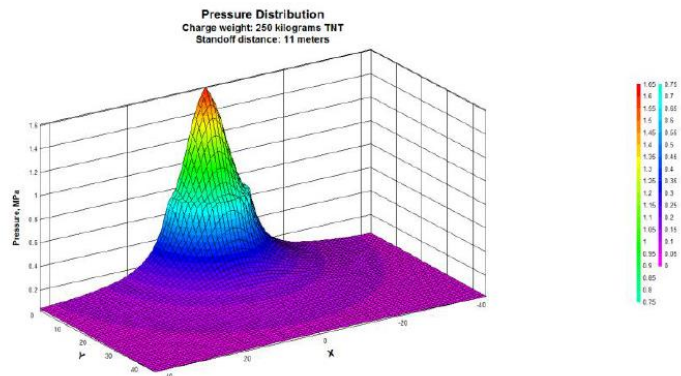


Blast Effects Analysis for a New Police Headquarters in Singapore

As part of the security and protective design consultancy for the development of a new police HQ, Patrick Mann & Associates were contracted to provide the blast analysis and design support to ensure that the structure was able to resist the effects of internal and external PBIED and VBIED attacks.

The tasks included:

- Blast Effects Analysis in order to determine the impact on the facility and its critical assets from the design basis security threats. This included:
 - Derivation of the blast demand in accordance with the US Department of Defense standard UFC 3-340-02.
 - Determine the vulnerability of the building elements, in accordance with PDC TR-06-02 and PDC TR-06-08.
 - Assessment of the effects on the facility, its critical assets and occupants from the explosion shock loading, and the potential for secondary effects such as fragmentation, cratering, etc.
- Structural Resilience Study in order to:
 - Develop hardening solutions for the at-risk items, including walls, columns, slabs, windows, doors, etc.; and
 - Provide detailed analysis of the proposed solutions to show that the proposed hardening measures are in accordance to the design intent.
- Design Specification in order to:
 - Articulate the structure detailing changes in order to ensure that they are correctly captured within the wider building design; and
 - Ensure that the window and doors are procured to the require design specification.



In most instances, the focus of the hardening solutions was to enhance the resilience of the component to the blast loading, i.e. to ensure that it responded in a control (ductile) manner post yield. As such, this generally therefore resulted in changes to the detailing opposed to increases in the component size and strength.