



# Blast-Resistant Design Manual



PCI Blast Resistance  
and Structural Integrity  
Committee  
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Precast Prestressed Concrete

# BLAST-RESISTANT DESIGN MANUAL

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# TABLE OF CONTENTS

<b>1. Introduction.....</b>	<b>1</b>
1.1 Purpose and Scope.....	1
<b>2. Free-Field Airblast Load.....</b>	<b>3</b>
2.1 Types of Explosions.....	3
2.2 Blast Load Parameters.....	5
2.3 Blast Loads from Hemispherical TNT Surface Burst.....	7
2.4 Blast Loads on Structures.....	15
2.4.1 Reflected Blast Loads.....	16
2.4.2 Clearing of Reflected Blast Loads.....	18
2.5 Consideration of Negative Phase Blast Load.....	23
2.6 Effect of Explosive Type and Geometry.....	23
2.6.1 TNT Equivalency Factors for Different High Explosive Type.....	24
2.6.2 Charge Geometry and Casing Effects.....	28
2.7 Structural Components with Non-Uniform Blast Loads.....	28
2.8 Blast Loads on Framing Components.....	31
2.9 Blast Walls and Revetments.....	31
2.10 Confined Detonations.....	32
<b>3. Single-Degree-of-Freedom Analysis of Structural Component Response to Blast Load.....</b>	<b>34</b>
3.1 Development of an Equivalent SDOF System.....	34
3.1.1 Equation of Motion for Equivalent SDOF System.....	36
3.1.2 Transformation Factors.....	37
3.1.2.1 Deflected Shape Function.....	38
3.1.2.2 Load Factor.....	39
3.1.2.3 Mass Factor.....	40
3.1.2.4 Load-Mass Factors.....	41
3.1.3 Resistance-Deflection Relationships.....	42
3.1.3.1 Resistance-Deflection Relationship for Ductile Flexural Response.....	44
3.1.3.2 Shear Response Mode.....	50
3.1.3.3 Resistance-Deflection Relationships for Response Modes with Membrane Action.....	51
3.1.3.4 Strain Energy.....	52
3.1.4 Damping.....	54

3.1.5 Initial Displacement.....	56
3.2 Methods for Solving SDOF Equation of Motion .....	57
3.2.1 Graphical Solution for Simplified Equation of Motion .....	57
3.2.2 General Numerical Solutions.....	59
3.3 Maximum Response Parameters.....	61
3.4 Component Damage Levels .....	63
3.5 Reaction Forces.....	65
3.5.1 Dynamic Reaction Forces.....	65
3.5.2 Equivalent Static Reaction Force .....	68
3.6 Rebound.....	69
3.7 Combined Axial and Lateral Loads.....	71
3.8 Overall Building Design Considerations.....	73
3.9 Limitations of SDOF Analysis .....	75
3.9.1 Limitations Due to Structural Response Mode Assumptions.....	75
3.9.2 Limitations Due to Component Interaction Effects.....	76
3.9.3 Limitations Due to Blast Load Assumptions.....	77
<b>4. Dynamic Response Properties of Precast and Prestressed Concrete Components.....</b>	<b>79</b>
4.1 Dynamic Material Properties.....	79
4.1.1 Concrete Dynamic Strength .....	79
4.1.2 Reinforcing Steel Dynamic Strength .....	80
4.1.3 Strength Reduction Factors.....	82
4.2 Flexural Response of Reinforced Concrete Components.....	82
4.2.1 Ultimate Dynamic Moment Capacity of Conventionally Reinforced Components .....	82
4.2.2 Dynamic Moment Capacity of Prestressed Concrete Components.....	84
4.2.3 Moment of Inertia and Modulus of Elasticity .....	86
4.3 Shear Response.....	88
4.3.1 Dynamic Diagonal Shear Capacity of Concrete.....	89
4.3.2 Dynamic Diagonal Shear Strength of Prestressed Concrete.....	90
4.3.3 Required Steel Shear Reinforcement for Diagonal Shear.....	90
4.4 Reinforcing Steel Development Lengths and Splices.....	92
4.5 Rebound.....	93
4.6 Connections.....	93
<b>5. Example Problems.....</b>	<b>98</b>

5.1 Wall Panel with Opening Design Example .....	98
5.2 Two-Span Continuous Wall Panel Design Example .....	106
5.3 Prestressed Concrete Double-Tee Beam Design Example.....	115
<b>6. Notation.....</b>	<b>123</b>
<b>7. References.....</b>	<b>130</b>

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# Figures

Figure 2-1: Pressure histories from shock wave and pressure wave.....	4
Figure 2-2: Typical pressure-time history of an airblast in free air .....	5
Figure 2-3: Pressure history shape for negative phase of load.....	6
Figure 2-4: Simplified blast pressure history for positive phase blast load .....	7
Figure 2-5: Blast loads on building surfaces from open air explosion.....	8
Figure 2-6: Positive phase shock wave parameters for a hemispherical surface burst of TNT at sea level (Metric) .....	9
Figure 2-7: Positive phase shock wave parameters for a hemispherical surface burst of TNT at sea level (English).....	10
Figure 2-8: Negative phase shock wave parameters for a hemispherical surface burst of TNT at sea level (Metric) .....	11
Figure 2-9: Negative phase shock wave parameters for a hemispherical surface burst of TNT at sea level (English).....	12
Figure 2-10: Comparison of typical reflected and side-on pressure-time histories .....	13
Figure 2-11: Peak side-on pressure versus peak dynamic pressure, density of air behind shock front, and particle velocity.....	15
Figure 2-12: Plan view of shock wave loads on building surface. ....	17
Figure 2-13: Plan view showing angle of incidence of shock front relative to building wall.....	17
Figure 2-14: Reflected pressure coefficient versus angle of incidence.....	19
Figure 2-15: Scaled reflected impulse versus angle of incidence .....	20
Figure 2-16: Reflected blast load affected by clearing .....	21
Figure 2-17: Sound velocity in reflected overpressure region .....	22
Figure 2-18: Close-in explosive charge causing non-uniform blast load on component.....	29
Figure 2-19: Equivalent uniform roof and side wall loading.....	30
Figure 2-20: Line-of-site standoff distance.....	30
Figure 2-21: Wave diffraction around walls .....	32
Figure 2-22: Blast pressure from confined explosion .....	33
Figure 3-1: Equivalent spring-mass SDOF system.....	34
Figure 3-2: Flow chart showing typical blast design process .....	35
Figure 3-3: Deflected shape functions for simply supported beam .....	38
Figure 3-4: Resistance-deflection relationship for simply supported beam.....	43
Figure 3-5: Fixed-end beam in ductile, flexural response.....	45
Figure 3-6: Resistance-deflection curve for flexural response .....	45
Figure 3-7: Resistance-deflection relationship controlled by shear response .....	51
Figure 3-8: Strain energy for component with ductile flexural response.....	53
Figure 3-9: Undamped response charts for SDOF response to right triangular blast load history .....	58

Figure 3-10: Example of calculated displacement history for equivalent SDOF system .....	59
Figure 3-11: Example of calculated resistance history for equivalent SDOF system.....	60
Figure 3-12 Support rotation angle .....	62
Figure 3-13 Free body diagram used to determine dynamic reaction force for uniformly loaded beam (Ref. 13) .....	66
Figure 4-1: Strain-rate vs. concrete compression strength.....	80
Figure 4-2: Strain-rate vs. reinforcing steel yield and ultimate strength.....	81
Figure 4-3: Reinforced concrete cross sections with and without compression face reinforcement .....	84
Figure 4-4: Coefficient for moment of inertia of cracked sections .....	88
Figure 4-5: Locations of critical sections for diagonal tension shear .....	89
Figure 4-6: Shear steel reinforcement for blast-loaded components.....	91
Figure 4-7: Example connection of spandrel to floor slab .....	94
Figure 4-8: Example connection of spandrel to column near floor slab .....	95
Figure 4-9: Example connections at top and bottom of precast wall panel .....	96
Figure 4-10: Example connection between precast concrete wall panels.....	96
Figure 5-1: Wall panel with opening for example 1 .....	98
Figure 5-2: Design blast load history for example panel .....	99
Figure 5-3: Resistance-deflection curve for example panel .....	102
Figure 5-4: Calculated deflection history for example panel .....	102
Figure 5-5: Calculated resistance history for example panel .....	103
Figure 5-6: Two-span wall example .....	106
Figure 5-7: Explosive charge locations near building .....	107
Figure 5-8: Design blast load history for example panel .....	108
Figure 5-9: Resistance-deflection curve for example panel.....	111
Figure 5-10: Resistance-deflection curve for example panel.....	112
Figure 5-11: Resistance-deflection curve for example panel.....	112
Figure 5-12: Double-tee beam section in example 3 .....	115
Figure 5-13: Design blast load history for example 3.....	116
Figure 5-14: Resistance-deflection curve for example 3 beam.....	120
Figure 5-15: Calculated deflection history for example 3 .....	121
Figure 5-16: Calculated resistance – deflection history for example 3.....	121

## Tables

Table 2-1: Blast load terms .....	13
Table 2-2 Type of blast load on building surfaces .....	16
Table 2-3: TNT equivalency factors for free-air explosions.....	24
Table 2-4: Heat of detonation of common explosives1 .....	27
Table 3-1: Load and mass factors for one-way components.....	41
Table 3-2: Flexural resistance, stiffness, and support shear for one-way members.....	49
Table 3-3 Damping ratio information for primarily elastic dynamic response.....	56
Table 3-4 Component damage levels from USACE17 .....	63
Table 3-5 Response limits for antiterrorism design of reinforced concrete .....	64
Table 3-6 Dynamic reaction force coefficients for one-way components .....	67
Table 4-1 Dynamic yield strength information for conventional reinforcing steels .....	82
Table 5-1: Blast loads on example 2 panel at various angles of incidence.....	108

# 1 . Introduction

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Blast resistant design is becoming more common in the precast concrete industry as more large government and Department of Defense (DOD) buildings now require some level of blast-resistant design for anti-terrorism and force protection (ATFP). Typically, this includes high profile government buildings and most DOD buildings. Additionally, many buildings for the chemical and petrochemical industries and for explosive storage and manufacturing facilities are subject to inherent accidental explosion hazards and therefore require blast design. The need for blast design should be specified in the design specification documents for each building.

Design guides and methods have been developed for blast-resistant design of many common building components based on both theoretical analysis and testing. Much of this blast design guidance is applicable to precast and prestressed concrete components. This report summarizes blast-resistant design information that can be used for precast or prestressed concrete elements and structures.

## 1.1 Purpose and Scope

This report describes the basic process of blast resistant structural design for precast or prestressed concrete components. This generally involves calculating blast loads on the component, determining the dynamic response of the component, checking the response against specified performance criteria, designing the component connections, and checking that the component has adequate shear capacity. The emphasis in this report is on blast loads from exterior explosions and dynamic analysis of blast-loaded structural components assuming they can be idealized as equivalent single degree of freedom (SDOF) systems. These assumptions simplify the blast resistant design procedure discussed in this report, but they apply to many cases of practical interest for ATFP design. One limitation is that they do not apply to cases where the explosion is close to the designed component or in confined spaces, as discussed in Chapter 2. Also, blast resistant design for components subject to accidental explosions should follow specific criteria from DOD's Unified Facilities Criteria (UFC) 3-340-02<sup>1</sup> or American Society of Civil Engineers' (ASCE's) *Design of Blast Resistant Buildings in Petrochemical Facilities*,<sup>2</sup> although many of the basic concepts discussed in this report are applicable.

This report is intended for engineers knowledgeable in conventional design of precast or prestressed concrete components. Also, a basic understanding of dynamic response, including the