

### INTRODUCTION

AFS-CSR Permanent Form Wall Systems provide a structure that is competitive against other current building systems. Typical uses are in Residential, Motel, Accommodation and Health Care developments. The significant project cost and time savings have been shown in many project comparisons. Permanent Form Walls provide many of the structural advantages of traditional Load Bearing Walls without the high cost and labour of traditional walls.

Load Bearing Walls allow thin slabs less than 200mm thick to be achieved for both Reinforced Concrete and Post Tensioned Slabs. Minimum slab thickness is determined by Structural Code provisions, Acoustic requirements and the serviceability requirements as defined by the client or relevant authorities. Below we discuss how code compliance and client requirements are achieved with thin slabs less than 200 mm thick bearing on walls.

### STRUCTURAL MINIMUM THICKNESS

The minimum thickness of structural slabs is governed by strength, various project serviceability requirements and the National Construction Code (NCC) Fire Resistance Levels (FRL's).

AS3600-2009 Concrete Structures Code Section 5.5.5 Fire Resistance Periods (FRP) For Slabs defines the minimum thickness for Solid Slabs supported on Walls or Beams in Table 5.5.1 FRP for Insulation for a typical Residential FRP of 90 minutes as 100mm. Table 5.5.2(A) for Solid Slabs supported on Walls or Beams does not define a minimum slab thickness and Table 5.5.1 minimum will govern. Minimum thickness for other slabs types is given in Tables 5.5.2(B) & (C). AS3600 therefore only restricts minimum slab depths to 200mm for FRL 90/90/90 for slabs supported on columns.

Practically a 150mm minimum thickness may be more appropriate due to practical detailing considerations and typical spans in multi story residential projects supported on walls.

FRL (Adequacy/Integrity/Insulation) minutes	Minimum Slab Thickness Refer AS3600 Table 5.5.1, 5.5.2 (A)	
	Column Frame	L/B Walls
90/90/90	180 mm	100 mm
120/120/120	200 mm	120 mm
180/180/180	200 mm	150 mm

### ACOUSTIC MINIMUM THICKNESS

Acoustic Logic and PKA Acoustic Consulting have provided reviews confirming the acoustic compliance of thin slabs from 150 to 200mm thick are similar, refer attached. The NCC (BCA) Part F5 Sound Transmission and Insulation shows both 150 and 200 thick slabs are contained within the Deemed to Satisfy provisions for acceptable forms of construction for walls providing  $R_w + C_{tr} > 50$  with respect to airborne sound. Where Impact Ratings are required for  $L_{n,w} + C_I < 62$  the detailing requirements are similar for 150 through to 200mm thick slabs.

For NCC Class 2, 3 and 9c (Residential, Motel, Accommodation and Health Care) buildings the detailing and costs for Acoustic Compliance are similar for 150 through to 200mm thick slabs.

Slab Thickness	Air borne sound	Impact Rating
200 mm	NCC F5 Deemed to Satisfy	Refer NCC for deemed to satisfy or Acoustic Consultant
150 mm	NCC F5 Deemed to Satisfy	As for 200 thick slab

### ONE WAY SLABS

Slabs supported by Walls will have the majority of slabs spanning in one direction between adjacent walls. This reduces reinforcement requirement in the secondary direction to minimum AS3600 requirements for crack control and secondary distribution. Slab profiles, reinforcement detailing and placement are simplified as shear concentrations at columns are eliminated. For both Reinforced and Post Tensioned Slabs the secondary direction can be satisfied with reduced PT or light reinforcement.

### CONCLUSION

AFS-CSR Permanent Form Walls allow competitive structures with thinner slabs and one way spans with significant concrete and reinforcement savings.

## REFERENCES

AS3600-2009 Concrete Structures Code, Standards Australia.  
NCC 2015 National Construction Code (BCA) 2014, ABCB 2015

## DEFINITIONS

Permanent Form	Prefabricated formwork that remains in place forming a permanent surface ready for finishing.
AFS LOGICWALL <sup>®</sup>	Permanent Form Wall with FC sheet forms
AFS REDIWALL <sup>®</sup>	Permanent Form Wall with PVC forms
FRL 90/90/90	Fire Resistance Level expressed as Fire Resistance Period (FRP) for Structural Adequacy, Integrity and Insulation
$R_w + C_{tr}$	Weighted Sound Reduction Index + adjustment factor which is used to account for low frequency noise
$L_{n,w} + C_i$	Weighted standardised impact sound pressure with spectrum adaption term
Thin Slab	Slab less than 200 thick

## APPENDIX

## AS3600 Section 5.5 FIRE RESISTANCE PERIODS (FRPs) FOR SLABS

TABLE 5.5.1

FIRE RESISTANCE PERIODS (FRPs) FOR INSULATION FOR SLABS

FRP for insulation min	Effective thickness mm
30	60
60	80
90	100
120	120
180	150
240	175

TABLE 5.5.2(A)

FIRE RESISTANCE PERIODS (FRPs) FOR STRUCTURAL ADEQUACY FOR SOLID AND HOLLOW-CORE SLABS SUPPORTED ON BEAMS OR WALLS AND FOR ONE-WAY RIBBED SLABS

FRP for structural adequacy (min)	Axis distance ( $a_s$ ) to lowest layer of reinforcement (mm)			
	Simply supported slabs			Continuous slabs (one-way and two-way)
	One-way	Two-way		
		$l_y/l_x \leq 1.5$	$1.5 < l_y/l_x \leq 2$	
30	10	10	10	10
60	20	10	15	10
90	30	15	20	15
120	40	20	25	20
180	55	30	40	30
240	65	40	50	40

TABLE 5.5.2(B)

FIRE RESISTANCE PERIODS (FRPs) FOR STRUCTURAL ADEQUACY FOR FLAT SLABS INCLUDING FLAT PLATES

FRP for structural adequacy (min)	Minimum dimensions (mm)	
	Slab thickness	Axis distance ( $a_s$ )
30	150	10
60	180	15
90	200	25
120	200	35
180	200	45
240	200	50

TABLE 5.5.2(C)

FIRE RESISTANCE PERIODS (FRPs) FOR STRUCTURAL ADEQUACY FOR TWO-WAY SIMPLY SUPPORTED RIBBED SLABS

FRP for structural adequacy (min)	Minimum dimensions (mm)						Flange thickness ( $h_s$ ) and axis distance ( $a_s$ ) in flange	
	Possible combinations of axis distance ( $a_s$ ) and width of ribs ( $b$ )							
	Combination 1		Combination 2		Combination 3		$a_s$	$h_s$
	$a_s$	$b$	$a_s$	$b$	$a_s$	$b$		
30	15	80	—	—	—	—	10	80
60	35	100	25	120	15	$\geq 200$	10	80
90	45	120	40	160	30	$\geq 250$	15	100
120	60	160	55	190	40	$\geq 300$	20	120
180	75	220	70	260	60	$\geq 410$	30	150
240	90	280	75	350	70	$\geq 500$	40	175

Stephen Nash BEng (Hons) MIEAust, AFS Development Engineer.

November 2015

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Ref: 215 033 L01

1 July 2015

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Dear Adnan

Re: 150mm cast in-situ concrete floor compliance with Part F5 Sound Transmission and Insulation of the National Construction Code

In Part F5 Sound Transmission and Insulation a 150mm concrete panel is contained within the Deemed-To Satisfy Provisions in Table 2 – Acceptable Forms of Construction for Walls as providing  $R_w + C_{tr} > 50$ .

The acoustic performance of 150mm concrete floor having  $R_w + C_{tr} > 50$  is confirmed on the following basis;

- a) The already acceptable 150mm concrete panel wall has a mass per square metre of 360 kgs. The 150mm concrete floor has the same mass of 360 kgs per square metre and as it is a simple homogenous construction it will therefore have the same acoustic performance as the complying 150mm concrete panel wall.
- b) On site testing of 150mm – 170 mm concrete floors show that they easily comply with the verification methods FV5.1 (a) of  $D_{ntw} + C_{tr}$  not less than 45. The general value is  $D_{ntw} + C_{tr}$  of 47 to 48. We have no instance where a 150 mm concrete floor did not comply with FV5.1(a).

On the basis of the above information it is my opinion that 150mm concrete floor, when properly installed without unprotected services, ducts or holes will comply with the intent of Part 5.4 Sound Insulation of Floors in respect to airborne sound insulation.

Yours faithfully



**Peter Knowland**

Principal

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18/08/2015

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**ATTN: ADNAN MALIK**

### 150mm Thick Concrete Floor Slabs - Acoustic Review

This letter confirms that the acoustic requirements for Class 2, 3 and 9c buildings (which includes all buildings with acoustic requirements within the BCA) can be achieved using a minimum 150mm thick concrete floor slabs and thicker.

The resulting separation between floors will achieve the BCA requirement of  $R_w + C_{tr} 50$  as required for the class of building including residential, hotels, serviced apartments and age care facilities using standard methods of construction.

Additionally the required impact ratings for the floor to comply with the BCA ( $L_{ntw} + c1 < 62$ ) and typical project requirements (IIC 50-55) can be achieved using standard constructions as detailed in the details attached.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

A handwritten signature in black ink that reads "B.G. White".

Acoustic Logic Consultancy Pty Ltd  
Ben White

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