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Different Types of Bridge Models and their Load Testing

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***Abstract*: A bridge is a structure built to span physical obstacles without closing the way underneath such as a body of water, valley or road for the purpose of providing passage over the obstructed, usually something that can be A detrimental to cross otherwise. Different models of civil engineering construction some type of bridges built of solid wood and wood based materials have been described in this work. The issue of approach while making decisions about production, advantages and disadvantages, forms, approaches to the issue of modeling and designing technology of making fundamental constructive elements of laminated wood etc. With the aim of testing of bridges and their model analysis and load bearing capacity of bridge is described in this project work. The load it can be bear depends upon the type of bridge and materials used. By this test easily estimate the loading capacity of different types of bridges. The study of this test is at which load the bridge can supports up to. Preparing of models and apply the loads. By using this low cost material like wooden strips we can achieve it.**

***Keywords*: Wooden strips, Fasteners (nails), Adhesives (an abound)**

1. Introduction

Before bridges were built, in many locations there were ferries which were used to cross rivers. Due to the necessity of transporting goods, services, and people across the water, ferries were known for having a monopoly over the local economy due to the prices they charged to cross the river. (History of Covered Bridges (2010)). Also, expansion across the United States countryside caused the need for bridges to be built to allow access for personal travel and transportation of goods. During the 19th century, the economic material to build bridges was timber due to its abundant availability, cost, and ease of construction. With the need for bridges to cross obstacles, patents began to be issued for truss designs. Many of the well-known patents included those submitted by Theodore Burr (Burr arch), Ethyl Town (Town lattice), Stephen Long (Long truss), and William Howe (Howe truss). (US Department of Transportation Federal Highway Administration (2005)). In the hopes of building more structures, over time, it was noticed that the joints and wood would deteriorate rather quickly due to the exposure to elements such as water, sun, snow and ice. To protect the wood bridges from these elements, they were covered to extend the life of the structure.

Due to the availability of timber and the need for a safe way to cross the lands, thousands of wood covered bridges were built during the 19th and early 20th centuries with many different types of configurations. (History of Covered Bridges (2010)).

With the industry boom during the 19th century and the popularity of the automobile increasing, the use of iron and steel in the construction of bridges became increasingly popular. With the decline in the use of wood as a material to build bridges, these types of bridges have become distinct historical landmarks which require restoration to preserve the rich history behind these bridge structures. As can be seen in the following figures from the Federal Highway Administration (FHWA) Covered Bridge Manual, each type of bridge has many of the same characteristics but each is uniquely different enough to cause concern when evaluating the structural behavior of each bridge is a list of the current number of surviving bridge types.

A. Scope of research

The main goal of this research was to identify the most appropriate analytical modeling technique that can be used to improve analysis of historical covered timber bridges. The intersection and interconnection of structural members, impact of classic arch behaviors, behavior and interaction of bolster beams and floor systems are among the factors that must be included in the development of these models. In addition, all parameters that may affect the overall behavior of the analyzed historical timber bridges herein need to be clearly defined. The results of this analysis will allow bridge engineers to more accurately perform analyses needed to complete bridge evaluation and rating calculations.

B. Overall bridge behavior

Lamar and Schafer (2004) along with Sangree (2006) evaluated the overall bridge behavior of multiple types of bridge structures. When comparing field test results to the developed analytical models, the studies determined that geometric properties such as the splice joints in the bottom chords should be evaluated to provide further explanation for the lack of convergence between the field and analytical results. The contractor will determine the location of the main site compound and seek all necessary approvals for its design and construction. Due to the size of the scheme, other smaller offices and compounds are likely to be established along the

route. Preparatory works for the temporary site establishments will involve some site clearance work, minor earthworks operations to level the site, drainage and pavement works for the car park and service installation. Typical plant will be similar to that described for the various roadwork's operations below.

C. Site Clearance and Demolition

Site clearance and demolition works includes the following:

- Isolation and diversion of live services;
- General clearance;
- Demolition of building, walls and bridges;
- Removal of pipelines, public and privately owned services or supplies;
- Tree felling and removal of stumps, removal of fencing, hedges, bushes and undergo

2. Methodology

Preliminary activities include the setting up of the contractor's compounds and offices for the Contractor and Engineer. This also includes cabins, stores, welfare facilities and car park. The contractor will determine the location of the main site compound and seek all necessary approvals for its design and construction. Due to the size of the scheme, other smaller offices and compounds are likely to be established along the route. Preparatory works for the temporary site establishments will involve some site clearance work, minor earthworks operations to level the site, drainage and pavement works for the car park and service installation. Typical plant will be similar to that described for the various roadwork's' operations below.

Specific facilities and structures identified in the Contract will be surveyed to determine their structural condition prior to any works commencing in the neighborhood. Restrictions will apply to activities undertaken in the vicinity of these properties relating to working hours, movements of site personnel, control of dust, noise and vibration levels induced during construction. These measures aim to minimize or control nuisance during construction and also avoid damage to nearby structures and buildings.

Site operatives and site staff will use the site establishments, on a daily basis, when the facilities are significantly completed and access is available for personal vehicles and other forms of transport. Construction plant will be established in the site compound and in working areas of the route, when the relevant work permits and licenses are issued. The initial actions will involve the construction of site access and egress points. Wherever practicable, haul routes will also be established to ensure that construction traffic is contained within the confines of the site, as far as possible. However, since the route intersects rivers, main roads, local roads and other obstructions the use of other public roads is likely to be required and approval for this will be sought by the contractor with the relevant authorities.

This will involve the installation of permanent fencing with temporary fencing erected where it is not possible to install the permanent fence, for example at areas where land will be returned to agriculture following completion of the works, or if the contractor considers that there is a risk of damage to the permanent works during construction.

3. Types of bridges

There are many types of bridges according to the materials used. Based on the structure and design the following bridges are given.

Types of bridges:

- Truss bridge
- Arch bridge
- Beam bridge
- Cable-stayed bridge
- Suspension bridge

A. Truss Bridge

A truss bridge is bridge whose load bearing super structure is composed of A structure of connected elements usually forming triangular units.

The material chosen and the design of the truss depend on the purpose of the building structure the type of roof, and method used to support the truss, and other factors. Although they are considered to be hinged, the joints of trusses in practice have some degree of rigidity.

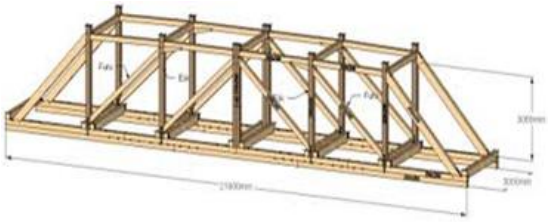

Fig. 1. Truss bridge

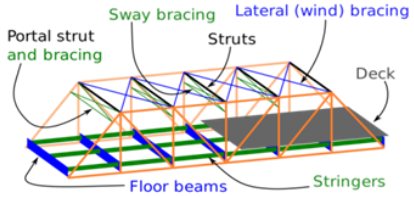

Fig. 2. Component parts of truss bridge

- The basic types of truss bridges have simple design which could be easily analyzed by 19th and early 20th century engineers.
- A truss bridge is economical to contract because it uses materials efficiently.
- This assumption means that members of the truss will act only in tension.
- A truss bridge is a bridge whose load-bearing superstructure is composed of a truss, a structure of connected elements usually forming triangular units.

The connected elements (typically straight) may be stressed from tension, compression, or sometimes both in response to dynamic loads.

B. *Arch bridge*

An arch bridge is a bridge with abutments at each end shaped as a curved arch. Arch bridges work by transevering the weight of the bridge and its load partially into a horizontal thrust held by the abutments at either side.

Fig. 3. Arch bridge

- Where the arches are placed in a water course bed the water is diverted. This so the gravel can first be excavated and replaced with a good footing.
- From these, the foundation piers are erected are raised to the height of the intended base of the arches.
- This is a point known as the springing.
- The thrust from the end arches is taken into the earth by substantial footings at the canyon walls.
- The several arches are constructed over the centering.
- One each basic arch barrel is constructed.
- However other less expensive structures are typically used today.
- A viaduct may be made from a series of arches.
- Made from masonry and stone, the arch design prevents any one area of the bridge receiving too much tension. With abundant building materials, arch bridges are durable and strong, requiring little to no maintenance. Its drawback is that masonry and stone don't have great tensile strength.

C. *Beam bridge*

This is also known as stringer bridges, are the simplest structural forms for bridge spans supported by an abutment or pier at each end No moments are transferred throughout the support, hence their structural type is known as simply supported. The simplest beam bridge could be a log, a wood plank.

- Because no moments are transferred, thrust cannot be accommodated, leading to innovative designs, such as ventricular truss and bow string arches, which contain the horizontal forces within the super structure.
- Beam bridges are often only used for relatively short distances because, unlike truss bridges, they have no built in supports.
- The only supports are provided by piers.
- As result, beam bridges rarely span more than 250 feet (80m).
- This does not mean that beam bridges are not used to cross great distances, it only means that a series of beam bridges must be joined together, creating what is known as a continuous span.

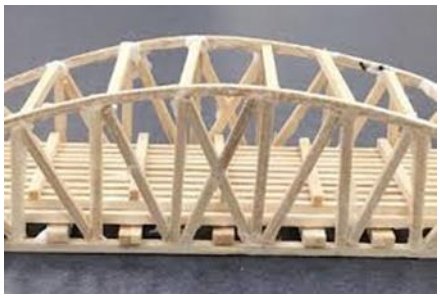

Fig. 4. Beam bridge

D. *Suspension bridge*

A suspension bridge is a type of bridge in which the deck is hanging below suspension cables on vertical suspenders. Simple suspension bridges, which lack vertical suspenders, have a long history in many mountainous parts of the world. This type of bridge has cables suspended between towers plus vertical suspender cables that carry the weight deck below, upon which traffic crosses.

- The suspension cables must be anchored at each end of the bridge, since any load applied to the bridge is transferred into a tension in these main cables.
- The main cables continue beyond the pillars to deck level supports, and further continue to connections with anchors in the ground
- The road way is supported by vertical suspender cables or rods called hangers.
- A suspension bridge is a type of bridge which the deck is hangs below suspension cables.

Fig. 5. Suspension bridge

4. Conclusion

- The required durability of structure should predominantly depend on the proper thickness of cover, which is a barrier against aggressive factors and protection for reinforcing steel.
- Structure strength, such as coating, impregnating or catholic or anodic protection are not required. What is more,

- They are expensive, and sometimes ineffective. By using proper cement, cover thickness can be reduced, which in
- Turn has an impact on material capacity/consumption. The analysis shows that the increase of cover thickness in case of worse properties of concrete with cement required in accordance with for bridge.
- Structures compared to concrete with standard Portland cement results in lower bearing capacity, and
- Finally, increased quantity of reinforcing steel. Such an increase is the most noticeable for short-span structures, in which the ratio of cover to design depth is significant.

Timber becomes more and more popular structural material for bridges in Nordic countries. That is due to its environmental advantages compared to other materials used in construction. However, the lifespan of timber is shorter than of e.g. steel. Also the maintenance needs and exploitation concerns are grater. Wooden bridges can be great for many small scale spans and perfect for private roads. Such bridges might be a disadvantage for those who do not pay attention to the bridge conditions and maintenance. A timber bridge can be more environmentally friendly or suit better in some aesthetical reasons. Maybe today the emissions are not the main concern during the design and construction.

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