Manual

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PCI Precast/Prestressed Concrete Institute

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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1. Introduction

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[1] or American Society of Civil Engineers' (ASCE's) *Design of Blast Resistant Buildings in Petrochemical Facilities*,[2] 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