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"Floating Structure"

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Abstract: *Floating structures have gained increasing attention in recent years due to their ability to address spatial limitations and provide solutions in challenging environments such as oceans, deep-water regions, and flood-prone areas. These structures, which include floating platforms, homes, bridges, and energy generation systems, require innovative design approaches to ensure stability, durability, and safety in dynamic marine environments. This paper explores the design principles and engineering challenges associated with floating structures, focusing on key factors such as buoyancy, hydrodynamic behaviour, material selection, and structural integrity under various environmental conditions. Furthermore, it highlights the challenges posed by environmental factors like waves, wind, and currents, as well as the need for sustainable and cost-effective solutions.*

Keywords- *Hydrodynamic behavior, Design principles, Dynamic stability*

I. INTRODUCTION

As population and urban development expand in land-scare island countries (or countries with long coastlines), city planners and engineers resort to land reclamation to ease the pressure on existing heavily-used land and underground spaces. Using fill materials from seabed, hills, deep underground excavations, and even construction debris, engineers are able to create relatively vast and valuable land from the sea. However, land reclamation has its limitation. It is suitable when the water depth is shallow (less than 20 m). When the water depth is large and the seabed is extremely soft, land reclamation is no longer cost effective or even feasible. Moreover, land reclamation destroys the marine habitat and may even lead to the disturbance of toxic sediments. When faced with these natural conditions and environmental consequences, very large floating structures may offer an attractive alternative solution for birthing land from the sea.

II. LITERATURE REVIEW

Dr. Eduard Vorster, Technical Director (1987). The Gautrain Rapid Rail Link is a state-of-the-art rapid rail network currently under construction in Gauteng, South Africa. The project comprises of a link between Pretoria, Johannesburg and the OR Tambo International airport with a total length of approximately 66km. The structure described in this paper will cross a dolomite area with a 3.1km long viaduct (V5c) south of Pretoria. The site is generally underlain by dolomitic ground with occasional syenite intrusions. The area is well known for the risk of sinkhole and do line (area settlement) formation due to the erodibility of the in situ soil, cavernous ground and bedrock conditions and potentially variable water table conditions (if left uncontrolled). Sinkholes and do lines may affect the rail services and may have catastrophic consequences if left untreated. The bedrock profile is highly undulating, sometimes with deep valleys or grykes between bedrock pinnacles

"E.Wantanbe ,C.M. Wang, T.Utusonomiya &T. Moan (2004).Very large floating structures (VLFS) have attracted the attention of architects, city planners, and engineers because they provide an exciting and environmentally friendly solution for land creation from the sea as opposed to the traditional land reclamation method. The applications of VLFS as floating piers, floating hotels, floating fuel storage facilities, floating stadia, floating bridges, floating airports, and even floating cities have triggered extensive research studies in the past two decades. The VLFS technology has developed considerably and there are many innovative methods proposed to minimize the hydroelastic motion, improve the mooring system and structural integrity of the VLFS. This keynote paper summarizes the applications, research and development of VLFS over the past two decades.

Hideyuki Suzuki (2004) This paper presents an overview of research and development on Megafloat, carried out by the Technological Research Association of Megafloat (TRAM) and other researchers. Megafloat is a type of very large floating structure (VLFS), pursued by TRAM, to develop technology for ocean space utilization and to show soundness of the technology and readiness for construction. On-site experiments with a 1000-m-long experimental model, as well as subsequent studies, are introduced

Dura Vermeer (2006). One solution to the housing crisis and the challenge of mitigating climate risk that is being put forward with increasing vigour is to allow houses to be built in areas deemed at risk from flooding at a far greater rate than is "You could build homes that go up and down [with rising and falling flood water levels] that mean you do not displace any water off the site. The Dutch are very good at this," says Flood line technical director Faruk Pekbeken.

III. OBJECTIVES

- To use materials that cannot corrode easily due to salt content and ph of the surrounding water.
- To focus on stability of the structure due to wave load and wind load.
- To understand the design and construction of floating structures

IV. METHODOLOGY

Floating structures, often used in marine and coastal engineering, involve a variety of methodologies to ensure their stability, functionality, and environmental compatibility. An amphibious house is a building that rests on the ground but whenever a flood occurs, the entire building rises up in its dock, where it floats, buoyed by the floodwater. Amphibious construction brings together standard components from the construction and marine industries to create an intelligent solution to flooding. The house itself sits in the ground and the floating base is almost invisible from the outside. Amphibious designs can vary to suit the location and owners' preferences.The amphibious design allowed the floor level to be set less than 1m above the ground level instead of 2m, had the house been static. Construction is slightly more expensive than mainstream house building due to the requirement for two foundation

systems: the dock and the hull; but overall the costs are comparable to a typical basement extension, or around a 20- 25% uplift on a similar size new house.

V. SUMMARY

Floating urbanization is a promising solution to reduce the vulnerability of cities against climate change, population growth or land scarcity. Although this type of construction introduces changes to aquatic systems, there is a lack of research studies addressing potential impacts. Water quality data collected under/near floating structures were compared with the corresponding parameters measured at the same depth at open water locations by (i) performing scans with underwater drones equipped with in situ sensors and video cameras and (ii) fixing two sets of continuous measuring in situ sensors for a period of several days/months at both positions. A total of 18 locations with different types of floating structures were considered in this study. Results show small differences in the measured parameters, such as lower dissolved oxygen concentrations or higher temperature measured underneath the floating structures. The magnitudes of these differences seem to be linked with the characteristics and type of water system. Given the wide variety and types of water bodies considered in this study, results suggest that water quality is not critically affected by the presence of the floating houses. Underwater images of biofouling and filter feeders illustrate the lively ecosystems that can emerge shortly after the construction of floating buildings.
Floating structures utilize materials and technologies that allow them to adapt to changing water levels while minimizing their environmental impact. They are increasingly seen as solutions for urban expansion in coastal areas and for sustainable living, enabling development in otherwise uninhabitable regions population and urban development expand in land-scare island countries (or countries with long coastlines), city planners and engineers resort to land reclamation to ease the pressure on existing heavily-used land and underground spaces. Using fill materials from seabed, hills, deep underground excavations, and even construction debris, engineers are able to create relatively vast and valuable land from the sea.

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