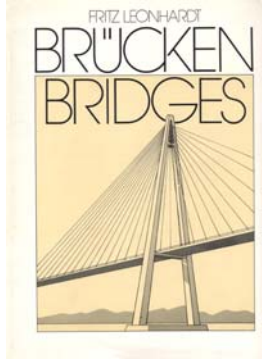


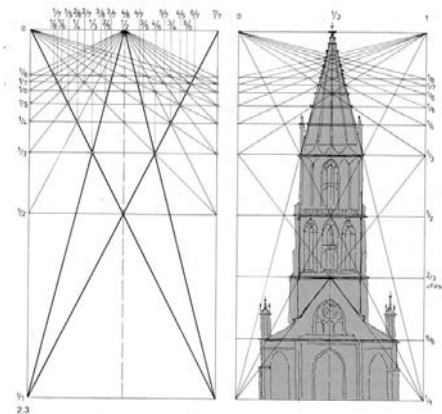
BRIDGES: AESTHETICS AND DESIGN



Leonhardt, Fritz (1984). *Bridges: Aesthetics and Design*. The MIT Press. Cambridge, Massachusetts.

ABSTRACT

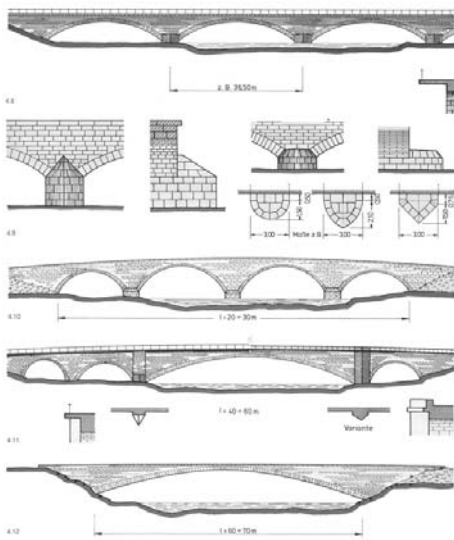
Bridges: Aesthetics and Design is a richly illustrated book describing the development of bridges, from the primitive wooden beam and masonry arch to today's large steel and prestressed concrete structures spanning rivers, valleys, and highways. In this worldwide survey, Leonhardt explores the numerous design possibilities by giving an overview of bridge aesthetics and develops a systematic approach to the aesthetic and functional design of bridges. This book is indispensable to anyone wishing to design bridges or to anyone interested in the art of bridge making. Leonhardt has taught at the University of Stuttgart for many years and is one of Europe's leading structural engineers.



The book is 308 pages and divided into 14 chapters. The content of each chapter is summarized below.

Chapter 1: Introduction conveys the author's passion for bridge building and design and conveys his objective to educate the reader about the functional and aesthetic possibilities of bridge design. Leonhardt outlines his intent to use numerous examples of excellent bridge design to serve as a basis for the reader for evaluating and designing aesthetically pleasing bridges. In addition he describes and illustrates the range of bridge types and illustrates numerous design responses to their functional requirements in both form and use of materials.

Chapter 2: The Basics of Aesthetics. The author conveys his belief that there is a universal and natural basis for aesthetics and artists and designers should embrace these principals as a basis for critiquing their own designs and creating beautiful objects and works of art. He provides an overview of the history of the study of aesthetics and aesthetic principals that have transcended many civilizations and cultures and touches on subjects such as proportion, harmony, and classical beauty. His narrative also includes a brief overview of components of aesthetics such as proportion, order, integration into the environment, and color. He summarizes with a plea to artists and designers to embrace the rules of



aesthetics not as a means to limit freedom but to evaluate our own designs and create objects of greater beauty.

Chapter 3: How is a Bridge Designed? is an overview of the bridge design process.

1. Information Gathering—The designer needs to fully understand the functional, technical, and contextual considerations before proceeding with design. The designer must visit and experience the site.
2. Design exploration—the designer must have a broad understanding of structural options and materials. Develop several alternatives, review to meet aesthetic and technical criteria, allow time to reflect on and get critique and input from peers.
3. Select preferred alternative—refine design and verify structural assumptions with calculations.
4. Final design—developing all the details necessary to construct a bridge.

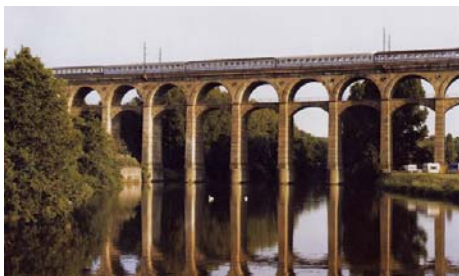
Chapter 4: Guidelines for the Aesthetic Design of Bridges is a broad summary of bridge types with clear illustrations and a design overview of arch bridges, beam bridges, beams for viaducts, cable-stayed bridges, suspension bridges and truss bridges.

Chapter 5: Influence of Alignment focuses on the importance of careful consideration of horizontal and vertical alignment in bridge design. Until recent history the bridge has driven horizontal and vertical alignment. Today, transportation systems drive bridge geometry. This chapter presents a concise overview of aesthetic and technical principals of horizontal and vertical alignment applied to bridge design.



Chapter 6: Influence of Building Materials is a broad survey of bridge materials including stone, brick, concrete, steel, aluminum and timber. The unique structural and aesthetic properties of each of these materials are discussed and well documented with photographs and illustrations. The author reiterates that bridge design requires an extensive knowledge of materials and that good bridge design is based on appropriate material selection considering form, technical quality, economics and compatibility with the environment.

Chapter 7: Old Stone Bridges is a historical overview of some of the finest examples of stone bridges in the world. The author highlights unique historical, aesthetic, and contextual characteristics of these bridges.



Chapter 8: Pedestrian Bridges is a historical overview of pedestrian bridge examples including primitive bridges, Japanese pedestrian bridges, arch bridges, suspended pedestrian bridges, modern timber bridges, pedestrian street overpasses, and stairs to bridges. The author discusses design considerations for specific bridge types and illustrates them with photographs and diagrams. The author highlights innovations and aesthetic qualities of selected bridge examples.

Chapter 9: Bridges at Grade-Separated Junctions. Examples include overpass bridges in flat country, overpass bridges in mountainous country, and overpass bridges for skew or curved crossings. This section is especially pertinent to transportation design with many fine examples of over passing bridges in masonry, concrete, and steel. Examples are well illustrated with photographs



and drawings including beam, arch and haunched bridges that are constructed with a variety of materials. The author highlights functional and aesthetic design considerations unique to each bridge type.

Chapter 10: Elevated Streets illustrates contemporary examples of primarily concrete structures with photographs and drawings. Attention is focused on innovative superstructure and substructure designs with a variety of beam cross sections and innovative pier shapes. The author discusses design, aesthetic, and cost considerations unique to selected examples.



Chapter 11: Large Beam Bridges includes river bridges (especially bridges across wide rivers), beam-viaducts, long high level bridges with haunched beams, viaducts with truss-agirders, and bridges along steep slopes. Bridge examples are contemporary, sleek, efficient and concise structures of concrete and steel crossing rivers, lakes, valleys, and breathtaking mountainous regions. These bridges are all appropriate and artful responses to their contextual settings.

Chapter 12: Large Arch and Frame Bridges. Examples include river bridges with full faced arches, river bridges, steel arches, viaducts with masonry and concrete arches, viaducts with steel arches, arches above the roadway deck and frame and strut girders. Examples range from historic monumental bridges to contemporary elegant steel and concrete structures.



Chapter 13: Cable-Stayed Bridges includes numerous configurations, masts and pier and box girder alternatives using steel, concrete and masonry (for piers). Crossings are over rivers, lakes, and mountain valleys. Author uses bridge examples to highlight aesthetic principals and specific structural challenges.

Chapter 14: Suspension Bridges is a historical journey starting in 1834 and capturing the world's significant suspension bridges including the Brooklyn Bridge, Golden Gate Bridge, George Washington Bridge, and bridges in Scotland, Wales, Portugal and San Salvador. Aesthetic and technical observations accompany each bridge example. The Tacoma Narrows "Galloping Girdy" is highlighted and the impact of its collapse on the design of subsequent suspension bridges.

SUMMARY

An excellent resource for those designing and guiding the design of bridges, this book provides a broad overview of basic bridge types and materials. Through numerous examples, the author builds an aesthetic basis for evaluating and appreciating bridge design. This is a comprehensive book richly illustrated with a world survey of photographs and illustrations.

KEY WORDS

Applicable Project Delivery Stages: Administration, Planning, Scoping, Design

Applicable Transportation Professionals: Structural Engineers, Bridge Engineers, Highway Engineers, Urban Designers, Landscape Architects, Architects, Geotechnical Engineers, Hydrological Engineers, Archeologists, Historians and Artists

Applicable Transportation Modes: Vehicular, Bus, Rail, Bicycle, Pedestrian

Transportation Topics: Visual Quality, Safety, Geometrics, Design Speed, Contextual Character, Arch Bridges, Beam Bridges, Large Beam Bridges, Cable-Stayed Bridges, Suspension Bridges, Haunched Beam, Beams-Viaducts, Pedestrian Street Overpasses, Underpass Bridges, Truss Girders, Barrel Arches, Steel Arches, Arches Above Roadway Decks, Horizontal Alignment, Vertical Alignment, Geometric Proportion, Scale, Color, Texture, Order, Golden Mean