Study of Salinity Effects on Coastal Structures in Bangladesh

Introduction/ Problem Statement:

With the continuous economic development as well as increase of population, we need to develop infrastructures at/near the sea. The Government of Bangladesh already planned several mega structures at/near the sea. More mega structures are also to be planned in the near future keeping in mind the target of economic development. Several billions of USD will be spent in these projects. It is very important to note that the service life of these structures will play a vital role against the sustainable development of our Blue Economy.

Seawater contains about 20,000 ppm of chloride (35 g of salt in 1 liter of seawater). The chloride ions can also move to several km inland with air as air borne chloride. Seawater can move to land areas as a result of intrusion of seawater in underground water reservoir, as in the south-west region of Bangladesh. In marine environment, deterioration of concrete structures is very common caused by the chloride induced corrosion of steel in concrete. Due to severe deterioration of the structure, the structure may need to replace or rehabilitate after a short period of service life. In USA, more than 8 billion USD is spent every year due to the necessity of repair/replacement of structures in the marine environment caused by the chloride induced corrosion. In Bangladesh, the cyclone shelters constructed in the marine coastal environment in around 1991 deteriorated shortly after construction. Therefore, we need to understand the challenges against durability of marine concrete structures and the solutions against early deterioration of concrete structures in the marine environment.

As we are spending huge amount national revenue for making structures at or near the sea, therefore, it is the high time to think about seawater resilient and sustainable marine infrastructure from the very early stage of planning. If not, there is a high possibility for significant deterioration of our structures in a short period of time and eventually it will ruin our goals of sustainable development of blue economy and of course a huge loss of our national revenue.

Through this research project an exposure map will be prepared and also a guideline for long-term durable and sustainable coastal infrastructures will be developed.

Rationale of the Research:

The number of marine concrete structures in Bangladesh is increasing every year. However, it was found that the marine concrete structures in Bangladesh are subjected to severe deterioration after a short period of exposure which results in significant loss of national revenue of the country. Therefore, this research study is crucial to overcome the loss of coastal establishments from chloride induced corrosion.

Research Objectives:

- To study the effects of salinity on concrete and steel comprising coastal structures.
- To observe the lifetime of coastal RCC structures
- Development of seawater resilient and sustainable infrastructure will help toward achievement of several Sustainable Development Goals (SDGs) of the United Nations, such as SDG 9 – Industry, Innovation and Infrastructure, SDG 11 – Sustainable Cities and Communities, SDG 13 – Climate Action, etc.

Scope of Research:

- To understand the main causes of deterioration of existing marine concrete structures,
- To understand the rate of deterioration of marine concrete structures with the change of different parameters related to concrete, such as water to cement ratio, cement content, type of aggregate, type of cement, etc.

Research Methodology:

- Conduct preliminary and detailed condition surveys on the marine concrete structures in the different exposure conditions of coastal regions to understand the main causes of deterioration of marine concrete structures.
- Measurement of air borne chloride in the inland areas from the coast line. Salt contents in the ground will also be determined to understand the extent of salt intrusion. Based on these data, an exposure map will be prepared.
- Conduct field and accelerated laboratory investigations on the durability of marine concrete structures.
- Prepare a guideline for making long-term durable and sustainable infrastructures in the coastal regions (defined as severe, moderate and mild) of Bangladesh.

Data Analysis:

Under the research project, review of existing literature would be conducted. Simultaneously, preliminary investigation of the existing coastal structures would be carried out. Qualitative and quantitative data would be generated and gathered resulting from visual observation, hammer test, crack map, etc. Then, detailed data would be acquired from cover depth, crack depth, carbonation, UPV, concrete core, scanning of steel bars, etc. Then, an extensive laboratory investigation would be performed, taking into consideration concrete PH, chlorine concentration, SEM, XRD, carbonation and chloride ingress.

Time Limit/ Work Plan:

SL. No.	Description	Required time in month
1.	Survey and sample collection	6 months
2.	Experiments and laboratory tests	4 months
3.	Data analysis and Results	2 months
	Total Duration	12 Months

Detailed Budget with Cost Breakup:

SL. No.	Description	Cost in taka
1.	Survey: i. Transport allowance ii. Sample Collection	 1,00,000 50,000
2.	Experiments and laboratory tests: i. Cost of materials for samples ii. Preparation of specimens iii. Labor charge	 1,00,000 1,00,000 1,00,000
3.	Data analysis and Results	50,000
	Total	5,00,000

Biodata of the Researcher

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Career Record

1) Job Record (After graduation)

Organization	City/ Country	Period		Position or Title	Brief Job Description
		From Month/Year	To Month/Year		
HOUSING AND BUILDING RESEARCH INSTITUTE	DHAKA, BANGLADESH	NOVEMBER 2011	CONTINUING	RESEARCH ENGINEER	RESEARCH BASED

Educational Record (Higher Education)

Institution	City/ Country	Period		Degree obtained	Major
		From Month/Year	To Month/Year		
IISEE, BRI	TSUKUBA, JAPAN	2016	2017	POST GRADUATE DIPLOMA	EARTHQUAKE ENGINEERING
NATIONAL GRADUATE INSTITUTE FOR POLICY STUDIES (GRIPS)	TOKYO, JAPAN	OCTOBER 2016	SEPTEMBER2017	MASTER OF DISASTER MANAGEMENT	DISASTER MANAGEMENT
DHAKA UNIVERSITY OF ENGINEERING AND TECHNOLOGY (DUET)	GAZIPUR, BANGLADESH	JANUARY 2007	DECEMBER 2010	B.SC IN CIVIL ENGINEERING	STRUCTURAL ENGINEERING
RANGPUR POLYTECHNIC INSTITUE	RANGPUR, BANGLADESH	JANUARY 2002	DECEMBER 2005	DIPLOMA IN ENGG.	CIVIL

UTTOR CHOWRA BARAGACHHA HIGH SCHOOL	NILPHAMARI, BANGLADESH	JANUARY 1996	DECEMBER 2000	S.S.C.	SCIENCE

Training or Study in Foreign Countries

Institution	City/ Country	Period		Field of Study / Program Title
		From Month/ Year	To Month/ Year	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	JAPAN	OCT/2016	SEP/2017	KNOWLEDGE CO-CREATION PROGRAM (GROUP & REGION FOCUS) ON SEISMOLOGY, EARTHQUAKE ENGINEERING, AND TSUNAMI DISASTER MITIGATION.

Related Personnel to be recruited for the research:

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