



Ensuring Soundness of Innovative Concept Design – A “Regressive” Approach?

David Williams

Consulting Engineer, Oakland, CA, USA

Contact: davidwilliams.eng@att.net

Abstract

As project design becomes a more automated process there is greater need for ensuring the soundness of innovative concepts. Elementary mechanics, risk register development and case-study awareness are important elements to inform the concept design process.

Keywords: concept design; elementary mechanics; case-studies; risk awareness.

1 Introduction

The desire for innovative design may result from the need for a non-traditional structural solution to a set of complex requirements or the desire for an iconic "statement" structure. It should not be innovation for the sake of difference alone. Creative design solutions often result from free-flowing brainstorming in an open marginally-restrained multi-disciplinary forum where no offered suggestions are ridiculed and all are seriously debated and subsequently subject to confirmation. Input from peripheral disciplines can often provide broader insight that adds to a creative, effective and pragmatic solution. But potentially great concepts need careful appraisal for soundness before being pushed forward.

2 Need for Concept Soundness

Although merely a potential concept, Conceptual Design should be considered as one of the most important phases during development of an innovative structural project. Why? Conceptual Design may be the last real chance for due-diligence on a project of non-traditional design. Once accepted by the client during project development, often based on subjective reasons, the Concept Design becomes a fait accompli with respect to "soundness of concept". Typically, most subsequent effort is focused on implementation of the concept in the most cost-efficient and

expedient fashion. Design quickly moves into a commoditization mentality - detailed analysis and computer-based production of procurement deliverables (traditional design substantiation calculations, drawings, specifications, costs).

Unless properly vetted for soundness, creative "sublime" designs can become a nightmare during implementation [1]. Reversing momentum from persuasive energy already invested in the Concept is difficult. Fortunately, soundness of design typically results in design excellence – "pure" form. So, addressing "soundness" at this early stage should not be regarded as a disincentive to Creativity, just a necessary step.

3 Approach to Concept Assessment

As an innovative solution, the Concept Design would not have been subject to a long history of construction and response performance under a range of conditions, the inherent situation of structures for which "codes" are developed. A more fundamental engineering approach to assessment of adequacy is required, with the assumption that an appropriate comprehensive "design code" does not exist. This is basic to most pioneering civil projects.

3.1 Elementary Analysis

The value of simple elementary mechanics in assessing unconventional concepts (for all manner