



Educating Engineers to Create Elegant Bridges

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Summary

This paper defines principles intended to serve as a basis for teaching engineering students how to endow the bridges they design with good visual qualities. These principles were developed as a means of addressing the current situation in bridge design, in which engineers generally receive no formal education in the visual aspects of bridge design and the vast majority of bridges create visual impacts that are at best mediocre. Educating future engineers to design bridges of high visual quality can be best accomplished by shifting the focus away from signature bridges intended to make grandiose visual statements and concentrating on more practical works, abandoning the notion of bridges as works of art in favour of a more realistic emphasis on the craft of bridge design, and by insisting that real improvements in technology are incorporated in every bridge, enabling each bridge to perform its function better than its predecessors.

Keywords: Bridge aesthetics, education.

Most engineers who design bridges have received little or no formal instruction in how to create bridges that look good. Engineers currently take this situation for granted, even though it is widely acknowledged inside and outside the profession that the way bridges look is important. As with any visible object, bridges will elicit an emotional response from people who look at them and a judgment will be made on this basis: the bridges will be found to be beautiful, ugly, or somewhere in between. When ugly objects are small, it is relatively easy to remove them from sight and hence to eliminate any impact they may have on quality of life. Bridges are too big for this. Because of their size and geometry, bridges stand out from almost any landscape they occupy, man-made or natural, and may well be seen by tens of thousands of people every day whether they want to or not. Our emotional response to bridges can therefore remain fresh for years. It thus follows that the way bridges look can have an effect on our quality of life, and for this reason it is indeed correct to say that the way bridges look is important.

If it is important, then we need to teach it and teach it well. This article proposes three broad principles that can be used as a foundation for teaching students how to consider the visual aspects of bridges in the design process. Based on a review of some current academic perspectives on bridge aesthetics and an assessment of the visual quality of recent bridges, it is proposed that mediocre bridge aesthetics is the result of a larger problem, namely that bridge technology has stagnated in recent decades. Any effective means of increasing the quality of bridge aesthetics through education must therefore be intimately linked with an effective means of fostering a culture of continuous improvement in bridge technology. The principles of bridge aesthetics education proposed in this article are a reflection of this perspective:

1. *Concentrate on practical bridges, i.e., those which are not intended to serve as grandiose monuments.* It is recommended that educators expend no time and effort trying to build a curriculum aimed at teaching students to design signature bridges, i.e., bridge intended to make a grand visual statement. Although engineers may disagree with the notion of bridges that function not only as means of transportation but also as public sculpture or landscape



architecture, this way of looking at bridges is in many cases a clear reflection of the prevailing political will. In such cases, engineers are clearly out of their depth. Neither our education nor our inclination predisposes us to create works of sculpture or pleasant spaces for people to mingle, and there is little point in adding these competencies to the training of engineers. If the purpose of a given bridge is to be significantly more than merely a practical means of getting from Point A to Point B, then we would do well to leave the leadership of these projects to others.

2. *Consider bridge design as a craft rather than an art.* Carl Condit, writing about the bridges of Robert Maillart, argues convincingly that bridges are not works of art in the same sense as is understood when the word is applied to works of sculpture, painting, or architecture [1]. According to Condit, works of art are characterized not so much by beauty, but by “layers of symbolic meaning”. These layers of meaning can certainly be found in the great works of sculpture, painting, and architecture, as evinced by the rich body of scholarly writing, each member of which purports to peel a new layer of meaning from these works. Condit claims that bridges do not embody this richness of meaning, and hence are not works of art in the same sense. Condit’s way of looking at bridges is remarkably consistent with the way practicing designers regard what they do, and likewise with the way students imagine their future practice. Bridge design is undoubtedly a creative activity, with an undeniable visual character, yet its visual appeal does not go far beyond a simple appreciation of the beauty of form and proportion. In terms of vocabulary, this understanding of bridge design is much closer to the meaning of the word “craft” than “art”. This meaning should be reflected in the way we teach students to deal with the visual aspects of bridge design.
3. *Focus first on creating good bridges, i.e., works that create value through by accomplishing their practical function better than their predecessors.* It can be taken as an axiom of engineering that it is always possible to do things better than they were done previously. The most effective way for engineers to create value is thus not merely by finding the most economical bridge design from a set of known possibilities, but rather by bringing forth new solutions from their imagination. Value is therefore not static but rather evolves as a function of time. According to this axiom of engineering, today’s most economical solution will never be the most economical solution tomorrow. It therefore follows that bridges that merely recycle tried and true technologies (like most of the recently built practical bridges) always sacrifice the value that could have been achieved by a design that incorporates new and better ideas.

The notion of maximizing value through continual improvement in technology has the following important implications for the visual design of bridges:

- a) Creativity breeds creativity. If engineers are continually engaged in generating new ideas related to technology, this creative state of mind will surely be active when they make decisions related to the way bridges look.
- b) New technical solutions create opportunities for creating new visible forms.
- c) Without new technical solutions, new opportunities for aesthetic expression are severely limited. In the past, designers have attempted to endow conventional structural systems with aesthetic meaning through the use of surface textures and other types of ornamentation. These approaches are generally unsuccessful.

1. References

- [1] CONDIT, C. "Review of Robert Maillart's Bridges by David P. Billington", *Technology and Culture*, Vol. 21, No. 2, 1980, pp. 243-246.