

FOLDING SCISSOR BRIDGE: “A DISASTER RELIEF REVOLUTION”

Bhavin Janani¹, Rangdatt Patel², Palak Patel³, Princy Shah⁴

¹, M.E student (Fracture Mechanics), Applied Mechanics Department, Faculty of Technology and Engineering, Maharaja Sayajirao University, Vadodara, Gujarat, India. Email id: bhavinjanani51@gmail.com

ABSTRACT— *The ratio of disasters has increased much due to tremendous change in atmospheric and geographic conditions and mainly due to human caused activities. Critical situations for precious infrastructure as well as more valuable human lives are employed due to destructive disasters. This paper discusses the innovative idea of folding scissor type bridge which can be proven as a boon to mankind. This bridge is constructed from steel sections and can be erected with hydraulic mechanism at any remote place as well as can be transported by means of army trucks or by air as well water transportation.*

Keywords— *Folding Bridge, Scissor bridge, Disaster management, Deployable bridge, Collapsible bridge*

I. INTRODUCTION

The idea of folding scissor disaster relief bridge was evolved after witnessing many disasters which had employed destructive dominance for Indian economy as well as to human lives. Several disasters are listed below.

Table – I
Disasters with their effects

Sr no	Disaster	Year	Place	Effect
01	Uttarakhand flood and land slides	2013	Uttarakhand India	More then 1000 people killed
02	Jammu Kashmir flood	2014	Jammu Kashmir India	Properly damage upto 6000 cr
03	Earthquake Nepal	2015	Nepal	9000 people killed and 22,000 + injured
04	Flood in Gujarat	2017	Gujarat	More then 250 people killed

Bridge systems often fail in natural disaster events such as earthquake, typhoons, flood, tsunamis and many more. Enhancing bridge resilience to disasters becomes critical for quick transportation to stuck people as well as delivery of food and medical supplies.

As no such bridge is constructed and employed till now in India it was somewhat challenging task for us to design and make such bridge. That's why we have designed and analysed many models on staad.pro software and constructed a prototype for 22ft span without any intermediate support which can carry load up to 1800kg and can be erected within time span of 20 times or less than that.

II. NECESSITY/OBJECTIVE OF THIS BRIDGE

- 1) In disaster relief during floods, earthquake, landslides or in any disaster.
- 2) War conditions
- 3) Communication link during maintenance work of permanent bridge.
- 4) Where and when it is required to launch transportation link between two stations without any intermediate support for short spans.

III. METHODOLOGY

A. Survey of different kind of disaster relief bridge

As we were inclined to develop a folding scissor deployable bridge, study of different bridges used in same conditions were done. The bridges which were studied are as per following:

Bailey bridge

Pontoon bridge

Armour vehicle launched bridge

B. Conceptual model making

Conceptual model of proposed folding scissor bridge is made from plywood and parts were assembled by means of bolts. Self weight of conceptual model is 900gms whereas load carrying capacity is 8kg as.

C. Designing

Designing of proposed folding scissor bridge is done in staad.pro software which is 3D structural analysis and physical modelling software including finite element method (FEM) analysis as per standards. We have designed different bridge model with various loading conditions and different member properties and adopted the best suited one for 115ft long bridge without any intermediate support as well as we have also designed a bridge to make prototype of 22ft long span.

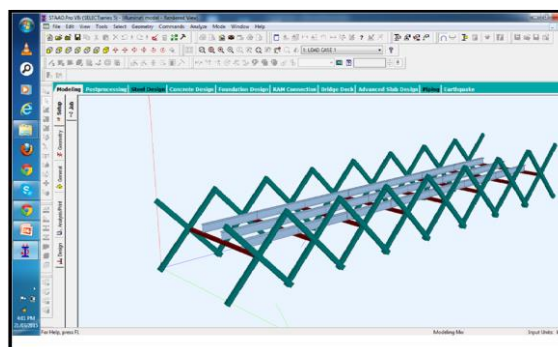


Fig-1-Staad pro design for 22ft span prototype

D. Construction of prototype

We have designed and constructed prototype of proposed folding scissor bridge in Vadodara, Gujarat India. Which is erected by hydraulic mechanism, pulleys, winch and wire rope mechanism. Initially wire rope mechanism is grouted in land but this bridge can be transported to the location wherever it is required by means of army trucks with little alterations.

Technical data:

Span: 22ft

Load carrying capacity: 1800kg

Erection time: 15 minutes

Length in folded condition: 2ft



Fig-2-Folding Bridge(Folded Condition)

E. *Construction materials*

Whole skeleton is made of from structural steel different materials like wooden planks, aluminium, pre cast concrete slabs can be used for deck depending on the requirements and application. High strength stranded cables are used for erection mechanism.

IV. FUTURE SCOPE

This research can be carried forward with different materials and different erection mechanisms as well as the whole assembly can be stored in a truck and one can also focus on how it fails under maximum loading condition.

V. CONCLUSION

All in all this kind of deployable scissor bridge which can be employed with in countable minutes at any remote place would be proven as a blessing in the field of disaster management as well as some of defence purpose.

REFERENCES

- [1] en.wikipedia.org/wiki/2013_North_India_floods
- [2] en.wikipedia.org/wiki/April_2015_Nepal_earthquake
- [3] en.wikipedia.org/wiki/2014_India-Pakistan_floods
- [4] en.wikipedia.org/wiki/2017_Gujarat_flood
- [5] Staad pro reference manual: communities.bentley.com/.../Technical_5F00_Reference_5F00_V8i.pdf
- [6] Ichiro Ario and Yuki Chikahiro. "A New Type of Bridge, Mobilebridge® to Super-Quickly Recover a Bridge" , World Journal of Engineering and Technology, 2015, 3, 170-176
- [7] Y. Chikahiro, I. Ario, M. Nakazawa, S. Ono, J. Holnicki-Szulc, P. Pawlowski & C. Graczykowski, "An experimental study on the design method of a real-sized Mobile Bridge for a moving vehicle", Mobile and Rapidly Assembled Structures IV 93