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**A REVIEW PAPER ON COMPARISON OF DOUBLE DECKER  
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**ABSTRACT**

This project deals with the study of double decker bridges keeping in mind various parameters involved in its construction. There are number of factors which govern the selection of bridge structure, such factors have been studied in this project. There are many different designs of bridges, each serving a particular purpose and applicable to different situations. Designs of bridges vary depending on factors such as: the function of the bridge, the nature of the terrain where the bridge is constructed and anchored, and the material used to make it and the funds available to build it. The study further elaborated on the advancement in construction of double decker bridges with time. The advancement studied was of Bogiebeel bridge with keeping in reference Narnarayan Setu, both of them being situated in Earthquake prone zone. The study in this project derived various bridge construction possibilities on the basis of technological innovation. Thus, there is a higher scope of advancement possible in bridge construction. In view of the particular problems posed by the surrounding conditions, functional requirements, and aesthetic considerations, this project required a special structural design and innovations in construction technology. These innovations-including the steel truss design and erection process, the main foundation design and construction techniques-are detailed in this project.

**KEYWORDS:** dynamics, vibration, Railway Bridge, bridge deck acceleration, moving load, train-bridge interaction, vehicle model. Bridge Structure, Designs, Terrain

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**I. INTRODUCTION**

Bridges are designed in accordance with their planned use. For example: The materials selected for trains, road traffic, or pedestrian paths are selected for their mechanical properties. The bridge design determines how tension, compression, shear, and torsion are distributed on the structure. The common bridges used are beam, cantilever, arch, suspension, truss, and floating bridges. They are different from each other in the materials used, construction techniques, shape, and span of the bridge.

**1.1. BOGIBEEL BRIDGE**

Bogiebeel bridges is a combined road and rail bridge over the Brahmaputra River in the northeastern Indian state of Assam between Dhemaji district and Dibrugarh district, which was started in the year 2002 and took a total of 200 months to complete. Bogiebeel river bridge is the longest rail-cumroad bridge in India, measuring 4.94 kilometres over the Brahmaputra river. As it is situated in an earthquake-prone area it is India's first bridge to have fully welded steel-concrete support beams that can withstand earthquakes of magnitudes up to 7 on the Richter Scale. It is Asia's 2nd longest rail-cum-road bridge and has a serviceable period of around 120 years. It is the 5th longest bridge in India after Bhupen Hazarika Setu, Dibang River Bridge, Mahatma Gandhi Setu and Bandra-Worli Sea Link. The bridge was constructed by a consortium of construction companies headed by Hindustan Construction Company. The bridge has a double rail line on the lower deck and a 3 lane road on the upper deck.

**II. LITERATURE REVIEW**

The purpose of construction of bridge over the river or stream is to ensure and facilitate the smooth communication over the waterways. However, in certain engineering designs of bridge, a significant portion of waterway is occupied by the piers placed on the river bed and approach road build on the river bed. This results the constriction of the natural waterway. When the waterway is constricted because of the construction of bridges, it results detrimental effects on the morphology of the streams.

The major consideration of the paper is to study the effect of constriction of the natural waterway on the river bank morphology and river island due to bridge construction. In this study, 4.94 km long Bogibeel Bridge constructed over the river Brahmaputra is taken into consideration to study the morphological changes in its upstream and downstream portion of the river reach due to the constriction of the waterway. With the completion of the construction of the piers and approach road of Bogibeel Bridge, some significant morphological changes have already been observed. The satellite imageries of the area over two decade clearly indicates the changes that took place in the river bank morphology due to the construction of the bridge structure on the river bed. Some significant gradual modification in the river bank as well as on the permanent river island is identifiable with the progress of the bridge construction. The portions of the river bank which recede alarmingly due to changes in the configuration of the river channel have been identified to take up effective and sustainable measures to reduce or stop the current erosion.

**1.1. Selection of Bridge Site:**

James Scott Groenier and Robert Gubernik (United States Department of Agriculture) ( 2014) have suggested various selection parameters for bridging site.

**1.2. Assessment of potential Earthquake induced damage to Pile Foundation:**

Antonio Bobet. et al. (Purdue University School of Civil Engineering, West Lafayette, Indiana)( September 2001 ) have studied the design of deep foundation of Bridges seismic region.

**1.3. Objective of The Study:**

The objective of the study is to monitor the nature of overall changes in the river channel in the pre, during and post river channel contraction years due to construction of bridge over the river Brahmaputra at Bogibeel. For the purpose, the study intended to look into the following aspects on the Brahmaputra river channel from the temporal remote sensing data of last 25 years (from 1994 to 2018).

**1.4. Covered Double Decker Pedestrian Bridge in Parma:**

Twelfth East Asia-Pacific Conference on Structural Engineering and Construction (Department of Structural Engineering, Politecnico di Milano, Milan, Italy) studied that The new Europa Bridge, currently under construction in Parma, Italy, is composed of two distinct structures: a road bridge and a covered pedestrian bridge. The road bridge is a three spans continuous bridge, with a mixed steel-concrete structure. The covered pedestrian bridge encloses a two level hall, which shall be used as an exhibition center. This paper presents the main concepts at the basis of the structural lay-out.

**III. METHODOLOGY**

To study the various factors governing the selection of bridge structure

1. The nature and conditions of river or stream.
2. The nature and volume of traffic to be carried.
3. Whether navigation is done in the river or not.
4. Hydraulic data collected at the site.
5. The climatic condition of the area.
6. The length and width of the bridge to be constructed.
7. The geological conditions of the site.
8. Physical features of the site.
9. The live load and other loads, for which the bridge is to be designed
10. Availability of local labour.
11. Strategic and economic consideration.

#### IV. FUTURE SCOPE

Future technologies have already been discussed & Future scope of Bridge construction lies there only. Some of them are listed below:

1. Use of Duplex Stainless Steel
2. V' shaped piers
3. Use of Fibre Reinforced Polymer (FRP) Reinforcement
4. Seismic Restrainers
5. Lean-on Bracing

#### V. CONCLUSION

The comparative study of Narnarayan Setu & Bogibeel Bridge gives us a complete conceptual idea of in the advancement of Bridge construction with changes in time.

While studying this structure we conclude that-

- Use of Duplex stainless steel is more efficient and preferable than regular stainless steel structure.
- V'shaped piers rigid frame is an efficient way to support a longer bridge, where using only one span isn't feasible. Each v-shaped pier supports the deck in two places while only requiring one foundation.
- FRP( Fibre Reinforced Polymer) composites are durable materials which are different from the steel reinforcement for their resistance to the electrochemical corrosion.
- Lean on Bracing method should be practice to prevent lateral torsional buckling .

Through this comparative study we have also seen the construction of DoubleDecker Bridges is such a challenging task. But when a dream of Engineers is converted into reality what a pleasure is felt that can not be explained in words. Thus, after taking many such points in consideration, the comparison of Narnarayan Setu & Bogibeel Bridge was done.

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