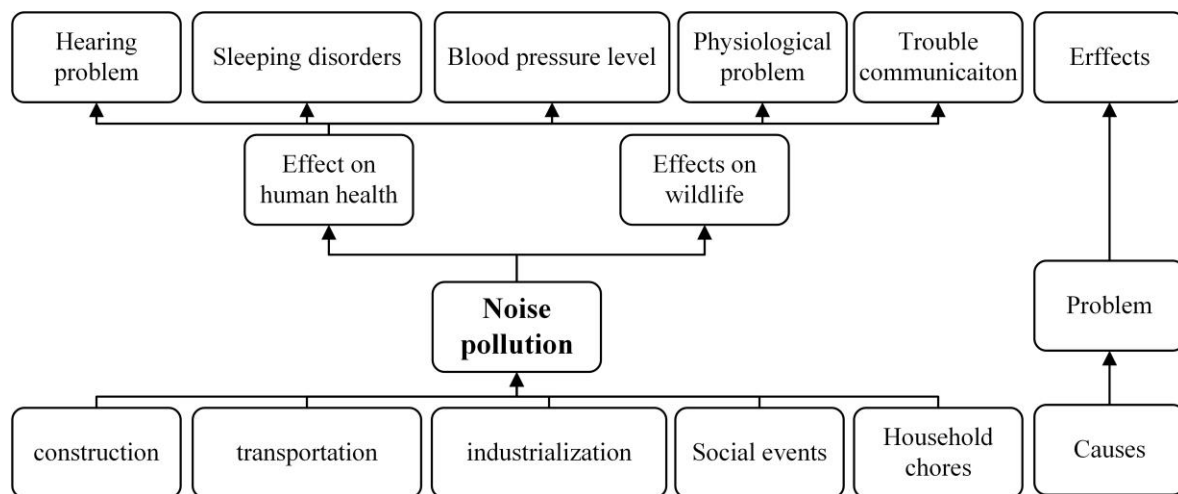


Fig. 4: Cause effect diagram of Noise Pollution

While implementing the project there are several changes in environment has been observed which causes are Lack of solid waste management can cause atmospheric pollution, lack of sanitation facilities creates different types of diseases which is harmful for human health, limited aware ness of environmental issues are responsible for atmosphere pollution, earth cutting & filling, uncontrolled discharge of polluting effluents of surface water and cutting down trees can formulate atmosphere pollution which causing the several types of effects on environment which are, increased health risk, decrease quality of human life, pollution increases chemical particles to air and Water pollution can be divided into two types such as drinking and low quality of irrigation water.

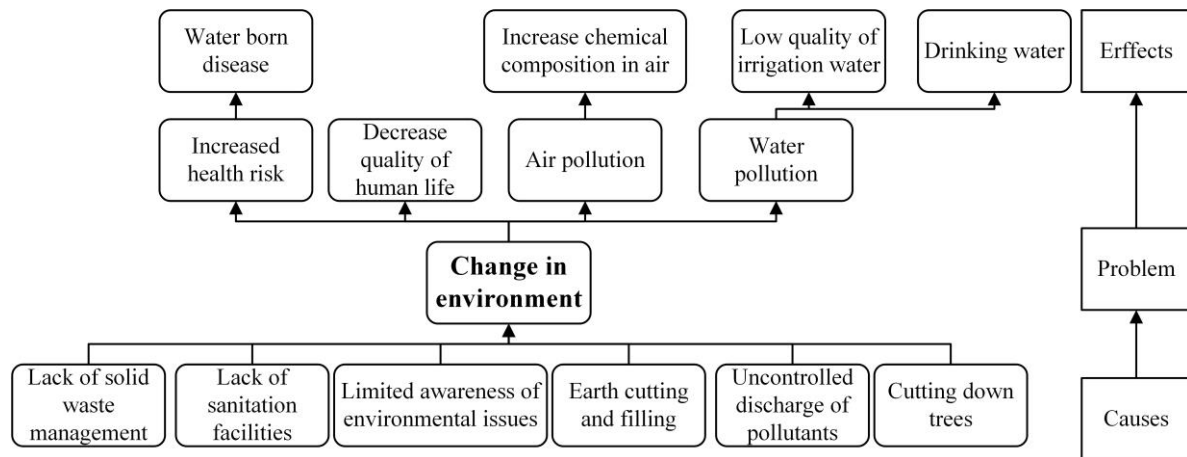


Fig. 5: Cause effect diagram on change in environment

### ENVIRONMENTAL MANAGEMENT PLAN

Environmental management is an essential tool in relation to environmental management as it provides the basic information for rational management decisions. The provided information on the actual nature and extent of key impacts and the effectiveness of the mitigation measures which, through a feedback mechanism, can be taken into account in the planning and execution of similar projects in future.

Table 1: Environmental monitoring Plan during operation and maintenance period

Impact	Means of Monitoring	Frequency of Monitoring	Location	Implementing party
Accident	Ensuring traffic signs, road mark, bump, zebra mark, guard rail and pole, and curb stones etc. to be properly	Annually	On And below road of the flyover	Supervisor: RHD, Reviewer: Consultant, PAPs, Performer: Contractor
Air Pollution	Measurement of SPM, NO <sub>x</sub> , SO <sub>2</sub> , CO	Monthly	On And below road of the flyover	Supervisor: RHD, Reviewer: Consultant, PAPs, Performer: Contractor
Noise Pollution	Measurement of noise dB(A)	Quarterly	On And below road of the flyover	Supervisor: RHD, Reviewer: Consultant, PAPs,
Waste Disposal	Minimize volume to use silt basin before disposing	Daily	On And below road of the flyover	Supervisor: RHD, Reviewer: CCC, Consultant, PAPs,

### CONCLUSIONS

There is no alternative to reduce traffic jam of the Chittagong city this flyover is become the first priority. It will reduce traffic jam of GEC circle, 2 no gate, Muradpur and WASA circle. Although, this project has some negative impact on its surrounding environment. Finally, this flyover project categorize into red category. So, the report guides those procedures of project activities so that there is least amount of negative impact on environment which reduce economic loss so as to ensure sustainable development. There also respective authorities assigned with schedule and responsibilities to take action to mitigate the negative impacts of the project. This management measures which comes from feedback, can be taken into account in the planning and execution of similar projects in future.

## ACKNOWLEDGMENTS

At first all praises belong to Almighty Allah, the most Merciful, very kind to man and his action. We would like to express our gratitude to our parents and other family members from the core of our heart for their love. This dissertation is done as a departmental project work of Environmental Planning and Management Studio. We want to specially thank to all of our friends for helpful and provide encourage to accomplish the dissertation. There is no word to express our profound gratitude and indebtedness to our teacher of Dept. of URP, CUET for their valuable advice, comments, sympathetic co-operation and systematic guidance at all stages of this field work & this report. Finally, our special appreciation goes to all the dwellers of the Chittagong city for their response and co-operation provided during the survey work.

## REFERENCES

- CDA. 2014. Chittagong Development Authority. Renaissance Forum. [Online]. Available at: [http://portal.cda.gov.bd/index.php?option=com\\_content&view=article&id=436:2012-06-17-07-36-22&catid=59:2010-09-02-09-35-55&Itemid=134](http://portal.cda.gov.bd/index.php?option=com_content&view=article&id=436:2012-06-17-07-36-22&catid=59:2010-09-02-09-35-55&Itemid=134) [Accessed 1 June 2016].
- FAO. 2016. Environmental impact assessment and environmental auditing in the pulp and paper industry. Available at: <http://www.fao.org/docrep/005/v9933e/v9933e02.htm> [Accessed 1 June 2016]
- Glasson, J; Therivel, R and Chadwick, A. 2005. Introduction to environmental impact assessment. Third ed. London: Routledge.
- Goyal, S, Goel, S and Tamhane, S. 2008. Assessment of environmental benefits of flyover construction over signalized junctions: a case study. *Environmental Monitoring and Assessment*, 148(1-4), 397-408. <http://dx.doi.org/10.1007/s10661-008-0170-4>
- Kumar, S. 2001. Methods for community participation a complete guideline for practitioners. Vistaar Publications. New Delhi
- Wilbur Smith Association. 2010. Initial environmental examination DPR for Flyover at Mohan Nagar Junction. Asian Development Bank.