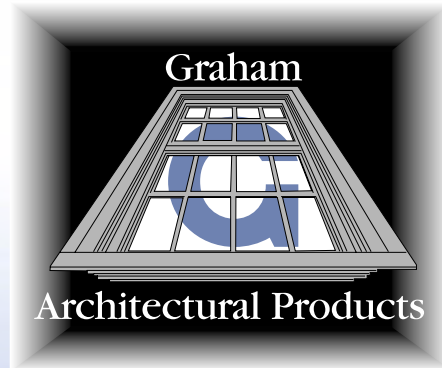


GOOD BETTER GRAHAM



Blast Mitigation Windows



Protecting the Protectors





America has been living with the threat of terrorism, both from home-grown and foreign terrorists, for more than 25 years.

Based on FBI data, the number of actual explosive incidents is beyond public comprehension.

Since the 1995 bombing of Oklahoma's Federal Building and the September 2001 attacks on the World Trade

Center and the Pentagon, blast mitigation windows for high-profile buildings and military structures have rapidly become a way of life.

Anyone working in, living in, or visiting a "high risk" building deserves protection. That's why Graham Architectural Products now manufactures a full line of commercial aluminum products that meets GSA Level D and Department of Defense UFC-4-010-01 criteria for bomb blast protection.

Graham, manufacturers of monumental

windows in the U.S.A. since 1973, now offers blast mitigation products in casement, double hung, sliding, dual action, and fixed configurations. Models are available for new construction, retrofit, and historical renovation; with a choice of 1" to 1-3/16" specialty glazing systems. Graham also offers doors and frames that meet DoD UFC-4-010-01 blast criteria. These products not only serve as life protectors, but are designed for energy efficiency and sound control as well.



Before Blast



After Blast

BLAST PROTECTION TESTING

Testing Photos courtesy of Baker Engineering & Risk Consultants, Inc., San Antonio, TX



Shock Tube Testing is a test method using a compressed gas charge to simulate an explosion's positive pressure. All Graham products have been tested for Condition 2, as stated in the Protection Level Matrix shown next page.



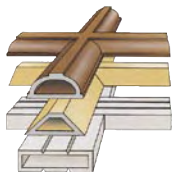
Arena Testing conducts an actual explosive charge, positioned at the predetermined weight of the projected standoff distance, producing both the positive and negative phase blast effects.

Both of these test methods measure the debris entering the room, as a result of the blast. Each tested window's "injury hazard performance condition" can thus be graded from 1-5 (higher numbers signify more hazard to occupants). The weight and distance of the charge help determine pressure and impulse to calculate blast classification level for GSA.



Blast mitigation windows for historic buildings.

Graham is known nationally for its work in historic renovation projects, often conducted under the watchful eye of The U.S.



National Park Service. Using an arsenal of architecturally accurate panning and trim systems, Graham preserves the aesthetics of the building's original architecture, while building in reassuring blast protection.

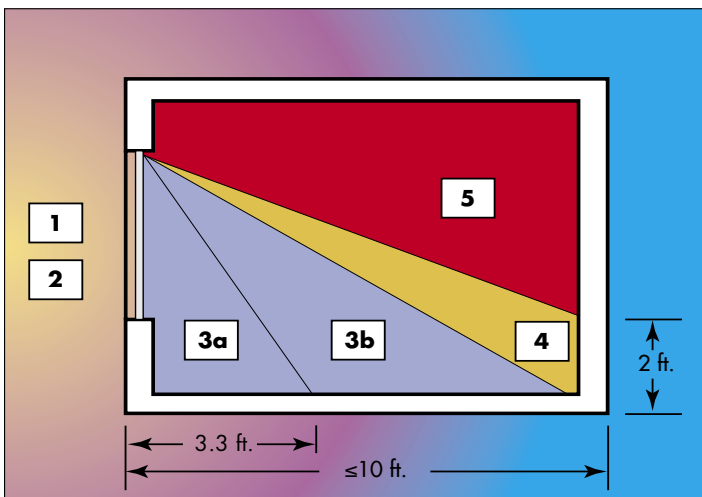


The special reinforced framing, glass, and anchoring systems are invisible and won't alter the structure's historic façade. Normal operating features for ventilation and cleaning are the same.

In the event of a blast, the window is designed to deform in a controlled manner. The interlayer between the laminated glass prevents flying glass shards associated with blast-related injuries.



Protection Level Design Criteria



Condition	Description	Glazing Response	Hazard	Protection
1	Glass not cracked, fully survived and/or fully retained by frame and no glass fragments either inside or outside structure.	None	None	Safe
2	Glass may be cracked but is retained in frame.	No significant fragments. Dusting or very small fragments near sill or on floor acceptable.	None	Very High
3a	Glass failed and not fully retained in frame.	Yes – Lands on floor no more than 3.3 feet from window.	Very Low	High
3b	Glass failed and not fully retained in frame.	Yes – Lands on floor no more than 10 feet from window.	Low	High
4	Glass failed and not fully retained	Yes – Lands on floor more than 10 feet from window and impacts a vertical surface located not more than 10 feet behind window no higher than 2 feet above floor level.	Medium	Medium
5	Glass fails catastrophically	Yes – Lands on floor more than 10 feet from window and impacts a vertical surface located not more than 10 feet behind window above a height of 2 feet.	High	Low

Effects of flying glass from blast attack.

The debris generated or the collapse of structures produced during an explosive (blast) attack causes the majority of injuries and death in a bombing event. As an example, in 1998, over 5,000 people were injured by flying glass and debris in the bombings of two American embassies in Africa. The types of injuries that occurred included deep lacerations and eye injuries. Approximately 90 people were blinded in the attack on the U.S. embassy in Kenya.

When designing window systems to resist blast forces, it is important that the glazing, framing, and anchorage all be designed to withstand the required forces. Generally, the glazing should be the weak link (i.e., it is not desirable for the window system to prematurely fail and blow into occupied spaces due to failure of the frame or anchorage). This approach is commonly referred to as balanced design.

Today, primarily because of the increased threat of terrorism, all federal buildings require enhanced levels of protection from the hazards of glass. Approximately 75 percent of all damage and injury from bomb blasts can be attributed to flying and falling glass following the explosion. Even high-profile private buildings and places of public assembly are now routinely evaluated for enhanced glazing protection measures. Protective glazing is a key component of "hardened" buildings for which the ultimate goal is to provide security for building occupants and assets.

- Adapted from a 2005 report from The National Institute of Building Sciences

GSA Protection Level Matrix

Building Classification	Examples	Maximum Overpressure	Maximum Impulse
A	No protection	0	0
B	No protection	0	0
C	Federal Courts Federal Buildings, etc.	4 psi. & up	28 psi. ms.
D	High-level Military e. g. Pentagon	10 psi. & up	90 psi. ms. & up
E	White House	Classified	Classified



Graham Blast Mitigation Window Projects Worldwide



Please feel free to contact Graham Architectural Products for information on current projects involving blast mitigation fenestration. 1-800-755-6274. Projects at the time of this printing include:

Project Name	Location
P-008 FIOC Phase I	Camp Pendleton, CA
Hanger Bldg.	San Diego, CA
Ft. MacArthur AFB	San Pedro, CA
USDA Mail Center	Washington, DC
2-C-1 Schofield	Oahu, HI
2-C-2 & D Schofield	Oahu, HI
Hickman AFB	Oahu, HI
Ft. Riley Red Cross	Ft. Riley, KS
Lift Building	Sarver, PA
Ft. Sam Houston	San Antonio, TX
Red Horse Medical Center	Seattle, WA
Naval & Marine Corps.	Moundsville, WV
Camp Mujuk Barracks	Pohang, Korea

Windows of Substance for All Applications

Graham Architectural Products makes windows of uncommon quality for even special applications, for a safer, more pleasant interior environment.

All Graham blast mitigation windows are first designed to meet strict industry window standards for thermal performance, air and water infiltration, and smooth operation.

Graham is a recognized leader in acoustical windows for quieting noise pollution.

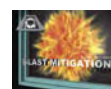


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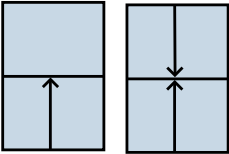
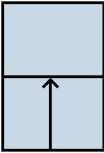
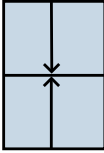
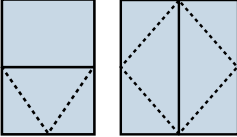
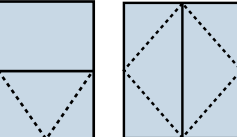
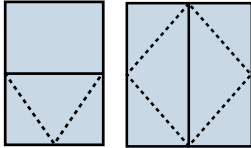


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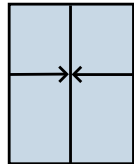
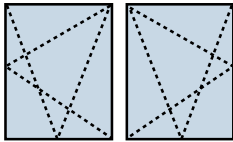




Graham Blast Protection Windows

Series Number	Features	Blast Performance Level
3400 Single Hung/ Double Hung with 4" frame depth 	<ul style="list-style-type: none"> • Tilt Double/Single Hung • Vents operate after blast impulse with hardware intact • Standard locking hardware • Trim and clip or receptor anchoring system • Tilt-in sash for ease of cleaning • 1" I.G. with laminated glass 	GSA level C protection/UFC @ 4 psi, 30 msec blast load
2200 Single Hung with 4" frame depth 	<ul style="list-style-type: none"> • Side-load Single Hung • Vents operate after blast impulse with hardware intact • Standard locking hardware • Trim and clip or receptor anchoring system • Sash removes for ease of cleaning • 1" I.G. with laminated glass • Removable take-out clips prevent unauthorized sash removal • Full-length extruded lift handles 	GSA level C protection/UFC @4-10 psi*
2275 Side Load/ Historic Double Hung with 4" frame depth 	<ul style="list-style-type: none"> • Side-load Double Hung • Exterior beveled glazing leg (for putty glazed look) • Vents operate after blast impulse with hardware intact • Standard locking hardware • Trim and clip or receptor anchoring system • Sash removes for ease of cleaning • 1" I.G. with laminated technology • Removable take-out clips prevent unauthorized sash removal • Full-length extruded lift handles 	GSA level C protection/UFC @4-10 psi*
6500 Casement/ Projected with 2-1/4" frame depth 	<ul style="list-style-type: none"> • Vents operate after blast impulse with hardware intact • Standard locking hardware • Trim and clip or receptor anchoring system • 1" I.G. with laminated glass 	GSA level C protection/UFC @ 6 psi, 40 msec blast load
6800 Casement/ Projected/Fixed with 3-1/2" frame depth 	<ul style="list-style-type: none"> • Vents operate after blast impulse with hardware intact • Standard locking hardware • Trim and clip or receptor anchoring system • 1" I.G. with laminated glass 	GSA level C protection/UFC @6 psi, 40 msec blast load
6800 High Performance Casement/Projected with 3-1/2" frame depth 	<ul style="list-style-type: none"> • High Performance • Standard locking hardware • Trim and clip or receptor anchoring system • Available in out-swing vents only • 1-3/16" I.G. with laminated glass 	GSA level D protection/UFC @10-40psi*
6500 Fixed with 2-1/4" frame depth 	<ul style="list-style-type: none"> • Monumental fixed windows • True muntins for DH look • Trim and clip or receptor anchoring system • External muntins for historical applications • 1" I.G. with laminated glass 	GSA level C protection/UFC @ 6 psi, 40 msec blast load
6800 Fixed with 3-1/2" frame depth 	<ul style="list-style-type: none"> • Monumental fixed windows • True muntins for DH look • Trim and clip or receptor anchoring system • External muntins for historical applications • 1" I.G. with laminated glass 	GSA level C protection/UFC @ 6 psi, 40 msec blast load



Series Number	Features	Blast Performance Level
6800 Fixed High Performance with 3-1/2" frame depth	 <ul style="list-style-type: none"> • High Performance • Trim and clip anchoring system • Up to 1-3/16" I.G. with laminated glass • Externally applied muntins • Intermediate horizontals 	GSA level D protection/UFC @ 10-40 psi*
1400 Fixed with 4" frame depth	 <ul style="list-style-type: none"> • Trim and clip or receptor anchoring system • 1" I.G. with laminated glass • Externally applied muntins 	GSA level C protection/UFC @ 4 psi / 28 psi msec
0200 Horizontal Sliding Window with 4" frame depth	 <ul style="list-style-type: none"> • Full-length extruded pull rails • Standard locking hardware • Trim and clip or receptor anchoring system • Sash removes for ease of cleaning • 1" I.G. with laminated glass • Adjustable (two positions) stainless steel ball bearing rollers 	GSA level C protection/UFC @ 4 psi / 28 psi msec
7500 Dual Action with 3-1/4" frame depth	 <ul style="list-style-type: none"> • Dual Action • Vents operate after blast impulse with hardware intact • Multi-point, dual-locking hardware • Trim and clip or receptor anchoring system • 1" I.G. with laminated glass 	GSA level C protection/UFC @ 4-10 psi*

Blast Mitigation Windows at a Glance

*Final design may vary.

Window Type	Frame Depth	Series	Blast Pressure	Protection Level	AAMA Rating
Aluminum Tilt Double/Single Hung	4"	3400 BM	4-10 PSI	STANDARD	H-AW50 H-HC50
Aluminum Side Load Single Hung	4"	2200 BM	4-10 PSI*	STANDARD	H-AW45 H-HC65
Aluminum Side Load Historic Double Hung	4"	2275 BM	4-10 PSI*	STANDARD	H-AW45 H-HC65
Aluminum Casement/Projected	2-1/4"	6500 BM	4-10 PSI	STANDARD	C-AW85 AP-AW120
Aluminum Casement/Projected	3-1/2"	6800 BM	4-10 PSI	STANDARD	C-AW70 AP-AW115
Aluminum Casement/Projected	3-1/2"	6800 BM H. Perf.	10-40 PSI*	ENHANCED	C-AW70 AP-AW115
Aluminum Fixed	2-1/4"	6500 BM	4-10 PSI	STANDARD	F-AW100
Aluminum Fixed	3-1/2"	6800 BM	4-10 PSI	STANDARD	F-AW80
Aluminum Fixed	3-1/2"	6800 BM H. Performance	10-40 PSI	ENHANCED	F-AW80
Aluminum Fixed	4"	1400 BM	4-10 PSI	STANDARD	F-AW65 F-HC130
Aluminum Horizontal Slider	4"	0200 BM	4-10 PSI*	STANDARD	HS-AW40 HS-HC40
Aluminum Dual Action	3-1/4"*	7500 BM	4-10 PSI*	STANDARD	DA-HC40

Please contact factory for blast tested doors and frames.

*Final design may vary.

Graham Projects Involve the Following Federal Agencies Among Others.

The Department of Defense
The Department of Homeland Security
The Department of State
The Justice Department
The U.S. General Services Administration
U.S. Army Corps of Engineers
USAF
U.S. Naval Facilities



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