An ASI Success Story

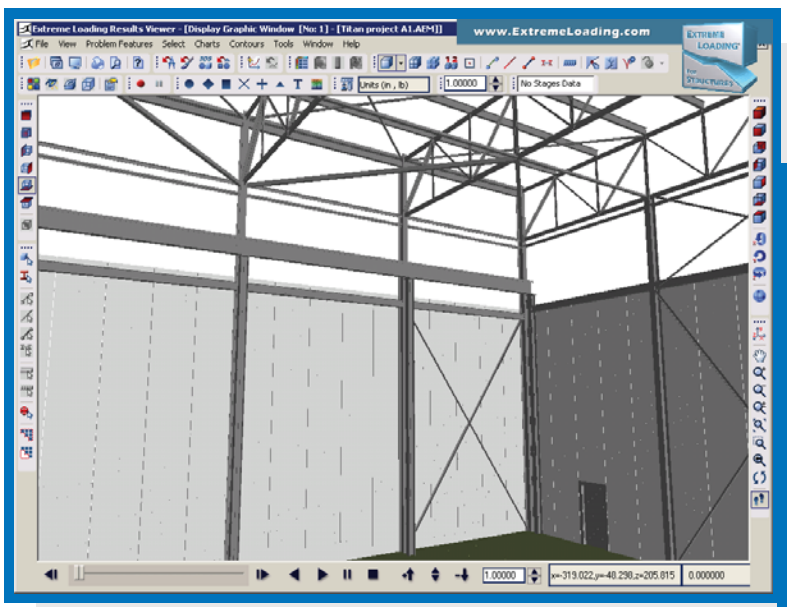
# Vulnerability Assessment Titan Tire Testing Facility

## Illinois, February 2008

Titan Tire Company tasked ASI to perform vulnerability assessment for a facility in an existing building to test large mining tires. The gauge pressure of the tire ranges from 100 to 160 psi. The tire dimensions are up to 163" diameter and 70" wide.

Titan needed to ensure the safety of the structure under the effect of the pressure loads resulting from catastrophic failure and release of all the potential energy stored in the tire at once; in addition, of course to the normal design loads. The possibility of flying debris that may be a hazard to the facility occupants was also an issue

The existing building is a crane bay that consists of steel roof truss supported on steel columns, vertical and horizontal bracing, pre-cast panels, Concrete Masonry Units (CMU) walls, and covering steel sheets.

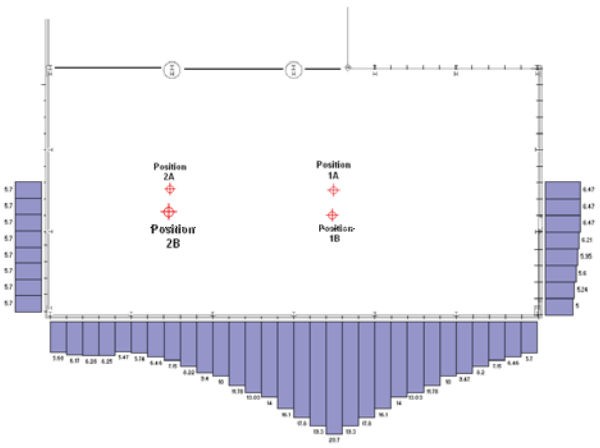



ELS Model

Actual Structural

ASI investigated the position of tire explosion which can occur and determined that the most critical failure would be 7 ft high above the ground level. At this critical height, ASI identified several critical scenarios for the location of the tire explosion and identified the dynamic loading due to the tire explosion on different components of the structure.

ASI created a 3D model of the structure and performed nonlinear dynamic analysis for all the critical scenarios using Extreme Loading® for Structures (ELS). Using the breakthrough technology in ELS, ASI produced simulations of the behavior of the facility under the effect of this unusual case of loading.

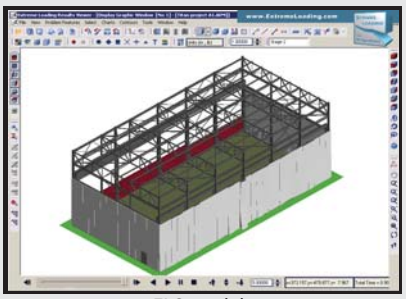



Pressure Distribution

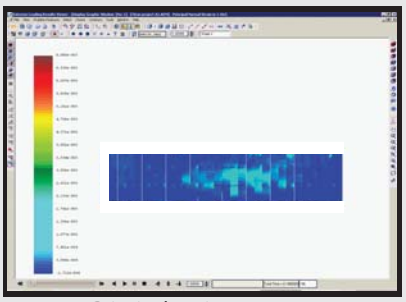
The analysis results showed that mild local damage is possible in some pre-cast panels close to tire location, especially in the connections. ASI provided recommendations for strengthening of specific connections between the panels and between the panels and tie girders as the analysis revealed these connections are subjected to significant forces.

The ASI engineers made a specific analysis of the behavior of non-reinforced CMU walls: the extent of damage and the velocity of flying debris were estimated from the analysis. ASI provided recommendations for strengthening specific walls to mitigate the risk of human injuries or damage due to flying debris.

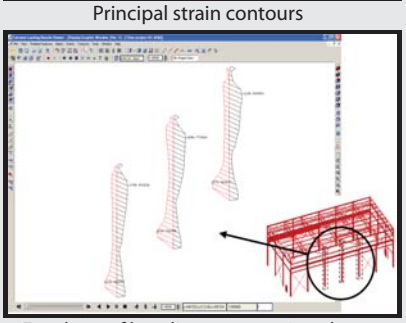
Taking the above safety recommendations into consideration, ASI was able to assure Titan based on its advanced analysis that there is no risk to the main structural elements due to the potential tire explosion and that the roof and the side cover of the facility are not affected by the tire explosion.



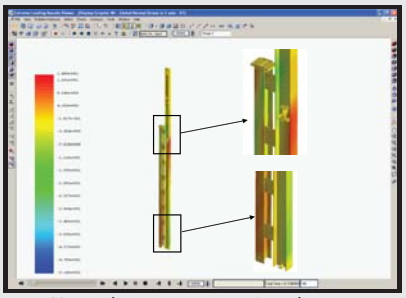
ELS model



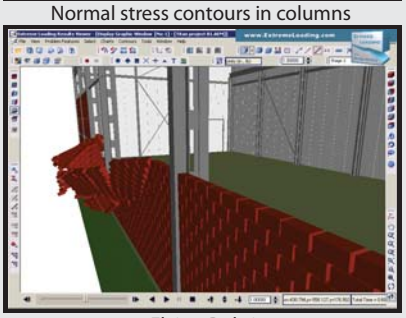
Principal strain contours



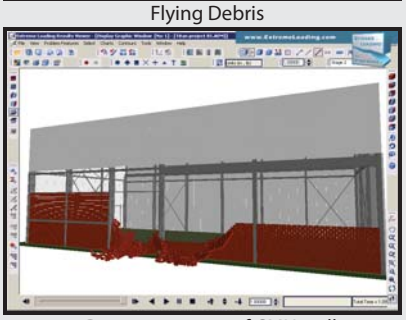
Envelope of bending moment in columns



Normal stress contours in columns



Flying Debris



Damage pattern of CMU wall

**Headquarters**
P. O. Box 13887
Durham, NC 27709-3887

**Tel:** (919) 645-4090
**Fax:** (919) 645-4085
**Email:** sales@appliedscienceint.com

www.appliedscienceint.com
www.extremeloading.com