STUDY ON BEHAVIOUR OF CONCRETE FINS AGAINST BLAST PRESSURE

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Master of Engineering Degree in Structural Engineering Design

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Sri Lanka

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Thesis submitted in partial fulfilment of the requirements for the degree Master of Engineering

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Declaration

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Abstract

Designing structures against blast loading is becoming more and more important as the number of terrorists attacks are increasing day by day. It is necessary to protect the structures against a credible blast load to ensure the safety of the occupants. In this context, blast resisting facades are incorporated in buildings to avoid the blast pressure waves entering into the building as the highest damage is done by the pressure waves when compared with the fragments moved by an explosion. Pressure waves could damage the axially loaded elements and it may lead to progressive collapse of the structure. This study investigated the behaviour of concrete fins and they were categorized depending on the failure mode which is based on the occupancy levels such as immediate occupancy, life safety and collapse prevention. Concrete fins were analysed using Sap2000 software by taking into account the material nonlinearity and loading nonlinearity. Weight of blasting materials, standoff distance, fin spacing, fin size and reinforcement ratios were varied to create different analysis cases. When the standoff distance was 50m, all the analysis cases were in immediate occupancy level, and it was found that standoff distance of 25m is as the manageable distance in blast. However, standoff distance of 10m resulted many analysis cases exceeded the collapse prevention limit. It was identified that standoff distance of 25m as the manageable limit with respect to the safety and the cost.

Specially dedicated to my beloved family and to whom were behind me always….

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LIST OF ABBREVIATIONS

Abbreviation	Description
f'c	Concrete cylinder strength
f_{cu}	Concrete cube strength
f_{dy}	Dynamic yield strength of steel
f_{du}	Dynamic tensile strength of steel
f_{dcu}	Dynamic cube strength of concrete
fu	Tensile strength of steel
fy	Yield strength of steel
P(t)	Pressure at time t
P(r)	Reflected pressure
Pr^-	Maximum pressure at negative phase
Pso	Peak incident pressure
R	Standoff distance
t_{of}	Duration of positive phase
t_{rf}^-	Duration of a blast
W	Weight of blast material
Z	Scaled distance