

Thesis Report

• Scope

Today, the civil engineering is a hard responsibility. The structural designer has to guarantee that the building is safe to be used, economic, environmental and follow the contemporary architectural ideas. Arches are one of these unique ideas for roofing providing large spaces without internal supports.

In design of steel structures nowadays, openings are required to be provided in structural members so that building services may be joined into structural zones for simplified layout and installation. Moreover, the depth of the construction zone may be reduced accordingly, and it may become helpful for buildings which always have a strict requirement on headroom. Many researches were made on straight castellated steel beams and also arched solid steel beams without openings to improve slightly the knowledge in this field about its behavior. It is important to investigate theoretically and experimentally the effect of opening depth, subtended angles and spans on the behavior of the arched cellular steel beams.

• Goals and objectives

The elementary goal of this study is to understand the behavior of the arched cellular steel beams. The related purposes can be listed as following:

- 1) To investigate the behavior of the arched cellular steel beams under the influence of static loading until failure.
- 2) To monitor the modes of failure.
- 3) To study the effect of opening depth, subtended angles and spans changing on the behavior and deformation of the arched castellated steel beam.
- 4) To start the basic input parameters and modelling standard required for the non-linear finite element analysis of the arched castellated steel beams.
- 5) To verify and validate the results of the nonlinear finite element analysis.
- 6) To perform a parametric study for various design parameters.

• Methodology

This study is planned to undertake the following:

- 1) Experimental phase to investigate and monitor the behavior and failure mechanism of the arched castellated steel beams.
- 2) Finite element analysis phase to match with the experimental investigation.
- 3) Analytical phase to start a parametric study for the various influencing factors required to capture the notable features of the behavior.

• Thesis organization

This thesis contains an introduction besides five chapters. Chapter one is the introduction of the thesis. Chapter two provides the literature review which contains detailed review of the previous research work in the field related to the arched castellated steel beams. Also, international codes requirements are highlighted. Chapter three describes the experimental part of the research. Chapter four focuses on the numerical models using a finite element software and the verification of the results. In Chapter five, a parametric study for the arched cellular steel beams is made for several parameters based on the numerical modeling. Finally, Chapter six provides the main conclusions, recommendations and the further studies to be investigated.