
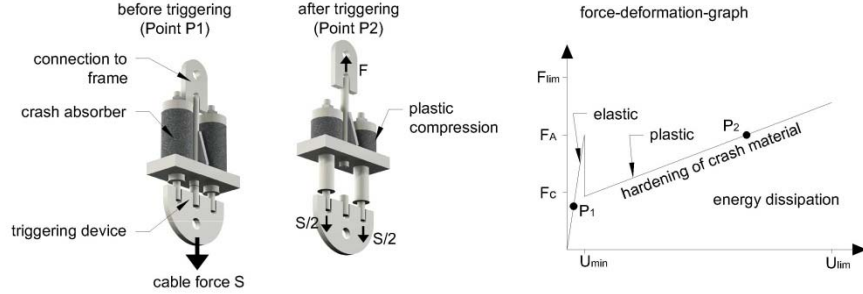


	Project sheet
Research project :	<b>Design methods and Structural Components of blast enhanced Facades</b>
Images :	 <p>Figure 1 : Dissipative Connection between glass and cable in a cable net facade</p>  <p>Figure 2 : Dissipative Cable End Connection</p>
Keywords :	Blast, load, façade, design, element, connection, cable, curtain wall
Researchers involved :	- WELLERSHOFF, Frank
Contact details :	<a href="mailto:frank.wellershoff@hcu-hamburg.de">frank.wellershoff@hcu-hamburg.de</a> ; <a href="http://www.hcu-hamburg.de/">http://www.hcu-hamburg.de/</a> phone +49 40 42827-5681
Time span :	Since 2006
Description :	<p>A “blast resistant” façade requires different numerical design methods and different structural components than a “normal” façade. The impulsive load requires a dynamic analysis with consideration of mass and inertia. To withstand an extreme blast load a façade should be flexible and able to absorb energy in properly designed and analyzed crash zones. These zones are the laminated glass and additional elasto-plastic connections along the load path to the sub structure.</p> <p>The dynamic behavior of facades under shock waves with short time durations but high impulse loads requires different design strategies, specialized analysis tools, and specialized connections between the façade elements itself as well as the connections to the primary building structure. The design philosophy is primarily to save lives and prevent injuries, and secondarily to protect buildings, functions, and assets. The design criteria take a balanced approach to safety, considering cost effectiveness and acknowledging acceptance to some risks.</p> <p>For cable net facades as lightweight and transparent structures particularly at the podium or entry levels of buildings the connections from the glass panels to their fittings, from the fittings to the cables, and the cable end connections must be well designed and in most cases, in order to minimize their size, are designed to the limits. For curtain walls facades the load path from the glazing to the mullions and transoms into the brackets has to be blast enhanced designed and calculated. For both façade types – cable facades and curtain walls – new energy dissipative connectors with residual strength capacity were recently developed as well as design rules and new appropriated software packages.</p>
Most important	- Wellershoff, F.: Blast enhanced facades for the new World Trade Centre

Inventory of existing research

publications :	<p>Towers NY, Challenging Glass Conference Proceedings, page 643 – 653, 2008</p> <ul style="list-style-type: none"> <li>- Wellershoff, F.: Explosionsgeschützte Fassadensysteme, Glas im konstruktiven Ingenieurbau 8, München, Konferenz Umdruck 2010</li> <li>- Wellershoff, F.: Blast enhanced cable facades, Proceedings of Glass Processing Days 2011, page 525 – 529</li> <li>- Wellershoff, F.: Blast enhanced facades, TU Delft Conference: Challenging Glass III, 2012, Proceedings</li> </ul>
Working group :	WG 3. Post-fracture performance
Category :	TG 7: Numerical know how and validation of numerical work
Sheet compiled on :	2012/09/14