



Form Dynamics at Concrete Overpass Bridges

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Abstract

Beyond an indispensable *form logic*, where the visible form comprehensibly represents the inherent structural system, further form refinements are possible in order to significantly enhance the external appearance. The approach of *form dynamics* is herein introduced, which shows strong and perplexing correlations between the work of engineers and the principles of *gestalt psychology*. Terms used in the field of gestalt psychology like (perception) forces, tensions, and balance of forces, which were mainly proposed by the psychologist Rudolf Arnheim, are also used in the field of structural mechanics.

Recommendations based on gestalt psychology are presented to encourage engineers to improve the outer expression of bridge structures in order to aim for a more *dynamic* appearance. Special attention is paid to concrete bridges, which cross highways and expressways, since they are exposed to extraordinarily high numbers of observers. An integral overpass bridge along the route A5 of the ASFINAG network, north of Vienna, Austria, which follows the above mentioned principles is introduced as an example.

Keywords: Bridges, aesthetics, form logic, form dynamics, gestalt psychology, structural shaping

1 Introduction

In the course of the conceptual design process of bridges the role of engineers inevitably has an influence on the visual appearance, as they select the structural system, which includes proportions, shapes, and dimensions of the respective bridge. Particularly within infrastructure projects, engineers have the leading role in, if not even the sole responsibility for the design process.

However, engineers are mostly unaware of the significant impact of structural forms and inherent physical processes on the human perception. Experiments in the field of gestalt psychology show that humans have a sense of perceiving the mechanism of *loading* and *carrying* while observing specific shapes [1]. At the end of the 19th century the German philosopher and

psychologist Theodor Lipps introduced the theory of “aesthetic-mechanical processes, which are materialized for us in shapes” [2]. He further outlined the “unconscious mechanical knowledge” of humans, which is commonly used as an intuitive judgement of geometrical forms, lines and therefore of larger components and form configurations like structures and buildings. Based on these observations, the visual appearance of mechanical laws or regularities, as so-called *form logic* within structures, is essential to ensure an aesthetic performance especially for bridges. Moreover, in the view of the author, engineers are obliged to achieve a specific form logic in publicly-financed infrastructure design in order to fulfil a purposeful, economical and, last but not least, aesthetic design. Form recommendations for integral bridges, which lead to an inherent structural form logic are detailed in [3].