

The Alamillo Bridge: At the Interface of Structure and Art

Cody H. Fleming
1.541 Mechanics and Design of Concrete Structures
Dept. of Civil and Environmental Engineering
Massachusetts Institute of Technology

Introduction:

For some engineers and architects, as well as the general public, the use of concrete is merely utilitarian in nature. Its inherent strength, ease of use, and low cost lend it to a wide variety of applications, many of which are very low profile in terms of public appeal. In areas where the amount of physical infrastructure is abundant, one can observe many fairly unattractive applications of concrete, including parking lots, roadways, and parking ramps. Furthermore, two very widely used applications of concrete, floor slabs and foundations, can never actually be seen by the majority of its users. This perception of concrete as solely being used in lackluster construction projects has been abandoned by Santiago Calatrava. Calatrava uses the properties of concrete in such a fashion as to create something that is both functional from an engineering standpoint and aesthetically pleasing. With concrete, Calatrava is able to design for structural elegance, meaning that the structure both serves the purpose of its namesake, i.e. it is structural, and also represents the form, or architecture, of the design. Perhaps the quintessential representation of using concrete for structural art is the Alamillo Bridge in Seville, Spain, with its incline pylon/cable stay design. This project proposes to evaluate the design and present an overall case study for the use of concrete in this application. It is significant because it is both an engineering marvel and highly visible in the public eye. More precisely, it presents a challenge to a person of technical engineering expertise but is also identifiable for the layman.

This project will investigate the mechanics of the superstructure and how that relates to the choice of concrete as the load bearing material. Furthermore, it will identify characteristics at the material level. For example, research into the strength of concrete used, rebar configuration, and prestressing methods (if used), will be included in the analysis. The relationship between the material properties and the overall geometric shapes will also be studied using both the methodology of the design engineer as well as those used in this class. Finally, a comparison and contrast of the use of concrete versus other engineering materials in terms of the basic engineering requirements: safety, cost, and user-interface, will provide a perspective on the use of concrete in civil engineering structures.