



Design Trend of Tower Shapes toward Long-Span Suspension Bridges

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Summary

Towers of long-span bridges play a key role as iconic symbols. The role of tower becomes more significant for longer span bridge structures. As the aesthetics has been appeared as one of dominant in decision process for tender design, innovative and unique tower shapes have been brought to birth in the world. However feasible tower shapes for long-span bridges are somewhat limited to a few specific structural systems. Such limitation might be inevitable when the structural safety at lower cost is imposed as strong constraints. Therefore, the development of a better looking tower shape satisfying the imposed constraints is a key issue to be addressed for super-long span bridge design to create an attractive landscape including the bridge. Considering that understanding design trends is very important step to establish design guide lines for future design, existing tower shapes have been investigated considering structural material, structural system, and architectural styles. This paper will focus mainly on the two issues: (1) the identification of the important factors affecting tower shapes by investigating the tower shapes of existing suspension bridges and (2) the proposal of tower shapes for the prototype suspension bridge whose main span is 2800m.

Keywords: long-span suspension bridge, tower shape, aesthetics, design trend

1. Introduction

This study has been motivated by the tower shape of a prototype suspension bridge structure whose main span is 2800m. Since this prototype bridge is designed to verify technical advancements under progress in Korea toward super-long span bridge, the tower shape resulted from pure engineering design is lack of aesthetic pleasure. Considering that the design of tower shape merges to structural art rather than pure art, design trend is intentionally classified according to structural system or structural material as their uses became popular. The development of tower shapes has been in two ways: (1) refinement of the original tower shapes reflecting the aesthetic design factors and (2) creation of innovative shapes through multi-disciplinary design team without imposing any structural or construction constraints in depth.

2. Design Trend of Suspension Bridge Towers

The design trend in bridge structures are born and grown together with the advancement of other areas such as structural material, construction method, design concept, architectural styles characterized and designers' philosophy. These design patterns are fashionable in general and they are changed gradually as designers learn and adapt to new ideas. In this study this bridge design trend has been investigated by classifying tower shapes according to structural system or structural material as their uses became popular considering that the design of tower is structural art work. As in many other cases, the bridge design trend has changed in chronological order.



3. Aesthetic Principles for Suspension Bridge Tower Design

An aesthetic design is the synthesized form obtained by integrating all different perspectives in a harmonious way. In order to satisfy the requirements within an integrated framework, this study has identified the triad of structural art upon the investigation of existing tower shapes.

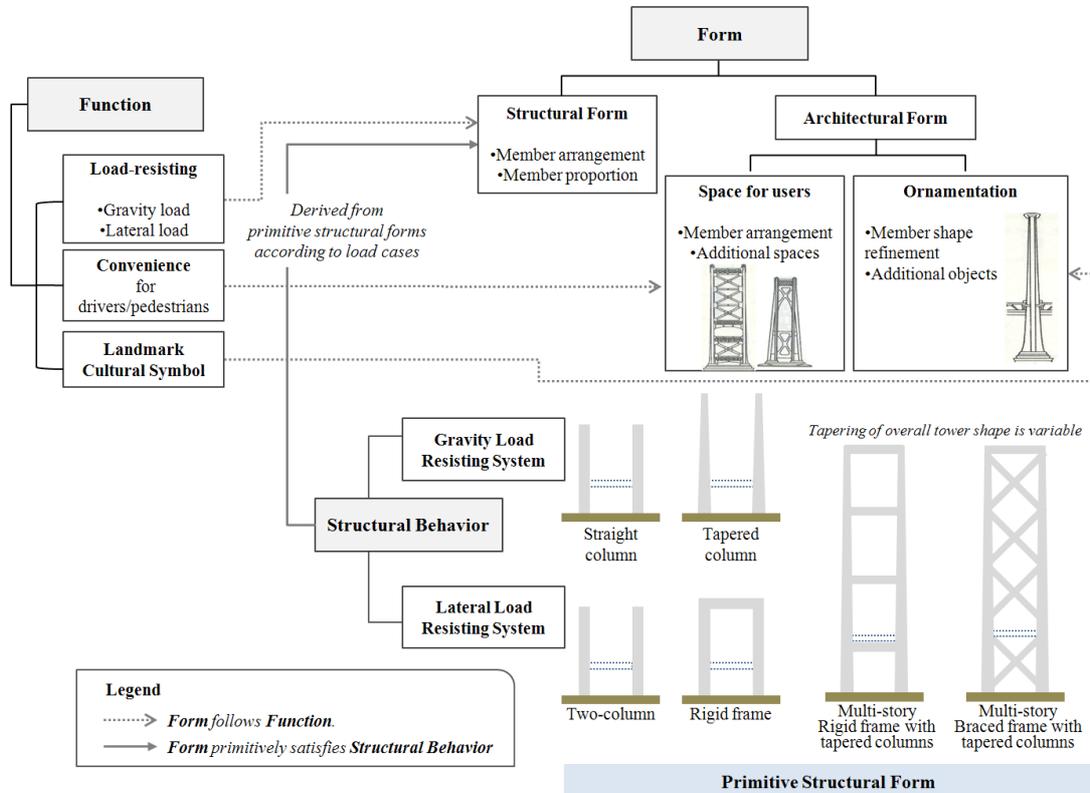


Fig. 8: Relationships among the triad of structural art: form, function, and structural behavior

4. Case Study

This section discusses how to develop design alternatives for tower shapes of super-long span bridge structures considering aesthetic design principle discussed in the previous section.

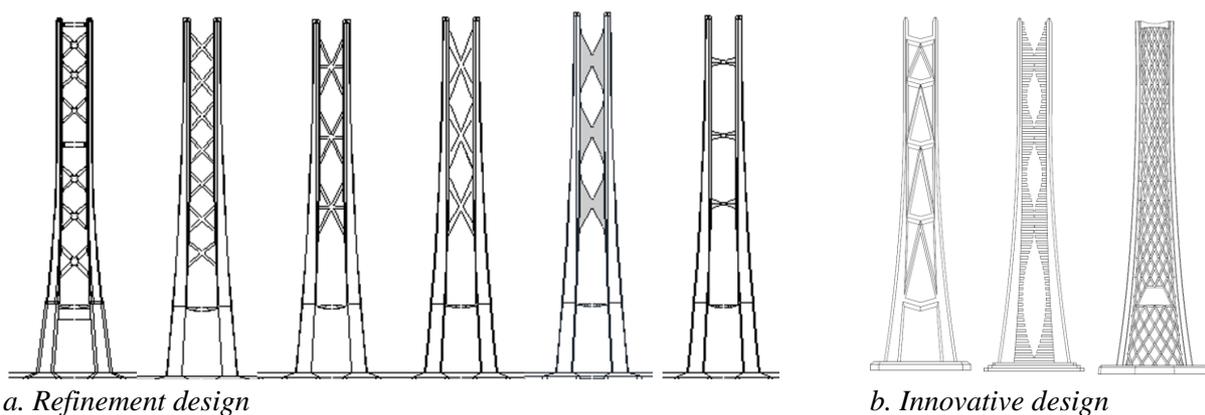


Fig.12: Design alternatives obtained by two different approaches

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