APPLIED SCIENCE INTERNATIONAL SUCCESS STORY

CASTELÃO SOCCER STADIUM

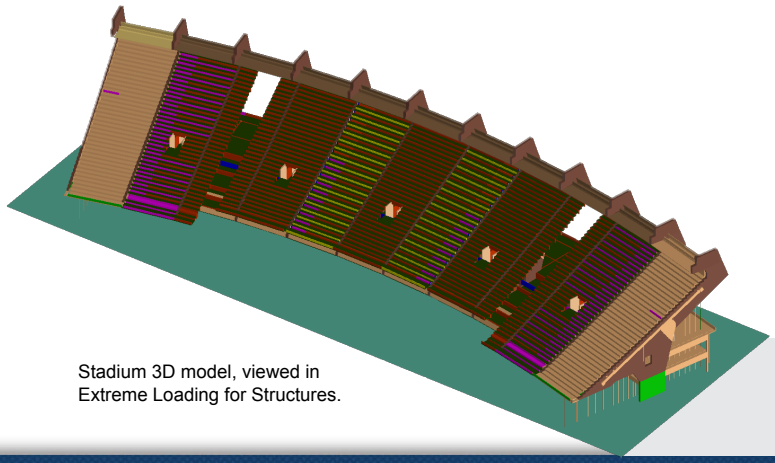
2011 Winner: Explosive Demolition of the Year

Iterative Scenario Analysis Identifies Optimal Demolition Plan

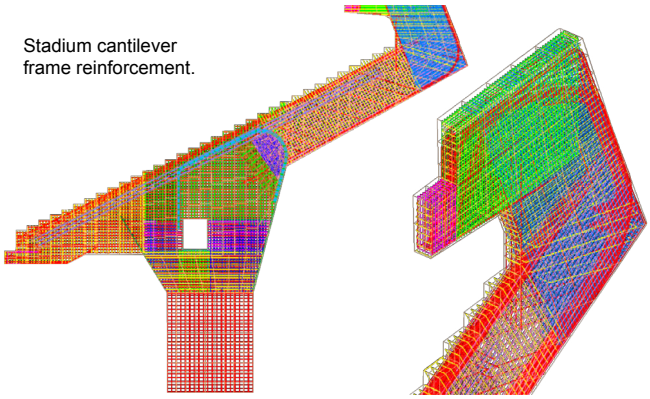
Fábio Bruno Construções contracted Applied Science International (ASI) to model the demolition of sections of the Castelão Stadium in Fortaleza, Brazil in preparation for renovation and expansion of the stadium to be used during the World Cup in 2014. The demolition plan included the removal of the large stadium awning and the lower level seating around the entire stadium by manual means. It also included demolishing the entire height of the stadium from sections 5600-6500 by controlled collapse using weakening and explosives. This was a particularly challenging demolition because both the remaining sections of the stadium and a 3-story structure less than 13 meters behind the cantilevered stadium seating needed to remain unharmed.

Castelão Stadium during demolition.

ASI worked with Fábio Bruno Construções to create a demolition plan that would both efficiently collapse the stadium sections while keeping the remaining stadium sections and surrounding structures undamaged. To achieve this, ASI modeled the full cantilevered stadium seating sections with all reinforcement details, post tensioned cables, expansion joints, elevator shaft, walls, columns, diamond cut gap, and temporary shoring in its Extreme Loading® for Structures (ELS) software in order to perform a complete and iterative analysis of the demolition plan.

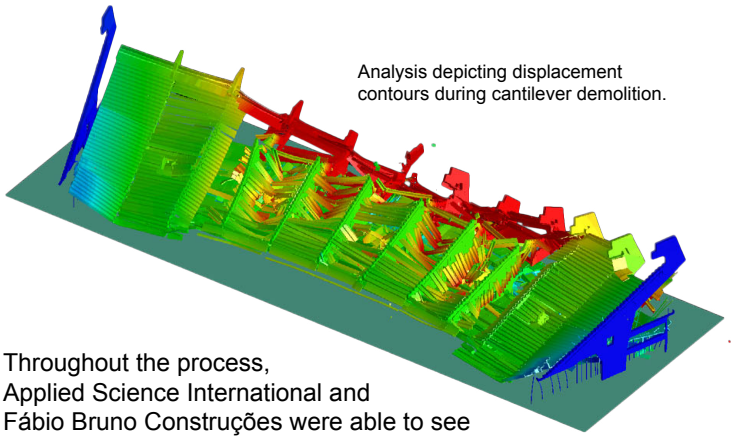


Stadium 3D model, viewed in Extreme Loading for Structures.



Stadium cantilever frame reinforcement.

An initial concept was developed to take advantage of the inherent cantilevered action of the upper seating area, using it as a pivot point, allowing the upper seating area to rotate down and around, increasing the gap between the 3-story building and the stadium. A variety of demolition scenarios were analyzed in ELS to determine the size of the compression zone that needed to be blasted in order to create a plastic hinge that would allow the required rotation. After five demolition scenarios were analyzed a final plan was determined. Additionally, ASI performed a vibration analysis of the chosen demolition plan to ensure that no damage would be caused to the neighboring structures by the impact of the debris with the ground.



Analysis depicting displacement contours during cantilever demolition.

Throughout the process, Applied Science International and Fábio Bruno Construções were able to see the results of each proposed scenario to determine the proper height of the compression zone and optimal charge size to perform a safe demolition. The demolition was safely performed on June 12th, 2011 by the Fábio Bruno Construções Demolition Team using ASI's engineered analysis.

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