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FIRE ASSESSMENT REPORT

FAR 2469-ISSUE 2 ASSESSMENT REPORT ON ZEGO® FIRE FORM™ INSULATED CONCRETE FORMWORK (ICF'S) AND ZEGO® ReFORM® FORMWORK

TEST STANDARDS
AS 1530.4-1997 and AS 3959-2009

CLIENT
ZEGO Pty Limited
GPO Box 4774
Sydney 2001
Australia

ASSESSMENT SUMMARY

Objective

This report gives BRANZ's assessment of the fire resistance of ZEGO®'s Fire Form™ Insulated Concrete Forms (ICF's) and ZEGO®'s ReFORM® in accordance with AS1530.4-1997 and AS1530.8.2 and compliance with AS 3600-2001.

The wall system consists of insulated formwork manufactured from expanded polystyrene with plastic webs. The core is then filled with concrete complying with AS 3600-2001.

Conclusion

It is considered that a concrete wall manufactured using the ZEGO® Fire Form™ ICF's system would provide at least the fire resistance in accordance with AS 1530.4-1997 as given in AS 3600-2001 for the appropriate concrete core thickness as shown in the following table.

ZEGO® ICF's Cavity thickness (mm)	ZEGO® ReFORM® Cavity thickness (mm)	AS 3600-2001 Fire resistance rating (minutes)
75	-	30
97	-	60
104	100	90
120	120	120
150	165	180
184	195	240
200	245	240
264	309	240

It is considered that the above fire resistance ratings meet the BAL-FZ requirements of AS 3959-2009 for a wall to achieve at least a FRL of 30/30/30 or -/30/30.

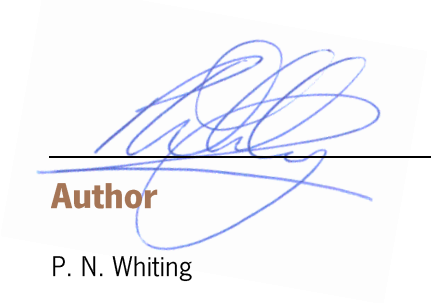
LIMITATION

This assessment is subject to the completeness and accuracy of the information supplied.

BRANZ reserves the right to amend or withdraw this assessment if information becomes available which indicates the stated fire performance may not be achieved.

CONTENTS

SIGNATORIES



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DOCUMENT REVISION STATUS

DATE ISSUED	ISSUE NO.	DESCRIPTION
16 February 2005	FAR 2469	Initial issue
31 August 2011	FAR 2469-Issue 2	Issue 2 includes ZEGO® ReFORM® and compliance with AS 3959-2009 requirements for BAL-FZ classified construction.

1 INTRODUCTION

This report gives BRANZ's assessment of the fire resistance of ZEGO® Fire Form™ Insulated Concrete Forms (ICF's) and ZEGO® ReFORM® in accordance with AS1530.4-1997 and AS1530.8.2 and compliance with AS 3600-2001.

The wall systems offer three possible options;

1. insulated formwork manufactured from expanded polystyrene (EPS) on both faces tied together with plastic web "Interconnects";
2. partially insulated formwork with EPS on one face and 19 mm thick re-useable ReFORM® formwork on the opposite face tied together with plastic web "Interconnects"; and
3. 19 mm thick re-useable ReFORM® formwork on both faces tied together with plastic web "Interconnects".

The plastic web "Interconnects" are the same for each wall option supplied in various lengths to achieve walls of different overall thickness. The core of the wall is then filled with concrete complying with AS 3600-2001. The re-useable ReFORM® formwork panels are able to be removed after the concrete has cured.

2 BACKGROUND

If a concrete wall is built to comply with AS 3600-2001 from, for example, a minimum of 120 mm thick concrete it is deemed to be able to achieve an Insulation of 120 minutes if tested in a fire resistance test (Section 5.7.2). If the wall is built to comply with the requirements of section 5.7.4 of that standard "Structural Adequacy for walls" it is deemed to achieve Structural Adequacy for 120 minutes. If the wall complies with AS 3600-2001, section 5.7.2 and 5.7.4 it is deemed the wall will maintain the Integrity criteria of the test standard for 120 minutes.

3 DISCUSSION

3.1 General

The proposal is to consider whether the ZEGO® ICF's and ZEGO® ReFORM® wall combinations described in section 1 would comply with AS 3600-2001 where the ZEGO® formwork includes plastic web Interconnects. The ICF's consist of expanded polystyrene panels nominally 60 mm wide with a plastic web slotted into each panel forming a cavity which is than filled with concrete. Other insulating panels available are 52 mm, 64 mm, and 100 mm thick along with fully strippable and reusable panels. The profile of the concrete ICF's interface consists of 8 mm deep ribbing on 50 % of each side.

The plastic webs are nominally 19 mm high x 4.5 mm wide and spaced at 192 mm horizontal centres and between 107 and 193 mm vertical centres.

3.2 Fire Resistance

In accordance with AS 1530.4 the failure criteria is as follows:

Structural adequacy – when the specimen fails to maintain the applied load.

Integrity – when the specimen fails structural adequacy. When flaming to the unexposed face occurs, for longer than 10 seconds, when hot gases can pass through the specimen to the unexposed face.

Insulation – when the average temperature on the unexposed face rises by more that 140 K or when the maximum temperature is in excess 180 K.

3.3 Structural Adequacy

The cavity of the ICF's and ReFORM® over the range of thicknesses represents a larger cross sectional area, excluding the area of the plastic webs, than the minimum defined in AS 3600-2001 Table 5.7.2. Therefore it is considered on the condition that the concrete meets the requirements of section 5.7.4 of AS 3600-2001 the ICF's and ReFORM® walls would meet the fire resistance rating for structural adequacy listed in table 5.7.2. of AS 3600.

3.4 Integrity

In accordance with AS 3600 section 5.7.3, and previous test experience on concrete wall systems, it is considered that insulation failure usually occurs before integrity failure. Therefore it is considered the ICF's and ReFORM® wall systems will maintain the integrity criteria of the test standard for at least the insulation ratings of the wall systems.

3.5 Insulation

If the wall complies with AS 3600 section 5.7.2 then it is considered that it would not exceed the insulation criteria of the test standard before that listed in Table 5.7.2 from AS 3600-2001 which is reproduced as follows:

ZEGO ICF's structural cavity concrete thickness (mm)	ZEGO® ReFORM® Cavity thickness (mm)	AS 3600-2001	
		Effective Thickness (mm)	Fire resistance rating (minutes)
75	-	60	30
97	-	80	60
104	100	100	90
120	120	120	120
150	165	150	180
184	195	170	240
200	245	170	240
264	309	170	240

3.6 Application in Bushfire Zones

In Australian Standard AS 3959-2009 "Construction of buildings in bushfire-prone areas", it specifies that for construction in Bushfire Attack Level Flame Zone (BAL-FZ) classified areas, the construction of an external wall shall be one of the following:

a) Walls made of non-combustible material (e.g., masonry, brick veneer, mud brick, aerated concrete, concrete) with a minimum of 90 mm in thickness, or
b) A system complying with AS 1530.8.2 when tested from the outside, or
c) A system with an FRL of 30/30/30 or –/30/30 when tested from the outside, or
d) A combination of any of Items (a), (b) or (c) above.

3.6.1 Fire Resistance Level

The definition of Fire Resistance Level (FRL) referred to in option (c) refers to the grading period, in minutes, that is determined by subjecting a specimen to the standard time temperature curve regime as set out in AS1530.4, to specify-

a) Structural adequacy
b) Integrity, and
c) Insulation

The FRL of ZEGO® ICF's and ZEGO® ReFORM® is discussed in the above sections 3.3 to 3.5 based on the concrete specification and thickness in accordance with AS 3600. On this basis, with ZEGO® ICF's structural cavity concrete thickness of at least 75 mm and ZEGO® ReFORM®'s structural cavity concrete thickness of at least 100 mm, the fire resistance levels achieved are at least 30 minutes and 90 minutes respectively. It is therefore considered that these meet the BAL-FZ requirements of AS 3959-2009 for a wall to achieve at least a FRL of 30/30/30 or -/30/30.

3.6.2 Lower Construction Levels

Section 3.4 of AS 3959-2009 states "Construction requirements specified for a particular Bushfire Attach Level (BAL) shall be acceptable for a lower level."

Therefore, construction that has met the criteria to be classified BAL-FZ is suitable to be used in construction where lower BAL classifications apply.

4 CONCLUSION

It is considered that a concrete wall manufactured using the ZEGO® Fire Form™ ICF's system and ZEGO® ReFORM® system would provide at least the fire resistance in accordance with AS 1530.4-1997 as given in AS 3600-2001 for the appropriate concrete core thickness as shown in the following table.

ZEGO® Fire Form™ ICF's Cavity thickness (mm)	**ZEGO® ReFORM® Cavity thickness (mm)**	**AS 3600-2001 Fire resistance rating (minutes)**
75	-	30
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It is considered that the above fire resistance ratings meet the BAL-FZ requirements of AS 3959-2009 for a wall to achieve at least a FRL of 30/30/30 or -/30/30.

5 LIMITATIONS

This assessment report may only be quoted or reproduced in full.

The wall will be designed in accordance with AS 3600-2001.

ANNEX A – SELECT DETAILS FROM ZEGO® FIRE FORM™ MANUAL

Figure 1 illustration of Plastic Interconnect - ZEGO® Manual Figure 2.6

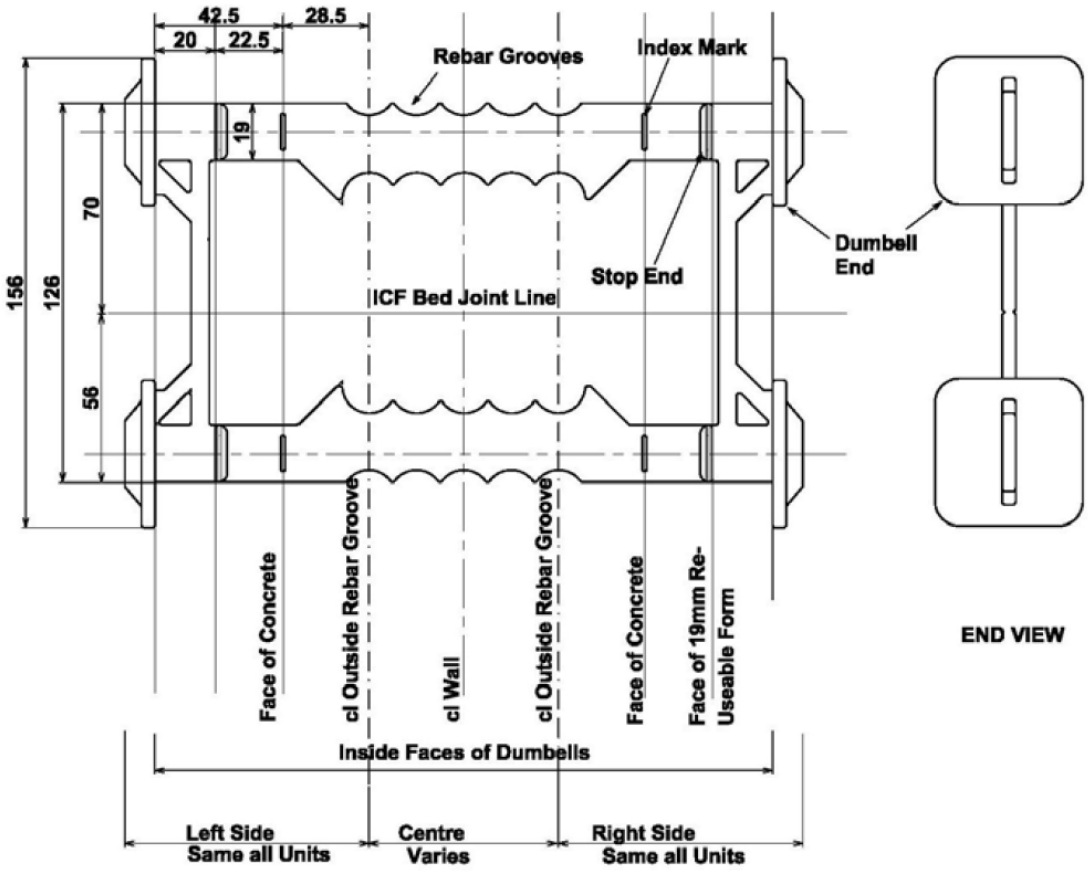


Figure 2 Assembly in Plan showing a "piggyback" installation - ZEGO® Manual Figure 2.8

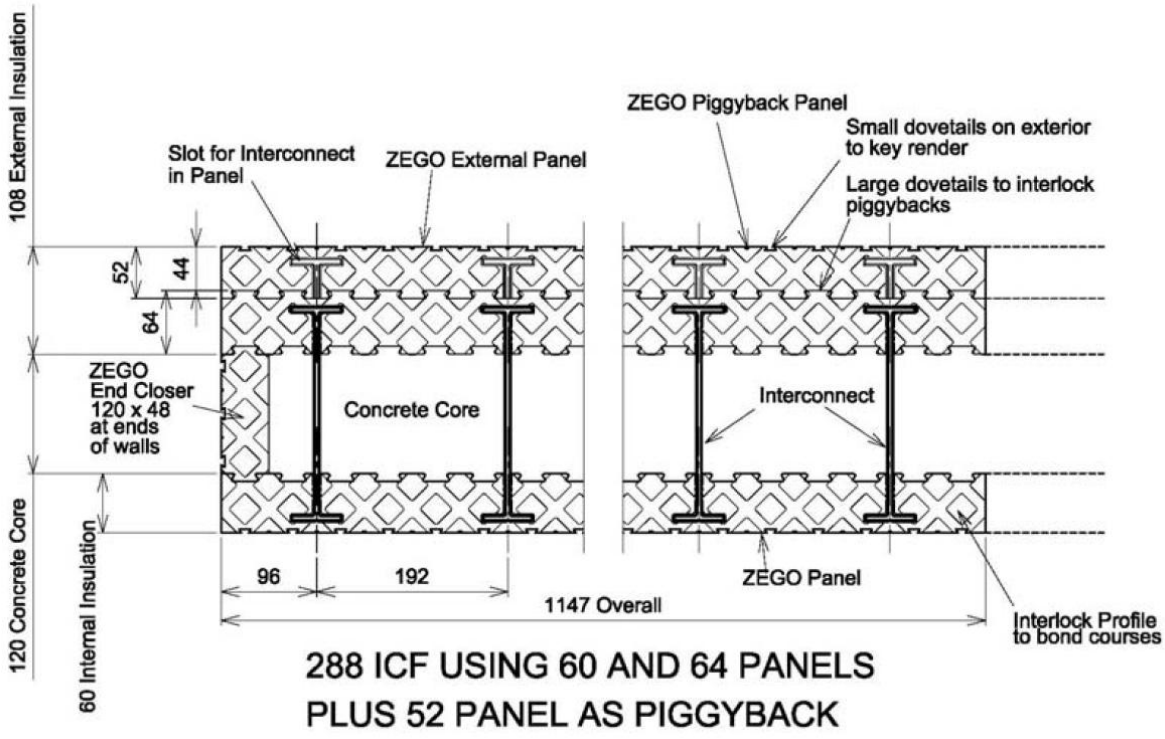


Figure 3 Assembly – Section
- ZEGO® Manual Figure 2.9

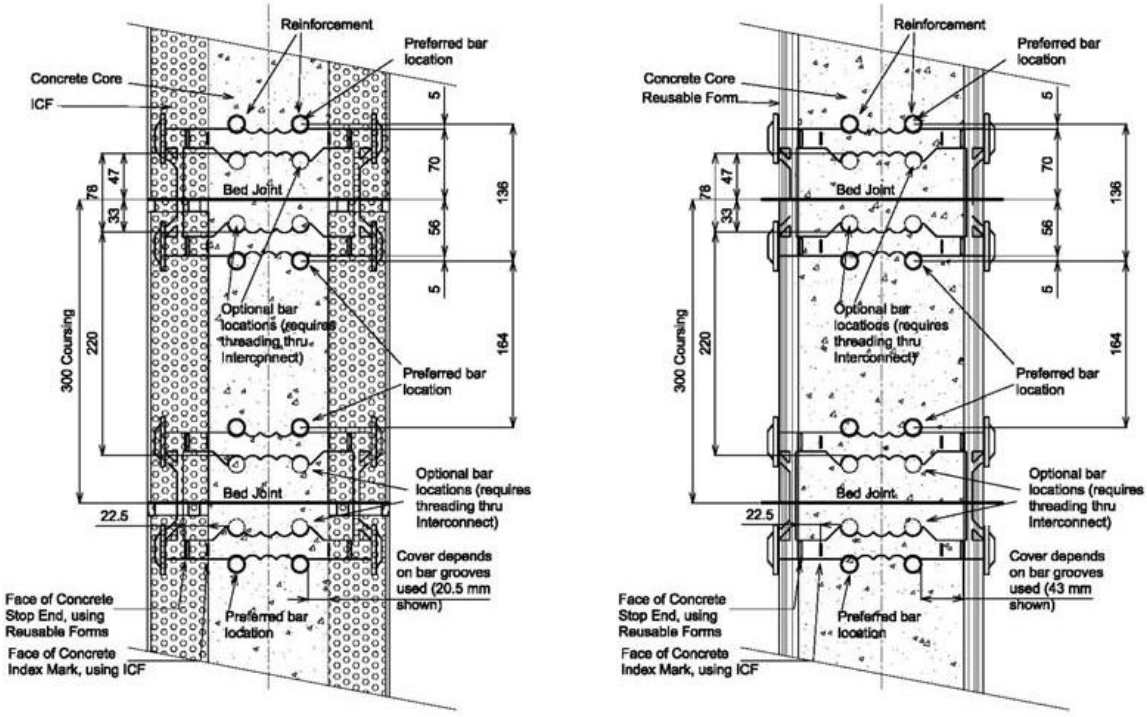
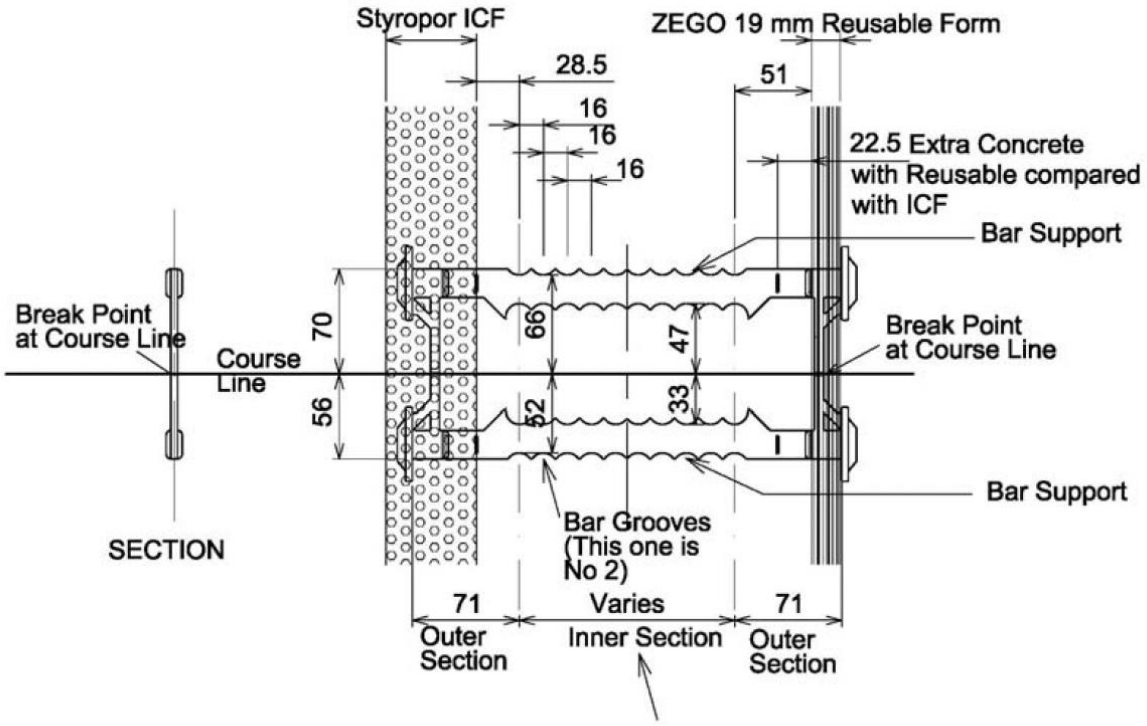


Figure 4 Interconnect terminology and Dimensions - ZEGO® Manual Figure 8.2



ANNEX B – LIABILITY AND INDEMNIFICATION:

BRANZ's agreement with its Client in relation to this report contains the following terms and conditions in relation to Liability and Indemnification

a. Limitation and Liability

i. BRANZ undertakes to exercise due care and skill in the performance of the Services and accepts liability to the Client only in cases of proven negligence.

ii. Nothing in this Agreement shall exclude or limit BRANZ's liability to a Client for death or personal injury or for fraud or any other matter resulting from BRANZ's negligence for which it would be illegal to exclude or limit its liability.

iii. BRANZ is neither an insurer nor a guarantor and disclaims all liability in such capacity. Clients seeking a guarantee against loss or damage should obtain appropriate insurance.

iv. Neither BRANZ nor any of its officers, employees, agents or subcontractors shall be liable to the Client nor any third party for any actions taken or not taken on the basis of any Output nor for any incorrect results arising from unclear, erroneous, incomplete, misleading or false information provided to BRANZ.

v. BRANZ shall not be liable for any delayed, partial or total non-performance of the Services arising directly or indirectly from any event outside BRANZ's control including failure by the Client to comply with any of its obligations hereunder.

vi. The liability of BRANZ in respect of any claim for loss, damage or expense of any nature and howsoever arising shall in no circumstances exceed a total aggregate sum equal to 10 times the amount of the fee paid in respect of the specific service which gives rise to such claim or NZD$50,000 (or its equivalent in local currency), whichever is the lesser.

vii. BRANZ shall have no liability for any indirect or consequential loss (including loss of profits).

viii. In the event of any claim the Client must give written notice to BRANZ within 30 days of discovery of the facts alleged to justify such claim and, in any case, BRANZ shall be discharged from all liability for all claims for loss, damage or expense unless legal proceedings are commenced in respect of the claim within one year from:

The date of performance by BRANZ of the service which gives rise to the claim;

or

The date when the service should have been completed in the event of any alleged non-performance.

b. Indemnification: The Client shall guarantee, hold harmless and indemnify BRANZ and its officers, employees, agents or subcontractors against all claims (actual or threatened) by any third party for loss, damage or expense of whatsoever nature including all legal expenses and related costs and howsoever arising relating to the performance, purported performance or non-performance, of any Services.

c. Without limiting clause b above, the Client shall guarantee, hold harmless and indemnify BRANZ and its officers, employees, agents or subcontractors against all claims (actual or threatened) by any party for loss, damage or expense of whatsoever nature including all legal expenses and related costs arising out of:

i. any failure by the Client to provide accurate and sufficient information to BRANZ to perform the Services;

ii. any misstatement or misrepresentation of the Outputs, including Public Outputs;

iii. any defects in the Products the subject of the Services; or

iv. any changes, modifications or alterations to the Products the subject of the Services.