

「組織的な若手研究者等海外派遣プログラム」で実施された 国際会議参加に関する報告

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The oral presentation with the title of *Evaluation of Multinational Criteria For Stability Of Steel Arch Bridges By FE Analysis* was conducted on the 5th International Conference on New Dimensions in Bridges, Flyovers, Overpasses & Elevated Structures, Wuyishan, China.

1. 国際会議の概要

The 5th International Conference on New Dimensions in Bridges, Flyovers, Overpasses & Elevated Structures was organized and hosted by Fuzhou University of China and a institution of Singapore. Many papers studied on the structures, designing, materials, construction method were collected from several researchers, and their oral presentations were given in English. This conference is very influential, especially for the studiers in universities.



Fig. 1 The conference venue (Wuyishan city)



Fig. 2 Oral presentation in the conference

2. 発表内容と成果

<日本語概要>

アーチリブでは圧縮力が支配的であるため、特に鋼アーチ橋の設計においては、座屈が問題となる。これまでに、鋼アーチ橋の座屈に関する様々な研究が多くの研究者により行われており、新しい座屈設計法も数多く発表されているが、その成果は必ずしも設計基準には反映されていない。本研究では、実在するアーチ橋を参考に設定したモデルに対してFEM解析により面内および面外座屈耐荷力を算定し、ライズ比、横構設置範囲、アーチリブ間隔、アーチリブと横構の剛比による影響を調査した。また、日本・中国・ヨーロッパ

の設計基準により算定される耐荷力を FEM 解析結果と比較することで、各国の設計基準の精度を評価した。その結果、面内耐荷力については中国の基準、面外耐荷力については日本の基準の精度が比較的良いことが明らかになった。

<English Abstract>

Arches resist general loading by a combination of axial compression and bending actions. The stability of arch rib becomes complex and it is closely associated with the critical flexure load of arch bridges. The analysis according to provisions for in-plane and out-of-plane stability of steel arch bridge in Chinese code: *Fundamental code for design on railway bridge and culvert*¹, Japanese code: *Specification for Highway Bridges*², American code: *AASHTO LRFD Bridge Design Specifications*³ and Eurocode 3: *Design of Steel Structures*⁴ are compared with FE result by employing an existing steel arch bridge. The influence of rise-to-span ratio, γ -value and arch rib spacing on the in-plane and out-of-plane critical flexure load and critical axial force of arch rib are focused. The results show that the in-plane critical flexure load decreases along with the increase of rise to span ratio according to Chinese code and Eurocode, while it doesn't change with the rise to span ratio by the American code. The out-of-plane critical flexure load according to Chinese code comes to a peak with the arch rib spacing of approximately 5m. The larger arch rib spacing gives the larger critical flexure load in Japanese code, while it gives smaller critical load in Eurocode. The increase of γ -value and decrease of rise-to-span ratio result in the increase of out-of-plane critical flexure load according to Chinese code and Eurocode, while in terms of Japanese code it doesn't change with γ -values, and is slightly affected by rise-to-span ratio. The comparison between results of multinational code and FE analysis shows that the relatively accurate in-plane and out-of-plane critical axial force of arch rib can be obtained by Chinese and Japanese code, respectively.

3. 今後の展望と感想

3.1 今後の研究展望

This study has certain deficiencies and need enhancement through future work. Some ideas for enhancement are as follows: First, more steel arch bridges with different structure styles should be chosen to obtain accurate and general conclusions. Second, more codes from differing countries would be used, in order to find out their own advantages and disadvantages, and it is better to give a suggestion that which one should be employed for a steel arch bridge. Third, The more parameters affect critical load of steel arch bridge need to be evaluated, so as to formulate more accurate equation to against the out-of-plane stability of steel arch bridge, such as nature and distribution of the load, the shape of the arch axis, and variations in the flexural and torsional stiffness of the cross section along the arch axis, the restraint available at the supports and elsewhere, residual stress resulting from uneven cooling after rolling of the steel, and yielding of the steel. Moreover, the in-plane stability is also need to be studied.

3.2 国際会議に参加した感想

I have learned a lot on bridge engineering and something else through this international conference. The speakers let me know more studying topics, and the new ones attract me deeply. I should not only concentrate on the study of steel arch bridge, but also on more meaningful topics. Additional to theoretical researchers, many bridge engineers attended the conference, whose experiences and opinions on bridge projects were very helpful for me. Besides, I learned what happened on real bridges recently. The members from different countries gathered together, communicated in English, which stimulate me to attach more importance on English studying for future study and life.