Project:

Verification of Floor Panel PSG-3

JOIST PANEL

Safety Factor.: K1 = 1.6 (Live Loads)

K2 = 1.5 (Dead Loads)

K3 = 1.15 (Steel)

K4 = 1.5 (Concrete)

σe = 75000 PSI

Loads on Floor Panel:

			Factored Loads	
Weight of finish layer on top =	10	lb/ft^2	15	lb/ft^2
Live Load =	40	lb/ft^2	64	lb/ft^2
Dead Load =	50	lb/ft^2	75	lb/ft^2

L.L 245 kg/m2 7.92M

829.71215 kg/m2

Position	N°	Type of Panel	C.compr. (in.)	ℓ (ft)	q (lb/ft^2)	M lb ft	fl.max. in	fl.adm. in	Mcal lb ft	Fe in^2	Re-Bar (N°)	Quantity per Joist
	1	PSG 3/80	2	12	154	2772	0.54	0.58	3696	0.1405	3	2
	2	PSG 3/100	2	14	154	3773	0.65	0.67	5031	0.1659	3	2
	3	PSG 3/120	2	16	154	4928	0.76	0.77	6571	0.1913	3	2
	5	PSG 3/150	2	18	154	6237	0.75	0.83	8316	0.2059	3	2
	6	PSG 3/160	2	19	154	6949	0.81	0.86	9266	0.2185	3	2
	7	PSG 3/180	2	20	154	7700	0.76	0.88	10267	0.2212	4	2
	8	PSG 3/200	2	22	154	9317	0.86	0.93	12423	0.2463	4	2
	9	PSG 3/220	2	24	154	10631	0.89	0.96	14174	0.2602	4	2
	10	PSG 3/240	2.5	26	154	13013	0.95	1.02	17351	0.2842	4	2

Armadura Principal			
Cant.	Diam.	cm^2 / m	
20	3.0	1.26	1.26
0	5.0	0.00	

Armadura Secundaria			
Cant.	Diam.	cm^2 / m	
20	2.5	0.87	0.87
0	5.0	0.00	

VERIFICATION WITH SIMPLE DEFLEXION, RECTANGULAR SECTION DOUBLE REINFORCEM

given	n	15	homologation coefficient	
given	As (cm2)	2.26	surface of iron under tension	2ø12
given	A's (cm2)	0	surface of iron under compression	
calculation	gamma	**0.00**	A's/As	
given	B (cm)	61	width of compressed section	
given	H (cm)	25	height of section	
calculation	h (cm)	**23**	usable height (H-abutment layer)	
given	delta (cm)	2	abutment layer	
given	slab (cm)	5		
calculation	Xc (cm)	**4.53**	(Xc must be < h of slab)	
given	L (m)	5		
given	W (dN/m2)	650		
calculation	on centre (cm)	61		
given	fraction divisor ir	10		
calculation	M (kgcm)	99125	straining moment	
calculation	Ji (cm4)	**13464.82**	moment of inertia of section	
sigma c	(kg/cmq)	**33.37**	max stress of compressed concrete	
sigma f	(kg/cmq)	**2039.30**	max stress on iron under tension	

VERIFICATION WITH SIMPLE FLEXION, RECTANGULAR SECTION DOUBLE REINFORCEMEN

given	n	15	homologation coefficient	
given	As (cmq)	1.13	surface of iron under tension	1ø12
calculation	A's (cmq)	0	surface of iron under compression	
calculation	gamma	**0.00**	A's/As	
given	b (cm)	10	width of compressed section	
calculation	H (cm)	25	height of section	
calculation	h (cm)	**23**	usable height (H-abutment layer)	
given	delta (cm)	2	abutment layer	
calculation	Xc (cm)	**7.30**		
given	fraction divisor ir	16		
calculation	M (kgcm)	61953.13	moment of stress at beam edge	
calculation	Ji (cm4)	**5478.33**	moment of inertia of section	
calculation **sigma c**	(kg/cmq)	**82.54**	max tension of compressed concrete	
calculation **sigma f**	(kg/cmq)	**2663.41**	max tension on iron under tension	

VERIFICATION OF SHEAR

calculation	Tmax =	991.25	daN
calculation	τ max =	4.41	daN/cmq

n irons	ø (mm)		A (cm2)
2		12	2.261947
1		12	1.130973
	Atot		3.39292

Azione distribuita
dovuta al vento
(solo dati in neretto)

$p = q_{ref} \cdot c_e \cdot c_p \cdot c_d$

$q_{ref} = v^2_{ref} / 1{,}6$

$v_{ref} = v_{ref,0}$ per $a_s \leq a_0$

$v_{ref} = v_{ref,0} + k_a \cdot (a_s - a_0)$ per $a_s > a_0$

	zona (Tab 7,1)	**9**
	Vref,o (m/s) =	**31**
	ao (m) =	**500**
	Ka (1/s) =	**0.03**
altezza sul mare del sito dove sorge la costruzione	as (m) =	**600**
	V ref (m/s) =	34

$c_e(z) = k^2_r \cdot c_t \cdot \ln(z / z_0) \cdot [7 + c_t \cdot \ln(z / z_0)]$

per $z \geq z_{min}$

$c_e(z) = c_e(z_{min})$ per $z < z_{min}$

classe rugosità (tab 7.3)		**D**
categ. esposizione (fig. 7.2)		**I**
cat. Esposiz. sito (tab 7.2)	Kr =	**0.17**
	Zo (m) =	**0.01**
	Zmin (m) =	**2**
Salvo casi particolari da valutare secondo C.7.5 si assume Ct=1		
coeff. Topog.	Ct =	**1**
altezza cost.	Z (m)=	**10**
	q ref (N/m2) =	722.5

Ce (zmin) =	1.88314
Ce (z) =	2.77646
Cp =	**1.2**
Cd =	**1**
P (N/m2) =	2407.19

FORMULE PER IL CALCOLO DELLA CAPACITA' PORTANTE

Terzaghi $$q_{ult} = cN_c s_c + \bar{q} N_q + 0{,}5\gamma B N_\gamma s_\gamma$$

VERIFICA qamm (assenza di falda)

D < B

			Nastrifor.	circolari	quadrate
dato	Sc	1	1	1.3	1.3
dato	Sg	1	1	0.6	0.8

a) verifica in tensioni totali

dato	cu (kPa)	100	1 kPa = 0,01 Kg/cmq
dato	fi (grad)	25	
fisso	Nc=Nc(fi)	5.7	(1 Kg/cmq = 100 kPa)
dato	D dal p.c.(m)	1.8	
dato	gamma (kN/mc)	19	1 kN/mc = 0,1 t/mc
			(1 t/mc = 10 kN/mc)

* * * q' = g x h 34.2 kN/mq

Qlim = cu x Nc x sc + q

* * * Qlim = 604.2 kN/mq

dato F.S. 3

Qamm = Qlim/FS

* * * Qamm = 201.4 kN/mq

b) verifica in tensioni efficaci

dato	c' (kPa)	14.4	
dato	B (m)	0.85	(B < 2 m)
dato	fi (grad)	25	
dato	Nc=Nc(fi)	25.1	
dato	Ng=Ng(fi)	12.7	
dato	Nq=Nq(fi)	9.7	

Qlim = c' x Nc x Sc + 0,5 x gamma' x B x Ng x Sg + q' x Nq

* * * Qlim = 795.7325 kN/mq

dato F.S. 3

Qamm = Qlim/FS

* * * Qamm = 265.2442 kN/mq

FORMULE PER IL CALCOLO DELLA CAPACITA' PORTANTE

Meyerhof $q_{ult} = cN_c s_c d_c + \bar{q} N_q s_q d_q + 0{,}5\gamma B N_\gamma s_\gamma d_\gamma$ car. verticale

VERIFICA qamm (assenza di falda-carico verticale)

a) verifica in tensioni totali

fi = 0 Sg = Sq = dq = dg = Kp = 1

dato	cu (kPa)	100		1 kPa = 0,01 Kg/cmq
dato	fi (grad)	0		(1 Kg/cmq = 100 kPa)
dato	B (m)	0.85		
dato	L (m)	3		
fisso	D dal p.c.(m)	1.8		
calcolo	Sc	1.057		
calcolo	dc	1.212		
fisso	Nc=Nc(fi)	5.14		
fisso	Nq=Nq(fi)	1		
fisso	Ng=Ng(fi)	0		
dato	gamma (kN/mc)	19		1 kN/mc = 0,1 t/mc
				(1 t/mc = 10 kN/mc)

* * * q' = g x h 34.2 kN/mq

Qlim = C x Nc x Sc x Dc + q

* * * Qlim = 692.3417 kN/mq

dato F.S. 3

Qamm = Qlim/FS

* * * Qamm = 230.7806 kN/mq

b) verifica in tensioni efficaci

fi > 10°

dato	c (kPa)	14.4		1 kPa = 0,01 Kg/cmq
dato	fi (grad)	25	0.436332	(1 Kg/cmq = 100 kPa)
dato	B (m)	0.85		
dato	L (m)	3		
dato	D dal p.c.(m)	1.8		
calcolo	Kp	2.464		
calcolo	Sc	1.140		
calcolo	Sq = Sg	1.070		
calcolo	Dc	1.665		
calcolo	Dq = Dg	1.332		
dato	Nc=Nc(fi)	20.71		
dato	Nq=Nq(fi)	10.7		
dato	Ng=Ng(fi)	6.8		
dato	gamma (kN/mc)	19		1 kN/mc = 0,1 t/mc
				(1 t/mc = 10 kN/mc)

* * * q' = g x h 34.2 kN/mq

Qlim = c' x Nc x Sc x Dc + 0,5 x gamma' x B x Ng x Sg x Dg + q' x Nq x Sq x Dq

* * * Qlim = 1165.694 kN/mq

dato F.S. 3

Qamm = Qlim/FS

* * * Qamm = 388.5647 kN/mq

FORMULE PER IL CALCOLO DELLA CAPACITA' PORTANTE

$q_{ult} = cN_c s_c d_c h + \bar{q} N_q s_q d_q h + 0{,}5\gamma B N_\gamma s_\gamma d_\gamma h$

Hansen $$q_{ult} = cN_c s_c d_c b_c + q N_q s_q d_q b_q + 0{,}5\gamma B N_\gamma s_\gamma d_\gamma b_\gamma$$ car. verticale / car. centrato

VERIFICA qamm (assenza di falda-carico verticale-terreno orizzontale)

a) verifica in tensioni totali

fi = 0 Sg = Sq = dq = dg = Kp = 1

fisso	cu (kPa)	0		1 kPa = 0,01 Kg/cmq
fisso	fi (grad)	0		(1 Kg/cmq = 100 kPa)
dato	B (m)	0.85		
dato	L (m)	3		
dato	D dal p.c.(m)	1.8	N.B.: D diverso da B	
calcolo	S'c	0.057		
calcolo	k	-0.609		
calcolo	D'c	-0.244		
fisso	Nc=Nc(fi)	5.14		
dato	gamma (kN/mc)	19		1 kN/mc = 0,1 t/mc
				(1 t/mc = 10 kN/mc)

* * * q' = g x h 34.2 kN/mq

Qlim = C x Nc x (1 + S'c x D'c) + q

* * * Qlim = 34.2 kN/mq

dato F.S. 3

Qamm = Qlim/FS

* * * Qamm = 11.4 kN/mq

b) verifica in tensioni efficaci

dato	c (kPa)	100		1 kPa = 0,01 Kg/cmq
dato	fi (grad)	25	0.436332	(1 Kg/cmq = 100 kPa)
dato	B (m)	0.85		
dato	L (m)	3		
dato	D dal p.c.(m)	1.8		
calcolo	Sc	1.21130894		
calcolo	Sq	1.1321205		
calcolo	Sg	0.88666667		
calcolo	Dc	0.75648781		
fisso	Dg	1		
calcolo	Dq	0.6721869		
dato	Nc=Nc(fi)	50.55		
dato	Nq=Nq(fi)	37.7		
calcolo	Ng=Ng(Nq)	25.6702366		
dato	gamma (kN/mc)	19		1 kN/mc = 0,1 t/mc
				(1 t/mc = 10 kN/mc)

* * * q' = g x h 34.2 kN/mq

Qlim = c'xNcxScxDc + 0,5xgamma'xBxNgxSgxDg + q'xNqxSqxDq

* * * Qlim = 5797.079 kN/mq

dato F.S. 3

Qamm = Qlim/FS

* * * Qamm = 1932.36 kN/mq

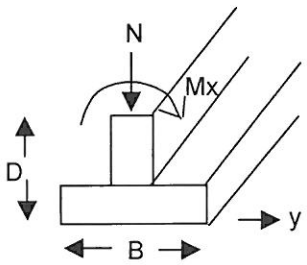
FORMULE PER IL CALCOLO DELLA CAPACITA' PORTANTE

Hansen $$q_{ult} = cN_c s_c d_c b_c + \bar{q} N_q s_q d_q b_q + 0{,}5\gamma B N_\gamma s_\gamma d_\gamma b_\gamma$$ car. verticale

car. eccentrico

car. eccentrico

VERIFICA qamm (assenza di falda-carico verticale-terreno orizzontale)



a) verifica in tensioni totali

fi = 0 Sg = Sq = dq = dg = Kp = 1

dato	Mx (kNm)	10.34			
dato	My (kNm)	0.01			
dato	P min (kN)	70			
calcolo	ex (My/P)	0.000	* * *	ex/B =	0.000143
calcolo	ey (Mx/P)	0.148	* * *	ey/L =	0.147714
dato	cu (kPa)	100			1 kPa = 0,01 Kg/cmq
fisso	fi (grad)	25			(1 Kg/cmq = 100 kPa)
dato	B (m)	1	* * *	B' (m) =	0.704571
dato	L (m)	1	* * *	L' (m) =	0.999714
dato	D dal p.c.(m)	1.8	N.B.: D diverso da B		
calcolo	S'c	0.141			
calcolo	k	-0.233			
calcolo	D'c	-0.093			
fisso	Nc=Nc(fi)	5.14			
dato	gamma (kN/mc)	19			1 kN/mc = 0,1 t/mc
					(1 t/mc = 10 kN/mc)

* * * q' = g x h 34.2 kN/mq

Qlim = C x Nc x (1 + S'c x D'c) + q

* * * Qlim = 541.4388 kN/mq

dato F.S. 3

Qamm = Qlim/FS

* * * Qamm = 180.4796 kN/mq

b) verifica in tensioni efficaci

dato	c (kPa)	10		1 kPa = 0,01 Kg/cmq
dato	fi (grad)	25	0.436332 rad	(1 Kg/cmq = 100 kPa)
fisso	B (m)	1		
fisso	L (m)	1		
fisso	D dal p.c.(m)	1.8		
calcolo	Sc (corretto)	1.364		
calcolo	Sq (corretto)	1.329		
calcolo	Sg	0.718		
calcolo	Dc	0.907		
fisso	Dg	1		
calcolo	Dq	0.874		
dato	Nc=Nc(fi)	20.71		
dato	Nq=Nq(fi)	10.7		
calcolo	Ng=Ng(Nq)	6.785		
fisso	gamma (kN/mc)	19		1 kN/mc = 0,1 t/mc
				(1 t/mc = 10 kN/mc)

* * * q' = g x h 34.2 kN/mq

Qlim = c'xNcxScxDc + 0,5xgamma'xBxNgxSgxDg + q'xNqxSqxDq

* * * Qlim = 727.5533 kN/mq

dato	F.S.		3				
			Qamm = Qlim/FS				
		* * *	Qamm =	242.5178	kN/mq		
		* * *	Pamm =	170.8223	kN/mq	<---------->	70 P (dato)
		* * *	q equiv. =	99.37957	kN/mq	<---------->	500 valore limite consigliabile

Verifica tensioni sul terreno

dato	Nmax (kN)	70			
calcolo	area (mq)	1			
calcolo	sigma media (kN/mq)	70		(Hp carico con eccentricità nulla)	
calcolo	M max (kNm)	10.34			
calcolo	N min (kN)	70			
calcolo	e max = M/N (m)	0.147714			
calcolo	raggio nocciolo = B/6 (m)	0.166667	* <--> *	B/6 >e ?	
				si --->a; no --->b	
	a (sezione int. reag.)			b (sez. parzializzata)	
calcolo	sigma1(kN/mq)	132.04		d' = (L/2-e)x3 (m)	1.056857
calcolo	sigma2 (kN/mq)	7.96		max sigma (kN/mq)	132.4682

calcolo	e min = M/N (m)	0.147714			
calcolo	raggio nocciolo = B/6 (m)	0.166667	* <--> *	B/6 >e ?	
				si --->a; no --->b	
	a (sezione int. reag.)			b (sez. parzializzata)	
calcolo	sigma1(kN/mq)	132.04		d' = (L/2-e)x3 (m)	1.056857
calcolo	sigma2 (kN/mq)	7.96		max sigma (kN/mq)	132.4682

Reazione del terreno con Qlim	170.8223	kN/m
Carichi uniformemente distribuiti	70	kN/m
	100.8223	

Bord Agrément na hÉireann
Irish Agrément Board

CERTIFICATE NO. 06/0241
Emmedue M2,
Botley Lane, Portarlington, Co. Offaly.

Tel: 0502 45000
Fax: 0502 45054
Web: www.m2ireland.com
E-mail: info@m2treland.com

Emmedue M2 Building System

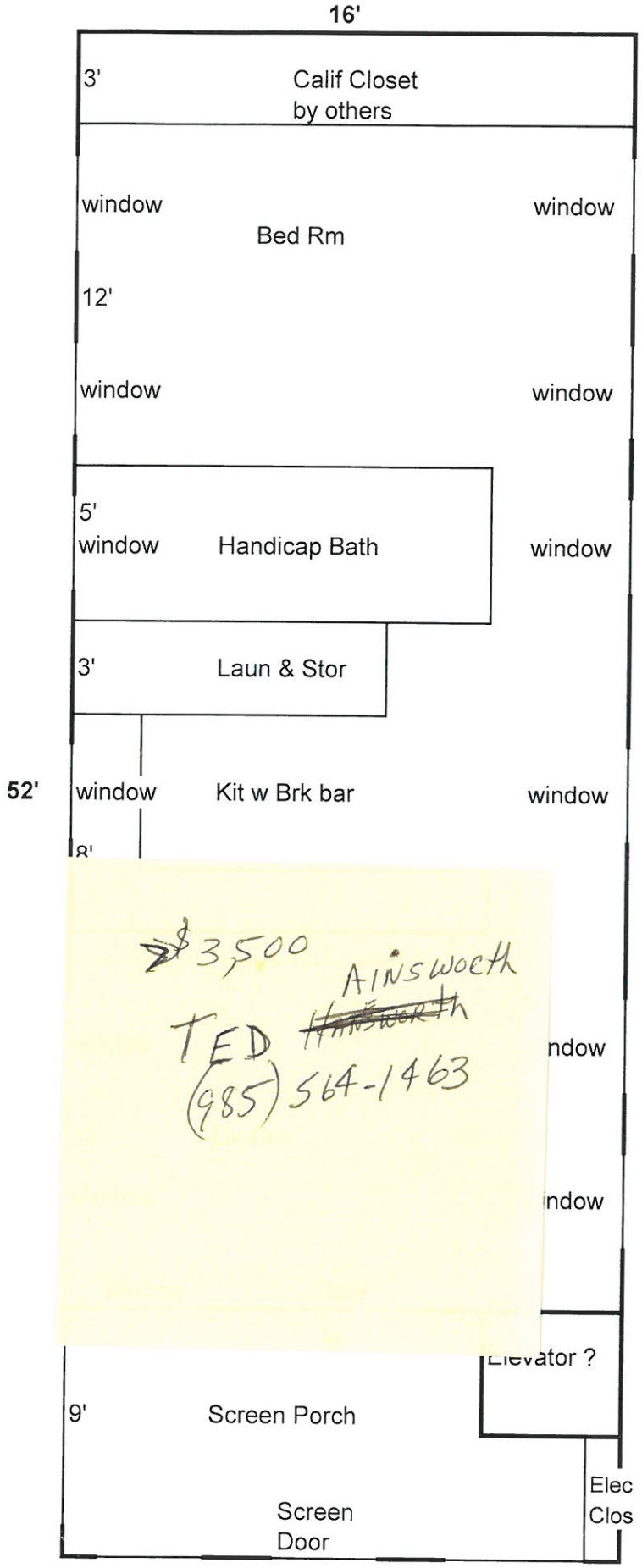
Système de mur
Wandsystem

The **Irish Agrément Board** is designated by Government to issue European Technical Approvals.

Irish Agrément Board Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2002**.

The **Irish Agrément Board** operates in association with the **National Standards Authority of Ireland (NSAI)** as the National Member of UEAtc.

PRODUCT DESCRIPTION:
The Emmedue M2 Building System consists of two types of wall panels. The first type is the single panel which consists of a polystyrene core with prefabricated zinc coated steel wire mesh reinforcement. Following erection on site it is encased in sprayed concrete. The second type of panel is the double panel which is a polystyrene permanent shutter for an insitu poured structural concrete core. Sprayed concrete also encases the polystyrene in the double panel. The single and double wall panels have zinc coated steel wire mesh reinforcement on each face. This consists of 2.5mm diameter reinforcement at 65mm centres. There are steel ties (82 per square metre) connecting the front and the back meshes through the polystyrene. These ties, which are also zinc coated, are 3mm in diameter. It should be noted that the surface of the polystyrene is corrugated. The depth of corrugation is 10mm and the length is 70mm. The sprayed concrete has a minimum thickness of 35mm and a characteristic 28 days cube strength of 25MPa. It is fibre reinforced with polypropylene fibres to control shrinkage. Externally the sprayed concrete is finished as a scratch coat to give a key for an approved render.



$3,500

AINSWORTH

TED ~~HAINSWORTH~~

(985) 564-1463

Steel exterior doors
w/ 3 Hinges

Handicap accessible

Walk-in shower w/o threshhold

Wall mount toilet

Ball valves on all water lines

Receptacles 30" to bottom of box

Cold weather water taps on exterior

Stairs 60" wide w/ handrail on both sides

Vaulted ceiling in Bedroom, Living room & hall

Eight foot ceiling in kitchen, laundry and bath

Hurricane screening by others

Hurricane windows by others

Solar water heater by others

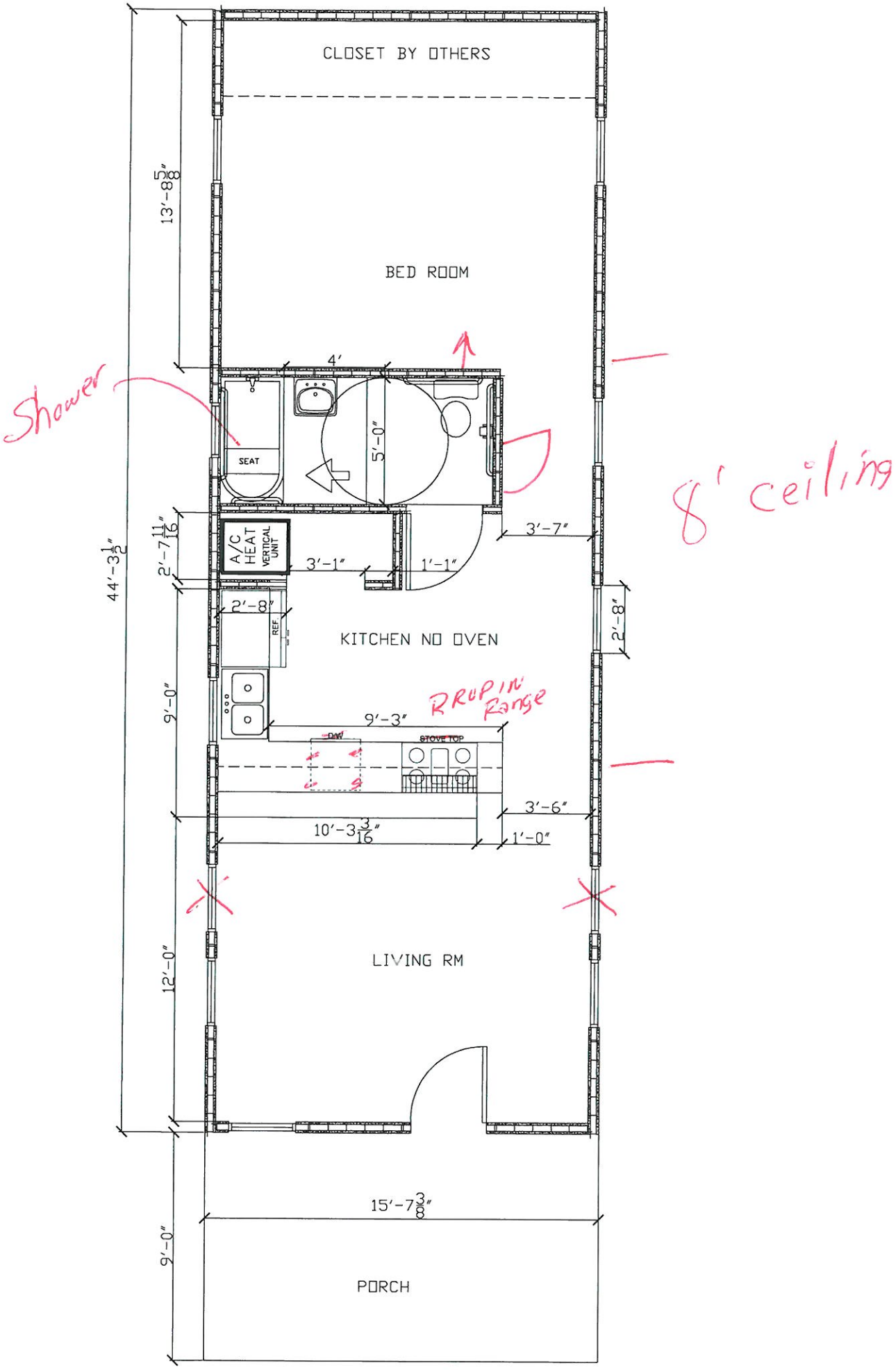
Personal elevator by others

A/C by others

Fans in bedroom and living room by others

All dimensions are subject to change as required

Garage will begin behind the porch - @ 43'


CLOSET BY OTHERS
BED ROOM
13'-8 5/8"
4'
5'-0"
SEAT
Shower
8' ceiling
A/C HEAT VERTICAL UNIT
2'-7 11/16"
3'-1"
1'-1"
3'-7"
44'-3 1/2"
2'-8"
REF.
KITCHEN NO OVEN
2'-8"
9'-0"
RRUPIN Range
9'-3"
DW
STOVE TOP
3'-6"
10'-3 3/16"
1'-0"
12'-0"
LIVING RM
15'-7 3/8"
9'-0"
PORCH

ɔn of Floor Panel (Single)

Coef. May.:	K1 = 1.6	(Live Load)
	K2 = 1.5	(Dead Load)
	K3 = 1.15	(Rebar)
	K4 = 1.5	(Concrete)

*If there is snow there will be an additional load of 80-100 kg/m²

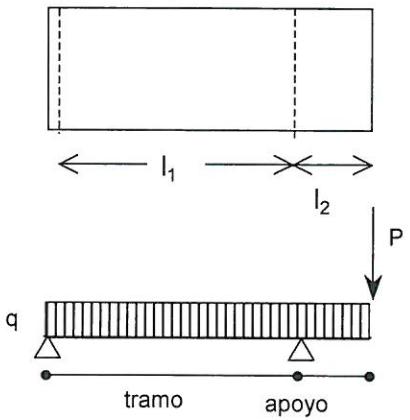
Loads on Floor:

		Factored Loads
Finish =	100 Kg/m²	150 Kg/m²
Live Load =	300 Kg/m²	480 Kg/m²
Dead Load =	200 Kg/m²	300 Kg/m²

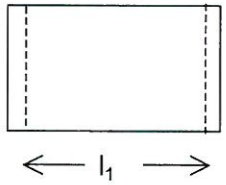
Loads on Roof :

		Factored Loads
Snow =	Kg/m²	Kg/m²
Finish =	100 Kg/m²	150 Kg/m²
Live Load =	100 Kg/m²	160 Kg/m²
Dead Load =	206 Kg/m²	309 Kg/m²

Tipo de apoyo 1



Tipo de apoyo 2



*Any instance w/ counterlevers an additional load of 100 kg/m is added @ P.

	Cant.	Diam.	cm² / m	
Armadura considerada	20	3.0	1.26	1.26
		5.0		

	Nº	Tipo de apoyo	Tipo de Panel	C.compr. (cm)	ℓ_1	ℓ_2	q (Kg/m²)	P Kg/m	M_{tramo} Kgm	M_{apoyo} Kgm	fl.max. mm	fl.adm. mm	M_{tramo} Tnm	Fe_{tramo} cm²	Ø (mm)	$Arm._{tramo}$	$Mcal_{apoyo}$ Tn	Fe_{apoyo} cm²	Ø (mm)	$Arm._{apoyo}$
	1	1	PSM140	5.6	4.28	1.48	930	100	1584	1159	18.2	17.1	1.58	0.61	6	Ø6 c/0.47m	1.16	0.11	6	Ø6 c/2.64m (*)
	2	1	PSM170	5.6	4.98	0.75	930	100	2713	333	22.3	19.9	2.71	1.53	6	Ø6 c/0.18m	0.33	s/ref.	6	
er	3	voladizo	PSM170	5.6		1.98	930	100		2011	0.6	7.9		s/ref.	6		2.01	0.81	6	Ø6 c/0.35m (*)
	4	2	PSM140	5.6	3.60		930		1507		9.2	14.4	1.51	0.52	9	Ø9 c/1.23m		s/ref.	6	
	5	2	PSM150	5.6	2.65		930		816		2.3	10.6	0.82	s/ref.	6			s/ref.	6	
	6	1	PSM150	5.6	4.18	0.30	619	100	1323	58	9.6	16.7	1.32	0.23	6	Ø6 c/1.24m	0.06	s/ref.	6	
	7	2	PSM150	5.6	1.70		619		224		0.3	6.8	0.22	s/ref.	6			s/ref.	6	
	8	1	PSM150	5.6	3.68	0.30	619	100	1019	58	5.8	14.7	1.02	s/ref.	6		0.06	s/ref.	6	

(*) en el cordón superior

Advanced Building System

Specification of the materials to complete EMMEDUE panels

EMMEDUE single panels used as load-bearing walls are completed on site by shooting on both sides structural cement-based plaster with a thickness of about 3 cm. (1" 1/5 approx.).
The panels thus obtained will become reinforced concrete elements with an expanded polystyrene (EPS) core.
This structural plaster should have a granulometry between 0 and 7 mm. and, once aged, have a resistance of 200 dN/cm^2. at least.

Indicatively, for each cubic metre of mortar, the dosage specified in weight for each of the materials in the mixture should be as follows:

Cement	**:**	**300 Kg. (6 bags)**
Sand	**:**	**1,350 Kg.**
Water	**:**	**130 litres**

The quantity of water depends on the specific humidity of the inert matters. Therefore the parameter which should be kept constant is the facility of usage which should be kept as described above.

Thus: w / c ≅ 0,45
i / c ≅ 4,5

Inert matters (sand) shall be well cleaned and free from clay or organic substances. If there are difficulties in usage, these should be solved without adding water but by adding super-fluidifying additives dosed according to the supplier's instructions.

EMMEDUE double panels are completed on site by casting plaster inside the panels, thus creating load-bearing elements as well as the internal reinforcement. This plaster should have a Rck not inferior to 250 dN/cm^2, the inert matters' granulometry should be inferior to 15 mm. and should have a good fluidity (~S5).

Traditional plaster will be used externally with double panels, as in the case of non-load-bearing single panels.

EMMEDUE S.r.l. Via Toniolo - Z.I. Bellocchi - 61032 FANO (PU) ITALY - Tel. + +39/0721/855650/1 - Fax + +39/0721/854030
Capitale sociale € 103.000 i.v. - Iscr. Trib. 13334 - Reg. Soc. C.C.I.A.A. Pesaro 123367 - Cod. Fisc./P.IVA/VAT (IT) 01326180419
w w w . m d u e . i t - i n f o @ m d u e . i t

Obra:

Verification of Floor Panel (Single)

Coef. May.:	K1 =	1.6	(Live Load)
	K2 =	1.5	(Dead Load)
	K3 =	1.15	(Rebar)
	K4 =	1.5	(Concrete)

*If there is snow there will be an additional load of 80-100 kg/m²

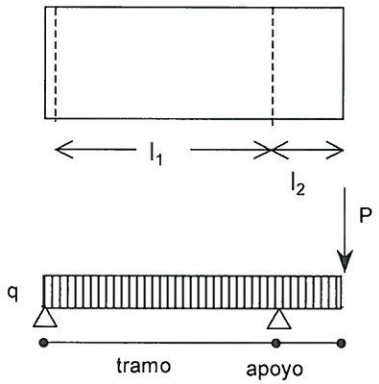
Loads on Floor:

			Factored Loads	
Finish =	100	Kg/m²	150	Kg/m²
Live Load =	300	Kg/m²	480	Kg/m²
Dead Load =	200	Kg/m²	300	Kg/m²

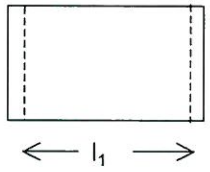
Loads on Roof :

			Factored Loads	
Snow =		Kg/m²		Kg/m²
Finish =	100	Kg/m²	150	Kg/m²
Live Load =	100	Kg/m²	160	Kg/m²
Dead Load =	206	Kg/m²	309	Kg/m²

Tipo de apoyo 1



Tipo de apoyo 2



*Any instance w/ counterlevers an additional load of 100 kg/m is added @ P.

	Cant.	Diam.	cm² / m	
Armadura considerada	20	3.0	1.26	1.26
		5.0		

Posición	Nº	Tipo de apoyo	Tipo de Panel	C.compr. (cm)	ℓ_1	ℓ_2	q (Kg/m²)	P Kg/m	M_{tramo} Kgm	M_{apoyo} Kgm	fl.max. mm	fl.adm. mm	M_{tramo} Tnm	Fe_{tramo} cm²	Ø (mm)	$Arm._{tramo}$	$Mcal_{apoyo}$ Tn	Fe_{apoyo} cm²	Ø (mm)	$Arm._{apoyo}$
Floor	1	1	PSM140	5.6	4.28	1.48	930	100	1584	1159	18.2	17.1	1.58	0.61	6	Ø6 c/0.47m	1.16	0.11	6	Ø6 c/2.64m (*)
Floor	2	1	PSM170	5.6	4.98	0.75	930	100	2713	333	22.3	19.9	2.71	1.53	6	Ø6 c/0.18m	0.33	s/ref.	6	
counterlever	3	voladizo	PSM170	5.6		1.98	930	100		2011	0.6	7.9		s/ref.	6		2.01	0.81	6	Ø6 c/0.35m (*)
Floor	4	2	PSM140	5.6	3.60		930		1507		9.2	14.4	1.51	0.52	9	Ø9 c/1.23m		s/ref.	6	
Floor	5	2	PSM150	5.6	2.65		930		816		2.3	10.6	0.82	s/ref.	6			s/ref.	6	
Roof	6	1	PSM150	5.6	4.18	0.30	619	100	1323	58	9.6	16.7	1.32	0.23	6	Ø6 c/1.24m	0.06	s/ref.	6	
Roof	7	2	PSM150	5.6	1.70		619		224		0.3	6.8	0.22	s/ref.	6			s/ref.	6	
Roof	8	1	PSM150	5.6	3.68	0.30	619	100	1019	58	5.8	14.7	1.02	s/ref.	6		0.06	s/ref.	6	

(*) en el cordón superior

of S. Floor Panel

Coef. May.: K1 = 1.5 (sobrecargas)
K2 = 1.4 (acciones permanentes)
K3 = 1.15 (acero)
K4 = 1.5 (hormigon)

Cargas en losas :

		Mayoración
Terminación =	100 Kg/m²	140 Kg/m²
Propio del losa =	206 Kg/m²	288 Kg/m²
Sobrecargas =	300 Kg/m²	450 Kg/m²

Cargas en cubierta :

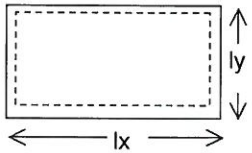
		Mayoración
Nieve =	100 Kg/m²	140 Kg/m²
Terminación =	100 Kg/m²	140 Kg/m²
Peso Propio del losa =	206 Kg/m²	288.4 Kg/m²
Sobrecargas =	150 Kg/m²	225 Kg/m²

$m_x = 0{,}001 \cdot q \cdot \ell_x^2 \cdot K_x$

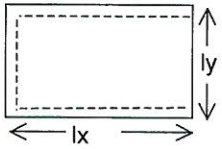
$m_y = 0{,}001 \cdot q \cdot \ell_y^2 \cdot K_y$

$w = 0{,}001 \cdot q \cdot \ell_y^4 / Eh^3$

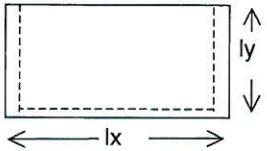
Tipo de apoyo 1



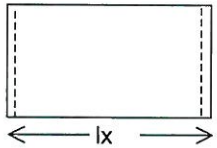
Tipo de apoyo 2



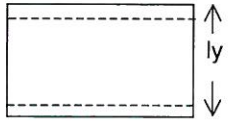
Tipo de apoyo 3



Tipo de apoyo 4



Tipo de apoyo 5



N°	Tipo de apoyo	Tipo de Panel	Capa c. (cm)	ℓ_x	ℓ_y	ℓ_y/ℓ_x	Kx (Tabla)	Ky (Tabla)	Kw (Tabla)	Carga Kg/m²	m_x Kgm	m_y Kgm	fl.max. mm	fl.adm. mm	Mx_{calc} Tn m	Fex cm²	Ø	$Armadura_x$	My_{calc} Tn m	Fey cm²	Ø	$Armadura_y$
1	1	PSM150	5.5	5.00	4.00	0.8	42	61	71	878.4	922	857	5.3	18.0	0.92	s/ref.	6		0.86	0.09	6	
2	2	PSM150	5.5	5.00	4.00	0.8	122	91	148	878.4	2679	1279	11.0	18.0	2.68	1.76	6	Ø6 c/0.16m	1.28	0.57	6	Ø6 c/0.5m
3	3	PSM150	5.5	5.00	4.00	0.8	144	46	277	878.4	3162	647	20.6	18.0	3.16	2.31	6	Ø6 c/0.12m	0.65	s/ref.	6	
4	4	PSM150	5.5	4.75			125		156	878.4	2477		23.1	19.5	2.48	1.54	6	Ø6 c/0.18m		s/ref.	6	
5	5	PSM150	5.5		4.75			125	156	878.4		2477	23.1	19.5		s/ref.	6		2.48	1.92	6	Ø6 c/0.15m

VERIFICATION WITH SIMPLE DEFLEXION, RECTANGULAR SECTION DOUBLE REINFORCEM

given	n	15	homologation coefficient	
given	As (cm2)	2.26	surface of iron under tension	2ø12
given	A's (cm2)	0	surface of iron under compression	
calculation	gamma	**0.00**	A's/As	
given	B (cm)	61	width of compressed section	
given	H (cm)	25	height of section	
calculation	h (cm)	**23**	usable height (H-abutment layer)	
given	delta (cm)	2	abutment layer	
given	slab (cm)	5		
calculation	Xc (cm)	**4.53**	(Xc must be < h of slab)	
given	L (m)	5		
given	W (dN/m2)	650		
calculation	on centre (cm)	61		
given	fraction divisor in	10		
calculation	M (kgcm)	99125	straining moment	
calculation	Ji (cm4)	**13464.82**	moment of inertia of section	
sigma c	(kg/cmq)	**33.37**	max stress of compressed concrete	
sigma f	(kg/cmq)	**2039.30**	max stress on iron under tension	

VERIFICATION WITH SIMPLE FLEXION, RECTANGULAR SECTION DOUBLE REINFORCEMEN

given	n	15	homologation coefficient	
given	As (cmq)	1.13	surface of iron under tension	1ø12
calculation	A's (cmq)	0	surface of iron under compression	
calculation	gamma	**0.00**	A's/As	
given	b (cm)	10	width of compressed section	
calculation	H (cm)	25	height of section	
calculation	h (cm)	**23**	usable height (H-abutment layer)	
given	delta (cm)	2	abutment layer	
calculation	Xc (cm)	**7.30**		
given	fraction divisor in	16		
calculation	M (kgcm)	61953.13	moment of stress at beam edge	
calculation	Ji (cm4)	**5478.33**	moment of inertia of section	
calculation **sigma c**	(kg/cmq)	**82.54**	max tension of compressed concrete	
calculation **sigma f**	(kg/cmq)	**2663.41**	max tension on iron under tension	

VERIFICATION OF SHEAR

calculation	Tmax =	991.25	daN
calculation	τ max =	4.41	daN/cmq

n irons	ø (mm)	A (cm2)
2	12	2.261947
1	12	1.130973
Atot		3.39292

Project:

Verification of Floor Panel PSG-3

JOIST PANEL

Safety Factor.: K1 = 1.6 (Live Loads)

K2 = 1.5 (Dead Loads)

K3 = 1.15 (Steel)

K4 = 1.5 (Concrete)

σe = 75000 PSI

Loads on Floor Panel: **Factored Loads**

Weight of finish layer on top =	10	lb/ft^2	15	lb/ft^2
Live Load =	40	lb/ft^2	64	lb/ft^2
Dead Load =	50	lb/ft^2	75	lb/ft^2

L.L 245 kg/m2 7.92M

829.71215 kg/m2

Position	Nº	Type of Panel	C.compr. (in.)	ℓ (ft)	q (lb/ft^2)	M lb ft	fl.max. in	fl.adm. in	Mcal lb ft	Fe in^2	Re-Bar (N°)	Quantity per Joist
	1	PSG 3/80	2	12	154	2772	0.54	0.58	3696	0.1405	3	2
	2	PSG 3/100	2	14	154	3773	0.65	0.67	5031	0.1659	3	2
	3	PSG 3/120	2	16	154	4928	0.76	0.77	6571	0.1913	3	2
	5	PSG 3/150	2	18	154	6237	0.75	0.83	8316	0.2059	3	2
	6	PSG 3/160	2	19	154	6949	0.81	0.86	9266	0.2185	3	2
	7	PSG 3/180	2	20	154	7700	0.76	0.88	10267	0.2212	4	2
	8	PSG 3/200	2	22	154	9317	0.86	0.93	12423	0.2463	4	2
	9	PSG 3/220	2	24	154	10631	0.89	0.96	14174	0.2602	4	2
	10	PSG 3/240	2.5	26	154	13013	0.95	1.02	17351	0.2842	4	2

Armadura Principal			
Cant.	Diam.	cm^2 / m	
20	3.0	1.26	1.26
0	5.0	0.00	

Armadura Secundaria			
Cant.	Diam.	cm^2 / m	
20	2.5	0.87	0.87
0	5.0	0.00	

Conductance concrete	1.49 W / m2 C
Conductance EPS 15 kg/m3	0.037 W / m2 C

Type of Panel	Surface Layer	Concrete Spray		EPS (15 kg/m3)		Conceret Spray		Surface Layer	Thermal Resistence	R Value
	(below)	Thickness (cm)	Term. Res. (m2 C / W)	Thickness (cm)	Term. Res. (m2 C / W)	Thickness (cm)	Term. Res. (m2 C / W)	(above)	(m2 C / W)	(ft2 F / BTU)
PSG 3 - 80	0.1230	2.5	0.0168	8	2.1622	5	0.0336	0.043	1.8380	19.90
PSG 3 - 100	0.1230	2.5	0.0168	10	2.7027	5	0.0336	0.043	2.2434	22.21
PSG 3 - 120	0.1230	2.5	0.0168	12	3.2432	5	0.0336	0.043	2.6488	24.52
PSG 3 - 140	0.1230	2.5	0.0168	14	3.7838	5	0.0336	0.043	3.0542	26.84
PSG 3 - 160	0.1230	2.5	0.0168	16	4.3243	5	0.0336	0.043	3.4596	29.15
PSG 3 - 180	0.1230	2.5	0.0168	18	4.8649	5	0.0336	0.043	3.8650	31.46
PSG 3 - 200	0.1230	2.5	0.0168	20	5.4054	5	0.0336	0.043	4.2704	33.77
PSG 3 - 220	0.1230	2.5	0.0168	22	5.9459	5	0.0336	0.043	4.6758	36.09
PSG 3 - 240	0.1230	2.5	0.0168	24	6.4865	5	0.0336	0.043	5.0812	38.40

Conductance Concrete	1.49 W / m^2 °C
Conductance EPS 15 Kg/m^3	0.037 W / m^2 °C

Type of Panel	Surface Layer	Concrete Spray		EPS (15 Kg/m^3)		Concrete Spray		Surface Layer	Termical Resistence	R value
	(interior)	Thickness (cm)	Term.Res. (m^2 °C / W)	Thickness (cm)	Term.Res. (m^2 °C / W)	Thickness (cm)	Term.Res. (m^2 °C / W)	(exterior)	(m^2 °C / W)	(ft^2 °F / BTU)
PSM40	0.1230	2.5	0.0168	4	1.0811	2.5	0.0168	0.0430	1.2806	16.71
PSM60	0.1230	2.5	0.0168	6	1.6216	2.5	0.0168	0.0430	1.8212	19.79
PSM80	0.1230	2.5	0.0168	8	2.1622	2.5	0.0168	0.0430	2.3617	22.87
PSM100	0.1230	2.5	0.0168	10	2.7027	2.5	0.0168	0.0430	2.9023	25.94
PSM120	0.1230	2.5	0.0168	12	3.2432	2.5	0.0168	0.0430	3.4428	29.02
PSM140	0.1230	2.5	0.0168	14	3.7838	2.5	0.0168	0.0430	3.9833	32.10
PSM150	0.1230	2.5	0.0168	15	4.0541	2.5	0.0168	0.0430	4.2536	33.64
PSM160	0.1230	2.5	0.0168	16	4.3243	2.5	0.0168	0.0430	4.5239	35.18
PSM180	0.1230	2.5	0.0168	18	4.8649	2.5	0.0168	0.0430	5.0644	38.26
PSM200	0.1230	2.5	0.0168	20	5.4054	2.5	0.0168	0.0430	5.6050	41.34
PSM220	0.1230	2.5	0.0168	22	5.9459	2.5	0.0168	0.0430	6.1455	44.42
PSM240	0.1230	2.5	0.0168	24	6.4865	2.5	0.0168	0.0430	6.6860	47.50

1/u = R

[Lq]

The Emmedue M2 System also has similar floor, stairs and optional roof panels which are permanent shutters for insitu poured concrete. As for the wall panels, they consist of a polystyrene core with prefabricated zinc coated steel wire mesh reinforcement. The floor panels consist of reinforced T's – the main reinforcement in the T's is placed on site.

The finished system is structurally jointless between walls and floor elements.

This Certificate certifies compliance with the requirements of the Building Regulations 1997 to 2002.

USE:
The Emmedue M2 single panel is designed for use in the construction of two storey buildings of all purpose groups, designated in Irish Building Regulations TGB B, excluding purpose group 1(b). The single panel system is a cellular type construction where the maximum unbuttressed length of wall is not to exceed 7m, and clear vertical height not to exceed 3.0m.

The Emmedue M2 double panel is designed for all Purpose Groups defined in the TGD to Part B of the Building Regulations.

The system has been assessed for use as load bearing and non-load bearing walls, and for floor and roof panels in the construction of specifically designed buildings. Fire and sound rated walls may also be constructed using the system.

MANUFACTURE AND MARKETING
The product is manufactured and marketed by:

Emmedue M2,
Botley Lane,
Portarlington,
Co. Offaly.

Part One / Certification 1

1.1 ASSESSMENT

In the opinion of the Irish Agrément Board (IAB), the Emmedue M2 Building System when used as specified in this Irish Agrément certificate is satisfactory for the purpose defined above, and meets the requirements of the Building Regulations 1997 - 2002 as indicated in Section 1.2 of this Certificate.

1.2 BUILDING REGULATIONS 1997 to 2002

REQUIREMENT:

Part D - Materials and Workmanship

D3 – The Emmedue M2 Building System, as certified in this Certificate, is comprised of proper materials fit for their intended use (see Parts 3 and 4 of this Certificate).

D1 – The Emmedue M2 Building System, used in accordance with this Certificate, meets the requirements for workmanship.

Part A – Structure

A1 – Loading

The Emmedue M2 Building System, as certified in this Certificate, has adequate strength and stability (see Parts 3 and 4 of this Certificate).

A2 – Ground Movement

The Emmedue M2 Building System, as certified in this Certificate, can be readily incorporated into structures which will meet this requirement.

A3 - Disproportionate Collapse

The Emmedue M2 Building System, as certified in this Certificate, can be incorporated into structures that will meet this requirement.

Part B – Fire Safety

B2 – Internal Fire Spread (linings)

The panels are non-combustible and have a Class 0 'spread of flame' rating. Surface spread of flame rating of the finished construction will be determined by the surface spread of flame rating of the lining materials used.

B3 – Internal Fire Spread (structure)

The Emmedue M2 Building System, as certified in this Certificate, will meet this requirement.

B4 – External Fire Spread

The Emmedue M2 Building System has a spread of flame rating equivalent to Class 0 on both faces. In respect of 'Spread of Flame', this is the highest performance classification set out in the Building Regulations 1997 to 2002.

Part C – Site Preparation and Resistance to Moisture

C4 – Resistance to Weather and Ground Moisture

The Emmedue M2 Building System, used in accordance with Part 3 of this Certificate, will have adequate weather resistance in all exposures, will resist the passage of moisture from whatever source and will prevent surface or interstitial condensation.

Part E – Sound

E1 – Airborne Sound (walls)

The Emmedue M2 Building System, as certified in this Certificate, will meet this requirement.

E2 and E3 – Airborne and Impact Sound (floors)

The Emmedue M2 Building System, as certified in this Certificate, will meet this requirement.

Part F – Ventilation

F1 – Means of Ventilation

Adequate building ventilation openings can be provided in walls constructed with the Emmedue M2 Building System. It is essential that ventilation ducts through such walls are fully sealed from any cavities within the walls or from contact with the cut edges of adjacent materials.

Part J – Heat Producing Appliances

J3 – Protection of Building

When used in accordance with Section 4.1 of this Certificate, the Emmedue M2 Building System can meet the Regulation requirements.

Part L – Conservation of Fuel and Energy

L1 – Conservation of Fuel and Energy

The Emmedue M2 Building System will contribute to enabling a building to meet this requirement.

Part M – Access for People with Disabilities

M1 – Access and Use

The Emmedue M2 Building System can incorporate this requirement.

2.1 PRODUCT DESCRIPTION

2.1.1 Single Panel Construction

Buildings constructed using this system shall have not more than two floors - ground floor and first floor - with the upper floor being constructed of Emmedue M2 ribbed floor panels (see figure 1) and covered with normal lightweight covering including clay or concrete pantiles. Load bearing concrete cores will be designed by structural engineer and reinforcement specified to IS 326/Eurocode 2.

External walls shall be constructed using Emmedue M2 single panels (see figure 2) each consisting of 12mm render on 35mm sprayed concrete on either 155mm (25kg/m^3) or 170mm (15kg/m^3) polystyrene, with an inner layer of 35mm sprayed concrete finished with a 4mm plaster skim coat (Figure 1). The sprayed concrete shall have a minimum characteristic strength of 25MPa at 28 days.

Internal load bearing walls shall be constructed as above using Emmedue M2 single panels. The minimum polystyrene core thickness shall be 65mm.

Load bearing party walls between dwellings shall be constructed using Emmedue M2 double panels (see figure 3) with density not less than 415kg/m^2,
consisting of a minimum 100mm thick concrete core (30MPa) between two layers of 65mm polystyrene (25kg/m^3), which shall have a 35mm concrete (25 MPa) sprayed onto them.

Non load bearing partitions shall be constructed using the Emmedue M2 single panel incorporating 25mm of sprayed concrete both sides of a polystyrene core (15kg/m^3) of varying thickness (40mm – 400mm).

The standard reinforcement is zinc coated electrowelded mesh reinforcement (2.5mm diameter at 65mm centres) and cross ties (3mm diameter at 82 number per square meter).

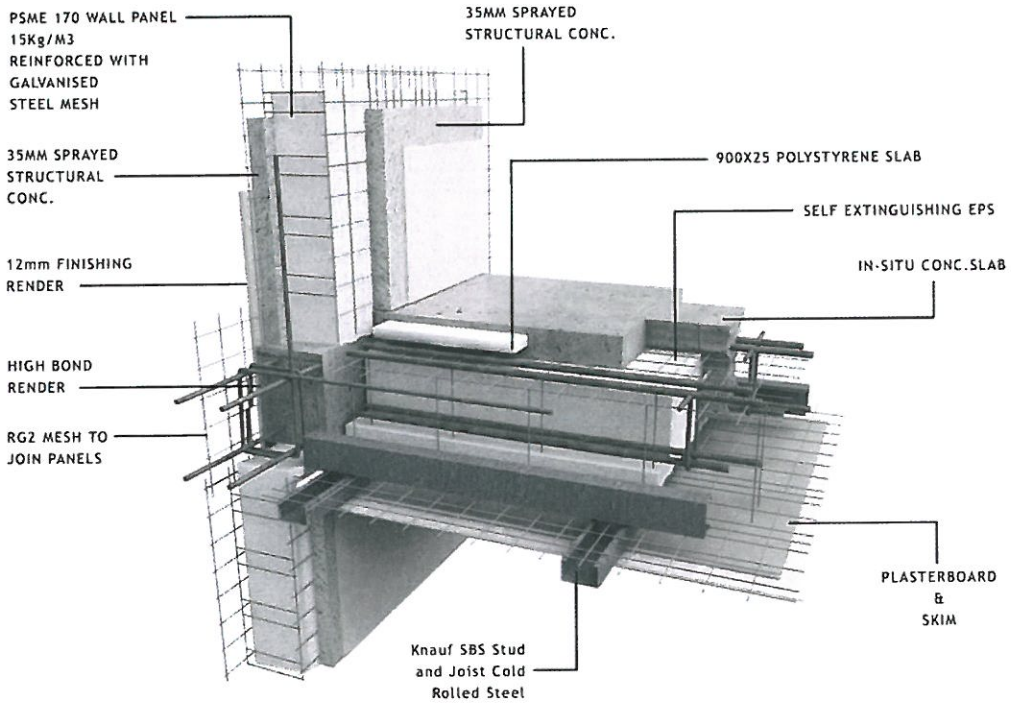


Figure 1: Emmedue single panel wall/floor junction

Maximum Loads
Vertical imposed loads shall be in accordance with the requirements of Eurocode 1/ BS 6399

Wind loadings shall be in accordance with the requirements of BS 6399.

Lateral Support and End Restraint
The ends of every load-bearing wall shall be securely anchored to a buttressing wall over its full height. Longer walls shall be provided with intermediate lateral restraint dividing the wall into distinct lengths by buttressing walls which provide support over the full height.

Interaction of Elements
Walls shall extend to the full height of each storey and shall be provided with horizontal lateral supports. A ring beam (Figure 2) is constructed on each floor in accordance with M2 Building System Operations Manual. Floors and roofs shall act to transfer lateral forces from walls to buttressing walls and be constructed in accordance with Emmedue M2 details. Roofs shall be strapped to walls in accordance with Emmedue M2 details and designed to resist both horizontal and vertical forces arising from dead, imposed and wind loads.

2.1.2 Double Panel Construction
The Emmedue M2 double panel consists of polystyrene permanent shuttering with external mesh reinforcement on both sides of the polystyrene, and steel ties tying the mesh reinforcement across the polystyrene and the concrete core (Figure 3). The mesh reinforcement and ties are as per the single panel.

The double panel system can be designed for use in buildings up to four storeys in height using IS 326/Eurocode 2
All design should be undertaken by a chartered structural engineer.

2.1.3 Chimneys
Chimneys are outside the scope of the Emmedue M2 System. However, the system can incorporate an IAB approved pre-fabricated chimney block system. The requirements of Clause 2.15 of TGD to Part J of the Building Regulations require that combustible material such as polystyrene insulation have at least the following separation distance:
a) 200mm from a flue, or
b) 40mm from the outer surface of a brick or blockwork chimney or fireplace recess.

2.1.4 Concrete
The typical specifications for the sprayed and in-situ poured concrete are as follows:
- Sprayed fibre reinforced concrete for wall panels – 25MPa
- In-situ poured concrete in double panel walls – 30MPa
- In-situ poured concrete in floor panels – 30MPa

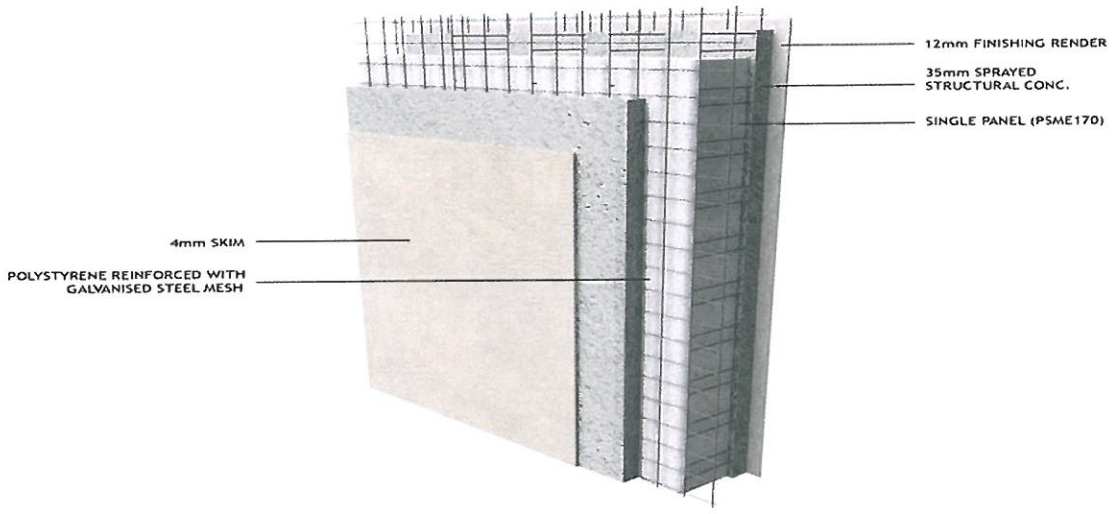


Figure 2: Emmedue single panel

2.1.5 Polystyrene

The polystyrene insulation is manufactured to comply with the requirements of IS EN 13163:2001.

Test	Density	
	15 kg/m^3	25 kg/m^3
Thermal conductivity (λ) (W/mK)	(0.034), (0.0371)	(0.0313), (0.0353) (0.0311), (0.032) (0.0318), (0.032)
Density (kg/m^3)	(14.8/15.5), (16.0/16.0)	(23.1/25.3), (21.1/24.6), (24.3/23.9), (24.3/23.3) (24.2/24.0), (24.2/25.2)
Compressive strength @ 10% deformation (kPa)	(70), (68), (71)	(126), (127), (118)
Long term water absorption - by total immersion (kg/m^3) - by partial immersion (kg/m^2)	(3.4), (3.8), (2.3), (3.4) (0.1), (0.1), (0.0), (0.1)	

Table 1: Polystyrene Test Results

2.1.6 Steel

All steel is purchased from Emmedue (Italy). The specification is as follows:

- Longitudinal steel wires: 2.5mm diameter
- Transversal steel wires: 2.5mm diameter
- Joint steel wire: 3.0mm diameter
- Steel wire yield: >600N/mm^2
- Steel wire fracture: >680N/mm^2

2.1.7 Ancillary Items

- Zinc-coated electrowelded wall tie connectors
- Pumped concrete
- Reinforcing bars
- Wall anchors
- Zinc-coated high tensile steel mesh
- Render
- Steel reinforcing bars
- Various fixing angles and brackets
- Joist hangers

2.2 DESIGN, STORAGE AND MARKING

The system is intended for use where Architect's drawings are available and satisfy the Building Regulations – the Architect and Engineer design team of the developer (the Client) are responsible for the drawings and overall building design to comply with the Building Regulations.

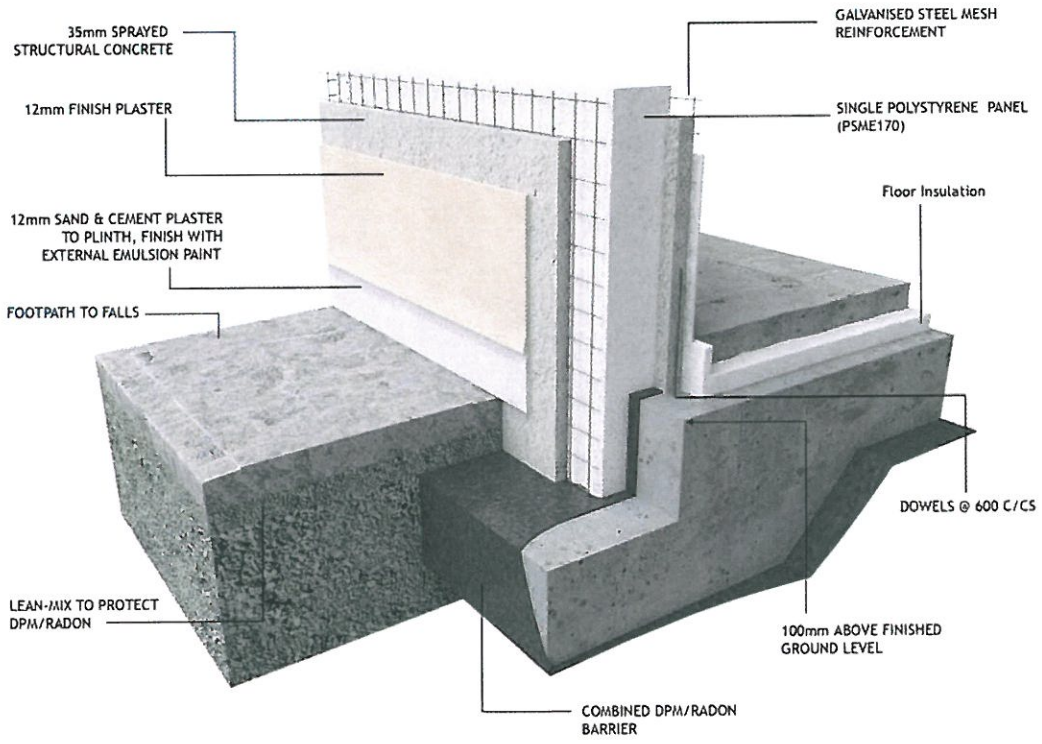


Figure 3: Emmedue foundation detail

Emmedue, through the use of a Chartered Engineer, are responsible for the structural design of the Emmedue M2 Building System for each project. The Engineer also liases with the Engineer for the Developer and provides the necessary loading information for the design of the foundations.

2.2.1 Emmedue Panels & Floor Slabs Formwork

Emmedue panels should be stored on a clean, flat, hard surface area on the site. Panels should be stored on timber battens approximately 2m apart. Panels should be tied down to prevent uplift in windy conditions. Panels should not be stored for excessive periods of time out in the atmosphere.

2.2.2 Handling of Panels

Panels should be stored and transported on site in a manner that prevents damage, buckling or sprawling of the polystyrene or bending of the mesh reinforcement. Operatives should place the panels in position and tie them down to starter bars adjoining panels and slabs in the manner described in the operatives' manual. Panels should be properly braced to provide rigid temporary support to the walls during erection and concrete spraying and the placing of concrete in slabs. Propping of walls and slabs should be in accordance with the Emmedue Operations Manual.

2.3 INSTALLATION

Emmedue undertakes responsibility for the design and manufacture of the system. Site construction is undertaken using trained approved installers.

2.3.1 Foundations

Foundations are outside the scope of this Certificate and the Emmedue M2 system. However, typical foundation details (see Figure 4) incorporating DPCs/radon barriers should be used. Both single and double panel walls should have starter bars from either foundation or ground floor slab. All foundations should be designed by a chartered engineer with appropriate experience.

2.3.2 Assembly of Panels for Walls

Emmedue panels are anchored to the foundation or floor slab at ground level with dowel bars. In order to guarantee the continuity among the elements, the Emmedue panels are equipped on both sides with mesh overlap from panel to panel.

In order to achieve proper heat insulation, no gaps should be left between two adjacent panels during assembly. In addition, the panels should be placed in a perfectly vertical position and be well-aligned to minimise any eccentric loading on the structure. Typical details are shown in Figure 5 and 6.

During assembly, the main openings for doors, windows and balconies have to be considered as foreseen in the design. Typical details are shown in Figure 5 and 6.

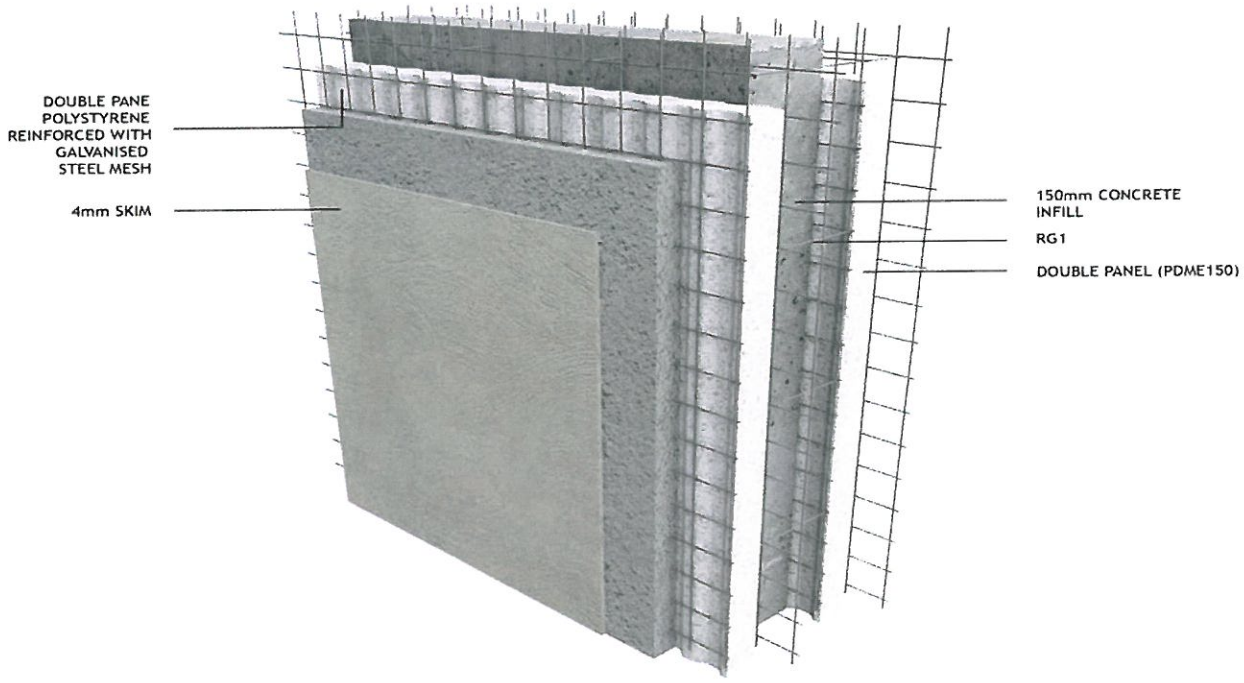


Figure 4: Emmedue double panel wall

Minor openings can be made after assembly by using cutting instruments such as circular saws, shears, knives and pliers. Care should be exercised in the cutting operation to minimise unnecessary damage to the polystyrene core.

2.3.3 Bracing Meshwork Installation

All internal walls are reinforced with angular mesh (RG1), which gives the structural mesh greater continuity.

The openings are braced using flat mesh (RG2) at 45° above and below corners of the opening. The window and door lintels, according to their length, and the window sills whose span is longer than 1.2m, can be integrated with additional reinforcements on both sides. To avoid cold bridging at door and window openings, a thermal break is provided between the internal and external concrete, as shown in Figure 5.

2.3.4 Installation of Emmedue Staircase

The stairs shall be designed to IS 326/Eurocode 2. Once the stairs panel is assembled and the reinforcement lattices are placed inside the panel internal channels, the latter are completed with gravel concrete (particle size <12mm) see Figure 7. The concrete may be cast in the panel ribs simultaneously with casting of the upper floor.

Subsequently, 25MPa sprayed concrete (50mm thick) is applied both on the lower face and on the sides of the flight, while on its upper side the flooring (marble, ceramic tiles etc.) can be directly laid on an adhesive layer. This panel enables the erection of stairs of classic dimensions only.

2.3.5 Separating Walls

All separating walls are to be constructed using the Emmedue M2 double panel wall. Care should be taken at the head of such walls to ensure the requirements of cl. 3.2.5 of Technical guidance document B of Irish Building Regulations 1997-2002 are adhered to.

2.3.6 Services

The laying of pipes for plumbing, electrical installation, heating services etc. takes place after the polystyrene panels have been erected and before the spraying of concrete takes place.

The polystyrene is melted using a hot air gun or similar tool. The electrical flexible pipes are placed under the meshwork. Where rigid pipes are placed within the polystyrene, the mesh may need to be cut. The area surrounding the cut should be restored by the addition of extra mesh connected to the meshwork of the panel. Copper pipes should be insulated from the meshwork with felt PVC or similar protection. No pipes greater than 50mm diameter should be installed in the polystyrene. Service pipes or ducts 100mm in diameter or more should be placed outside the structure or in ducts within the building.

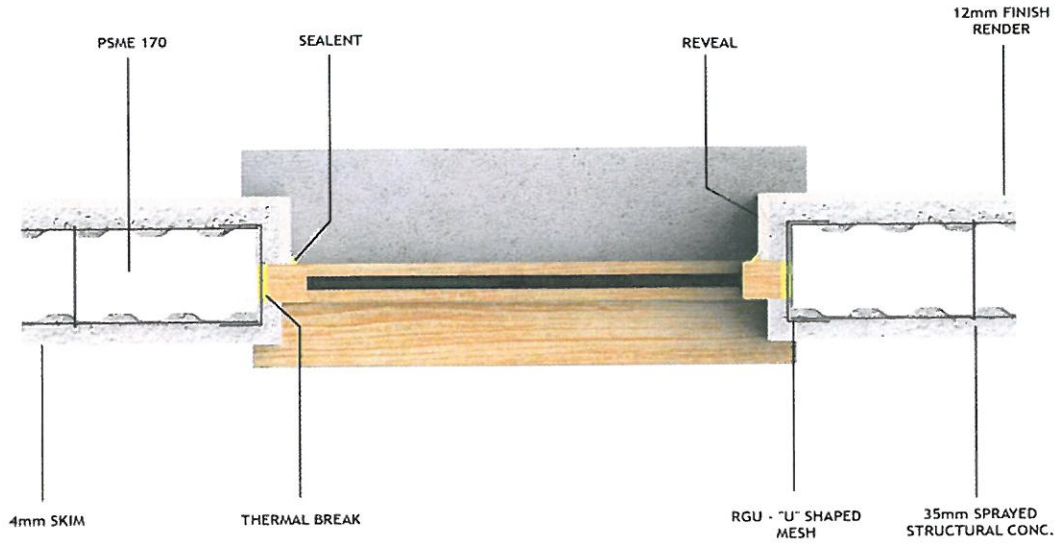


Figure 5a: Horizontal section through window opening on single panel wall

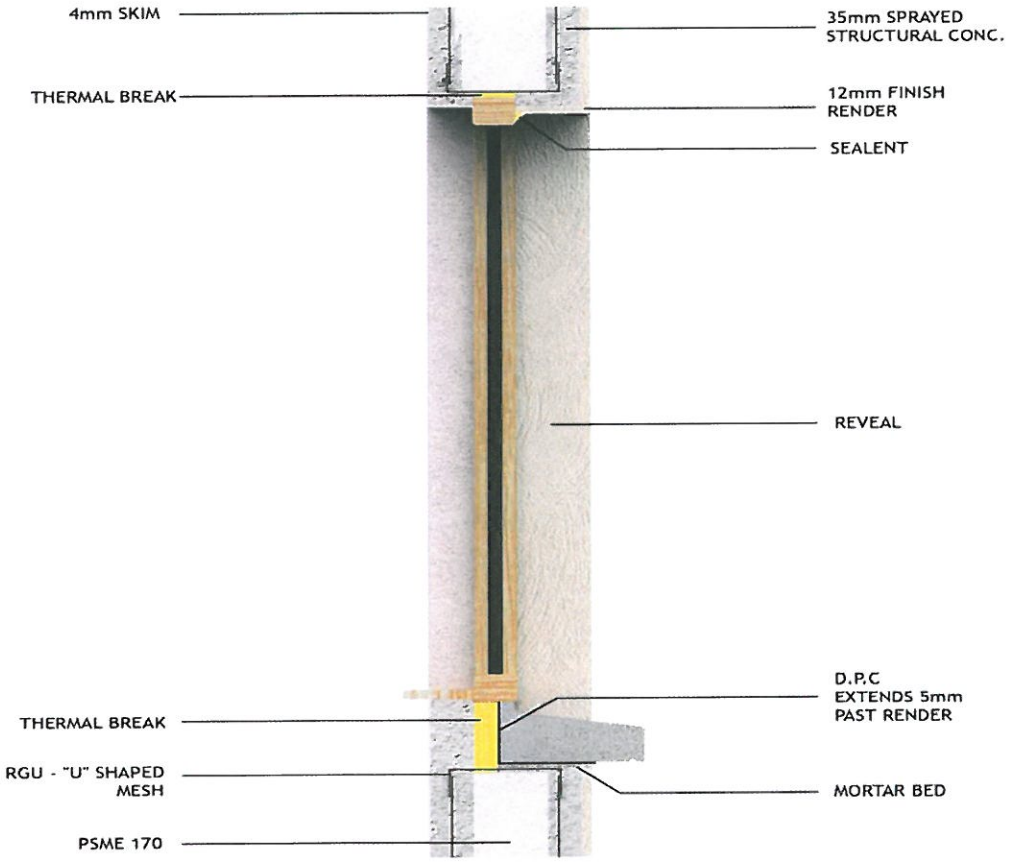


Figure 5b: Vertical section through window opening single panel wall.

The location of services should be as per the service drawing for the structure. Any alteration of change of location of services should be advised to Emmedue and noted in the service drawings for the structure.

2.3.7 Details of Balconies & Bay-Windows
The balconies can be executed by Emmedue ribbed floor panel with additional anchoring bars being anchored to the floor, designed in accordance with IS 326/Eurocode 2 (see Figure 8).

2.3.8 Sprayed Concrete
An approved concrete mix of 25MPa sprayed concrete should be used. The minimum cover to reinforcement is 30mm.
This operation will be carried out by trained installers, starting at the bottom and working up. Guide rails are used to ensure require thickness.
Emmedue have a QC testing schedule for concrete cubes and cores.

2.3.9 Finishing of the Floors
Place posts and boards at 1.1m intervals, slightly increasing the height of posts at the centre of the floor slab.

For the ribbed floors, the workers should take care to walk exclusively on the wooden bridge boards laying on the posts.

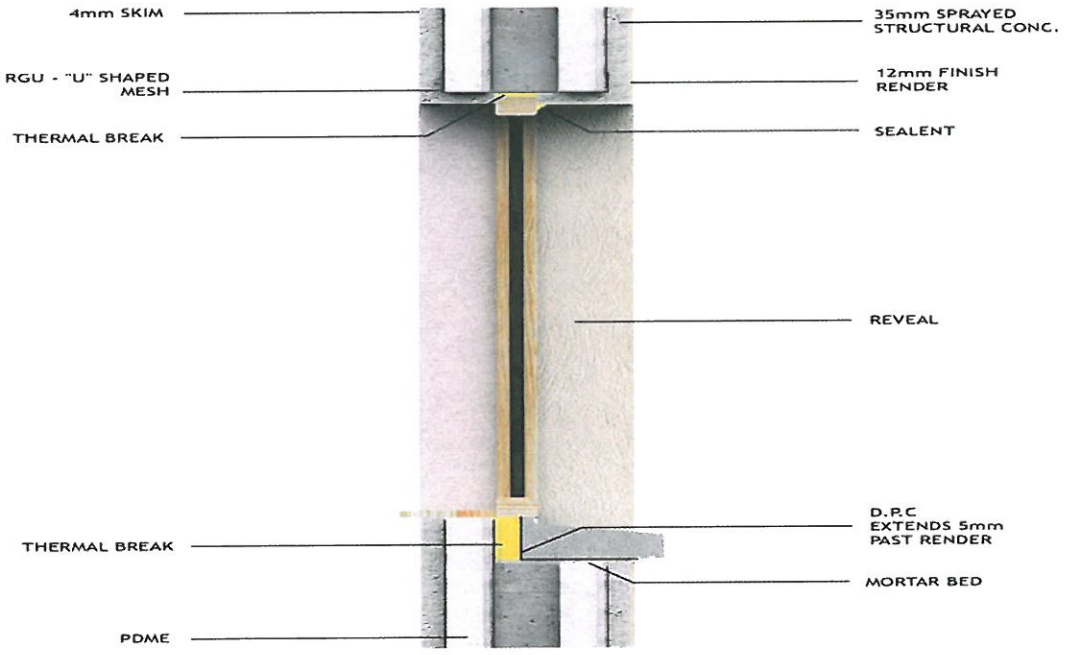


Figure 6a: Vertical section through window opening on double panel wall.

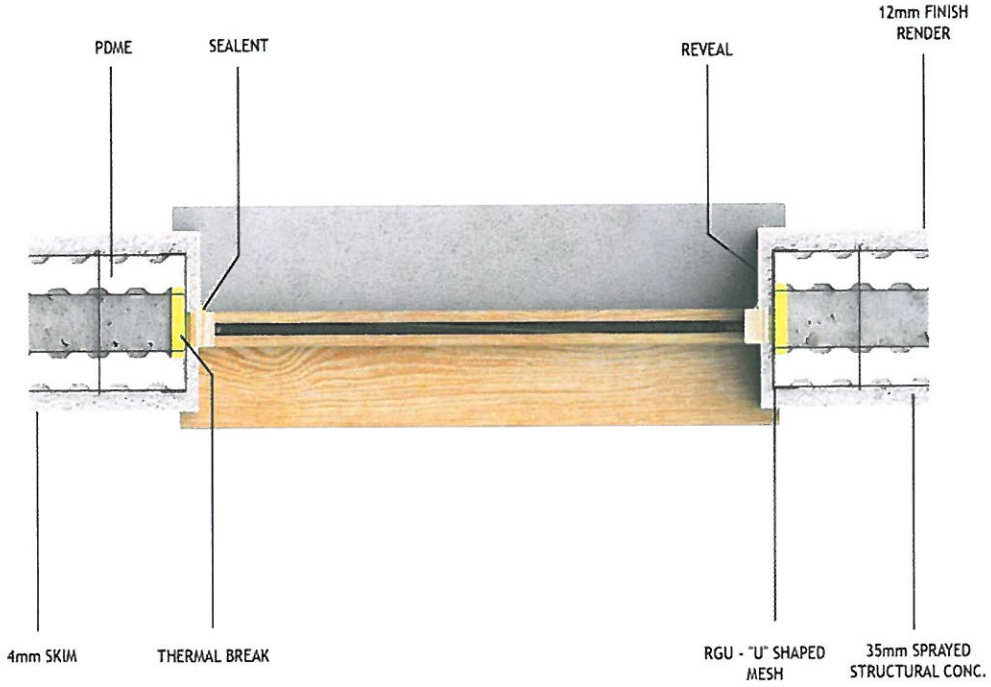


Figure 6b: Horizontal section through window opening on double panel wall.

The ring beam is constructed on each floor in accordance with M2 Building System Manual.

The designer should verify the floor panel reinforcement and, if required, should integrate it with additional reinforcement rods (to be substantiated by calculations) inside the panel ribs.

Once the floor slab concrete has reached the right cure degree, the posts should be removed starting from the centre outwards so as to gradually transfer the load to the floor slab.

2.3.10 Precautions

- Do not overload partition walls on one side only. Instead, spray the concrete onto both sides alternately.

- If a panel is cut during erection and its meshwork has no wire-crossing joints, panels should be joined with flat meshwork (min. width 225mm).

2.3.11 Fixing Objects to Walls

Lightweight objects: 25mm screws, pins or similar devices may be used.

Heavy objects (shelves, water-tanks etc.): Plastic pins with 45mm screws or similar devices are recommended

Very heavy objects: During erection, metal pins may be inserted in plaster pallets. Alternatively, a threaded pin fastened with epoxy resin may be used.

2.3.12 Walls Erected by Emmedue Double Panels

In buildings of up to four storeys, walls should be erected with Emmedue double panels that are properly reinforced. After panels have been fastened and aligned, the concrete can be carefully poured in layers and vibrated. The minimum concrete characteristic strength is 25MPa.

Once the in-situ concrete has gained sufficient strength, both sides of panels are coated with sprayed concrete in a similar way as the single panel. The minimum coating thickness for external panels is 35mm.

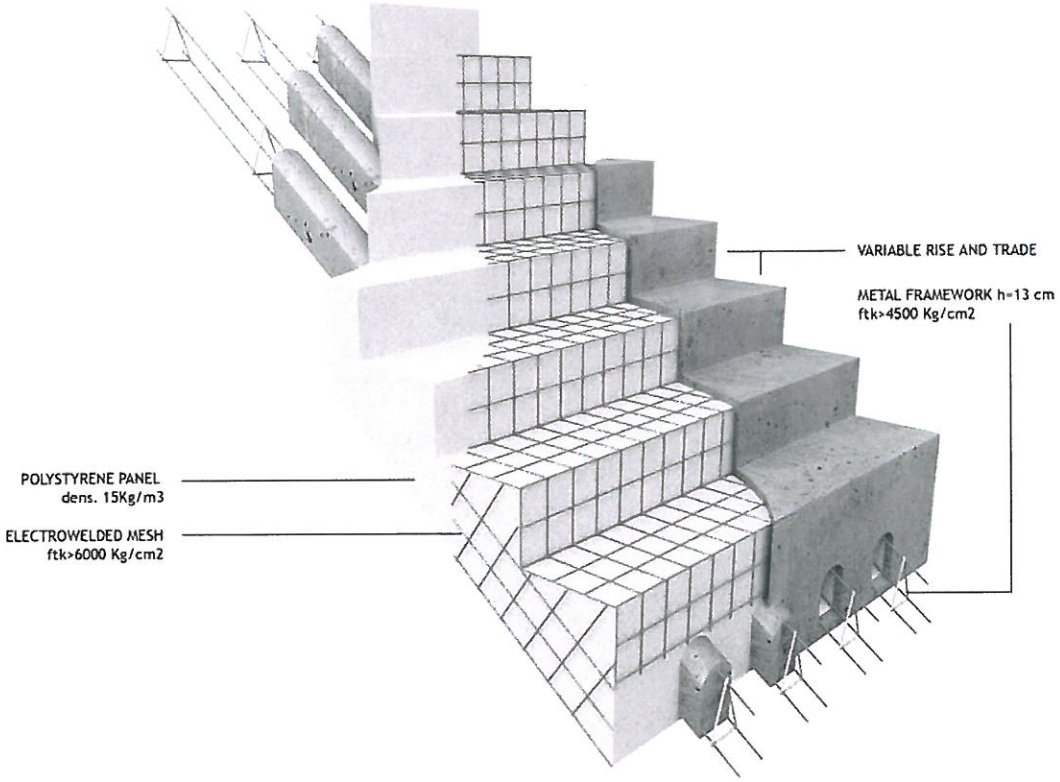


Figure 7: Details of staircase

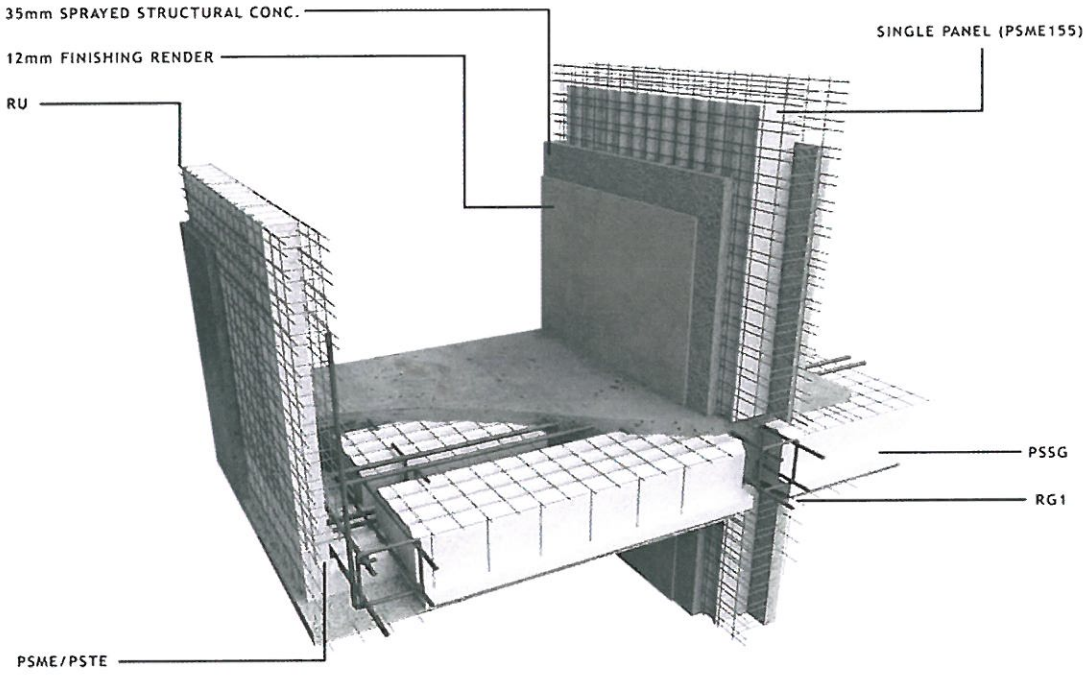


Figure 8: Details of balcony

3.1 STRENGTH & STABILITY

3.1.1 General

Buildings constructed using the Emmedue M2 Building System shall be certified by a competent, chartered civil or structural engineer, with experience in design of buildings and structures incorporating the Emmedue M2 System, as being in accordance with Part A of the Building Regulations 1997 to 2002.

3.1.2 Design Loads

The loads to be taken into account at design stage should be determined in accordance with Part A of the Building Regulations 1997 to 2002.

3.1.3 Impact Resistance

The Emmedue M2 Building System provides a robust system that has a high resistance to hard and soft body impacts likely to be associated with normal use situations. The rendered wall is acceptable for all normal situations. This includes Category B in Table 2 of BS 8200:1985. Category A involves external walls of houses and public buildings in vandal prone areas – prone to vandalism and abnormally rough use and some damage could be expected to occur to the rendering in this type of location.

3.2 STRUCTURAL FIRE SAFETY

3.2.1 Internal fire spread (linings)

The wall panels have a Class 0 rating in accordance with Building Regulations Technical Guidance Document B Appendix A Cl. A10.

3.2.2 Internal fire spread (structure)

When the building has been designed and installed in accordance with the requirements of this certificate, the walls are capable of withstanding the effects of fire for 60 minutes without loss of stability.

3.2.3 External fire spread

The wall panels are non-combustible, and have a Class 0 rating (see Cl 3.2.1). External panels can be designed to meet the requirements of Building Regulations Technical Guidance Document B Table 4.1.

3.3 WEATHERTIGHTNESS

Externally the walls are protected by an approved render applied to the 35mm sprayed 25MPa fibre reinforced structural concrete. A DPC/radon barrier is installed at ground level to prevent rising damp. A DPC is also used around window sills, and a sealant is required around windows and door frames.

4.1 BEHAVIOUR IN RELATION TO FIRE

The single and double panels have a Class 0 rating as per Table A6 of Part B of the Building Regulations 1997 to 2002.

For ceilings, 12mm plasterboard slab is fixed to the underside of the polystyrene to give a Class 0 rating. In the case of common stairwells (multiple occupancy apartment stairs), a minimum of 50mm sprayed concrete is applied to encase the polystyrene.

4.2 THERMAL INSULATION AND U-VALUES

Assessments were carried out to verify that the requirements of Part L can be achieved using the Emmedue M2 Building System in typical designs.

4.3 CONDENSATION

The system was subjected to a condensation risk analysis, which concluded that the risk of surface and interstitial condensation is minimal and that no vapour barrier is required.

4.4 SOUND

Sound testing has been carried out on the party walls in houses and apartments (Figure 9), and also on the compartment floors in apartments. The sound assessment showed that the required sound attenuation values can be achieved using double panel construction for party walls with a minimum density of 415kgm^2 concrete. The floor construction tested for sound is shown in Figure 3.

4.5 DURABILITY

Buildings based on the Emmedue M2 Building System, when constructed in accordance with the manufacturer's instructions and this Certificate, will have a minimum design life of at least 60 years in accordance with BS 7543: 1992 *Guide to Durability of Building Elements, products and components.*

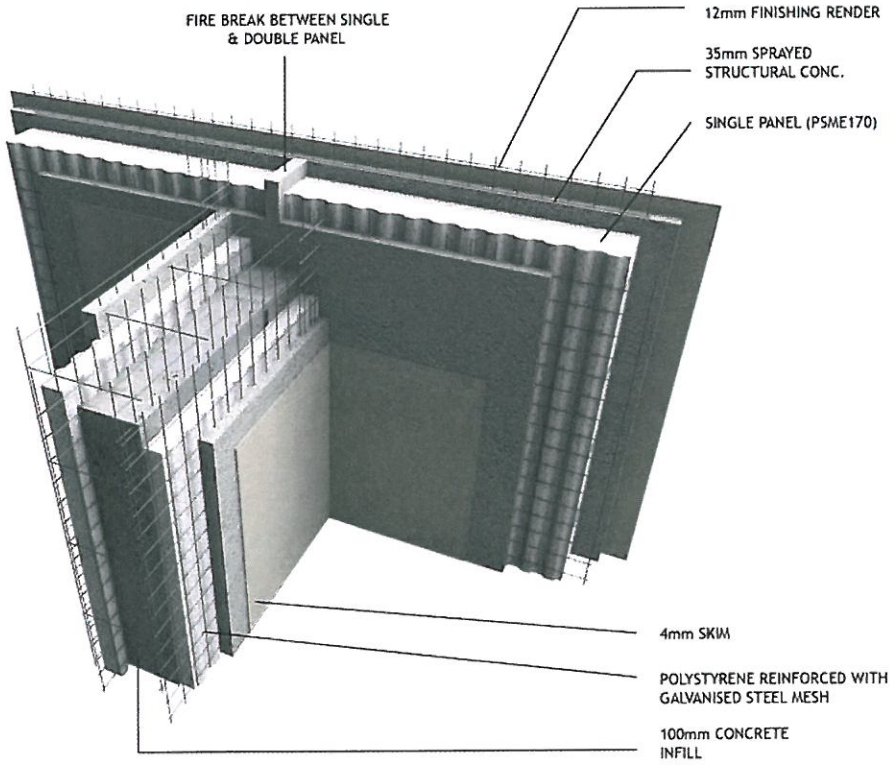


Figure 9: Detail at external/separating wall junction

4.7 MAINTENANCE

The rendering/concrete in the wall panels is maintenance free – however, the coloured rendering may discolour with time. The external sealants around window and door frames should be inspected periodically and replaced when necessary.

4.8 PRACTICABILITY

A Site Erection Manual and a Manual for Health & Safety are provided for each project, which incorporate the Emmedue M2 Building System.

The handing over involves a final inspection of the building and the completion of a Certificate of Compliance Report by the Chartered Engineer responsible for the project.

Erection of the Emmedue M2 Building System must be by trained installers.

4.9 TESTS AND ASSESSMENTS WERE CARRIED OUT TO DETERMINE THE FOLLOWING:

- Structural strength and stability
- Behaviour in fire
- Resistance to airborne and impact sound transmission
- Thermal transmittance values
- Condensation risks for external walls
- Impact resistance for external walls
- Site erection controls

4.10 OTHER INVESTIGATIONS

- The manufacturing process was examined including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used
- Site visits were conducted to assess the practicability of installation
- Bought-in components were assessed for suitability for use
- No failures of the product in use have been reported to the IAB.

5.1 National Standards Authority of Ireland ("NSAI") following consultation with the Irish Agrément Board ("IAB") has assessed the performance and method of installation of the product/process and the quality of the materials used in its manufacture and certifies the product/process to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this Certificate and in accordance with the manufacturer's instructions and usual trade practice. This Certificate shall remain valid for five years from date of issue so long as:

(a) the specification of the product is unchanged.

(b) the Building Regulations 1997 to 2002 and any other regulation or standard applicable to the product/process, its use or installation remains unchanged.

(c) the product continues to be assessed for the quality of its manufacture and marking by NSAI.

(d) no new information becomes available which in the opinion of the NSAI, would preclude the granting of the Certificate.

(e) the product or process continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this certificate.

(f) the registration and/or surveillance fees due to IAB are paid.

5.2 The IAB mark and certification number may only be used on or in relation to product/processes in respect of which a valid Certificate exists. If the Certificate becomes invalid the Certificate holder must not use the IAB mark and certification number, and must remove them from the products already marked.

5.3 In granting Certification, the NSAI makes no representation as to;

(a) the absence or presence of patent rights subsisting in the product/process; or

(b) the legal right of the Certificate holder to market, install or maintain the product/process; or

(c) whether individual products have been manufactured or installed by the Certificate holder in accordance with the descriptions and specifications set out in this Certificate.

5.4 This Certificate does not comprise installation instructions and does not replace the manufacturer's directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this Certificate relating to the safe use of the certified product/process are preconditions to the validity of the Certificate. However the NSAI does not certify that the manufacture or installation of the certified product or process in accordance with the descriptions and specifications set out in this Certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act. 1989, or of any other current or future common law duty of care owed by the manufacturer or by the Certificate holder.

5.6 The NSAI is not responsible to any person or body for loss or damage including personal injury arising as a direct or indirect result of the use of this product or process.

5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

Bord Agrément na hÉireann
Irish Agrément Board

The Irish Agrément Board

This Certificate No. **06/0241** is accordingly granted by the NSAI to **Emmedue Ltd.** on behalf of The Irish Agrément Board.

Date of Issue: **February 2006**

Signed

Manager Irish Agrément Board

Readers may check that the status of this Certificate has not changed by contacting the Irish Agrément Board, NSAI, Glasnevin, Dublin 9, Ireland. Telephone: (01) 807 3800. Fax: (01) 807 3842. www.nsai.ie

(Wall)

1st Floor PSME 80 15 cm Thick

PSME 80 15 cm = 5.905512

60 13 cm = 5.11811 1125 mm

40 11 cm = 4.330709

30 mm = 1.181099

EMMEDUE BUILDING CONCEPT

EMMEDUE BUILDING CONCEPT

Emmedue Overview

Characteristics

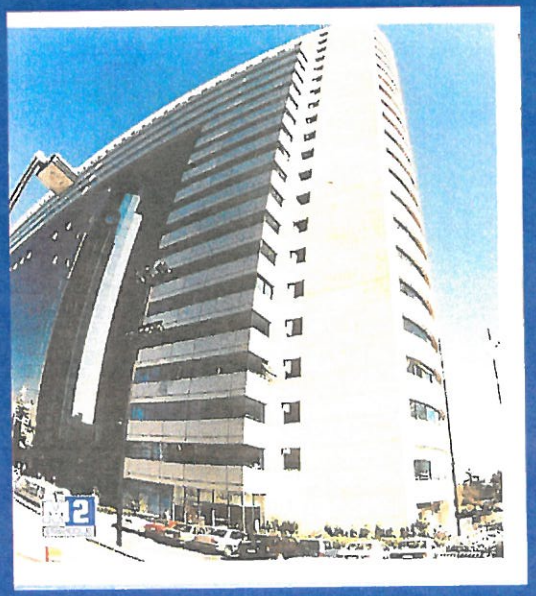
Advantages

Comparison (TBC)

EMMEDUE BUILDING CONCEPT

Emmedue Overview

EMMEDUE® is an innovative earthquake-resistant and insulating building system enabling the construction of earthquake-resistant buildings from **1 up to Multi** storeys as well as architectural structures from the simplest to the most complex.



EMMEDUE BUILDING CONCEPT

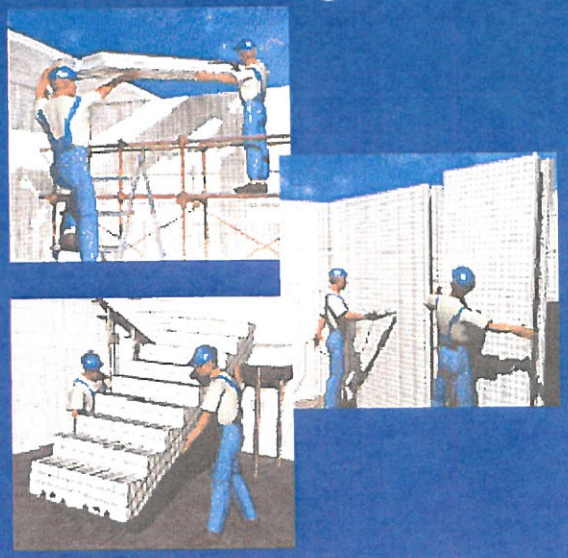
EMMEDUE® is an integrated system made up of modular panels whose structural function is guaranteed by two electrowelded galvanized steel meshes joined one another by double steel connectors, inside of which is a suitable shaped foam polystyrene slab that contributes to perfect heat insulation and soundproofing.

EMMEDUE BUILDING CONCEPT

Characteristics

Easy handling

Thanks to their light weight, on the building sites, **EMMEDUE®** panels can be easily carried by by one or two workers, even when assembled and when measuring over 4 sq.m. In the following stage, they may be handled and placed by hand by only one worker without the aid of a lifting machine.

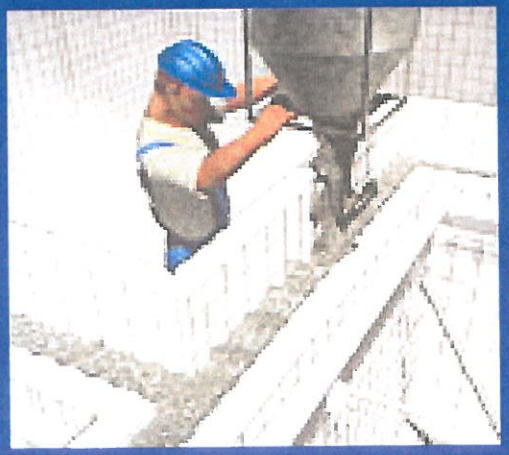


EMMEDUE BUILDING CONCEPT

Characteristics

High Insulating Quality

By the use of **EMMEDUE®** permanent form work unlike traditional disposable formwork structural concrete is kept at cool temperatures and away from the elements of extreme weather conditions (as seem below).

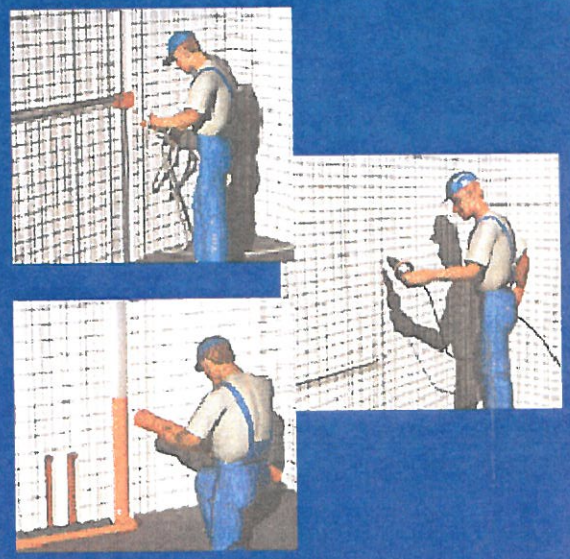


EMMEDUE BUILDING CONCEPT

Characteristics

Chases

As to the installation of the various systems (plumbing, heating, sanitary, wiring, telephone, etc.), the ease by which chases are made further confirms the validity of this method. The operation is quickly carried out with no additional masonry assistance, and it is absolutely clean.



EMMEDUE BUILDING CONCEPT

Advantages

LIGHT

The **EMMEDUE®** panels present a remarkable easiness of handling, transport and assembling thanks to their very reduced weight that permits their use in any condition.

Prior of the concrete application, the weight per square metre changes according to the type of panel: **from 3,5 Kg/m2 to 5 Kg/m2**. Thanks to the lightness of the panel, any worker, even by himself, can easily handle over **3 m2** of wall without difficulty.

EMMEDUE BUILDING CONCEPT

Advantages

INEXPENSIVE

The **EMMEDUE®** panels represent a real advantage both for the final users and the contractors, since they permit to attain better performances compared to the traditional products and with far lower costs

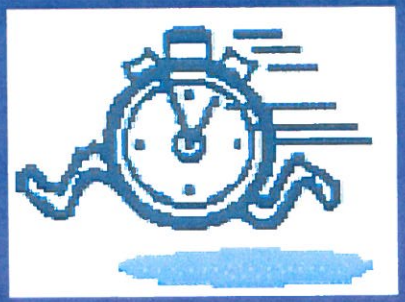
To this regard, economic comparisons between **EMMEDUE®** buildings and other traditional systems having equal performances have shown a saving exceeding **20%** as for the double panel and **40%** as for single panels.

EMMEDUE BUILDING CONCEPT

Advantages

RAPID ASSEMBLING

Several experiences carried out in all kinds of conditions, in different countries of the world and with any kind of labour have shown that the time required to realize buildings following the **EMMEDUE®** system is much shorter compared to the conventional systems.

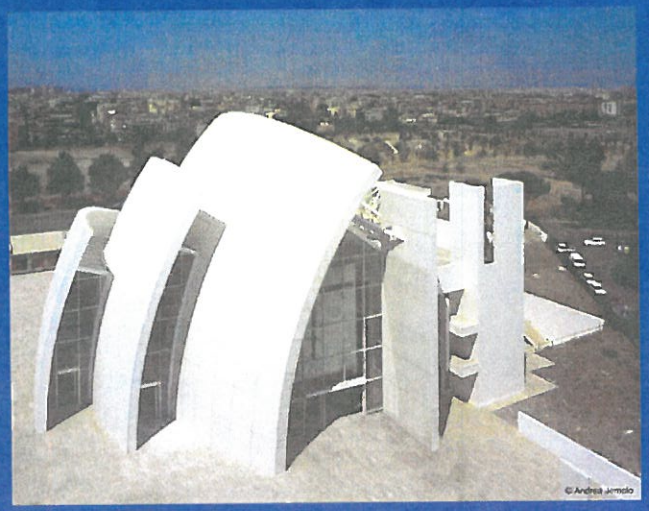


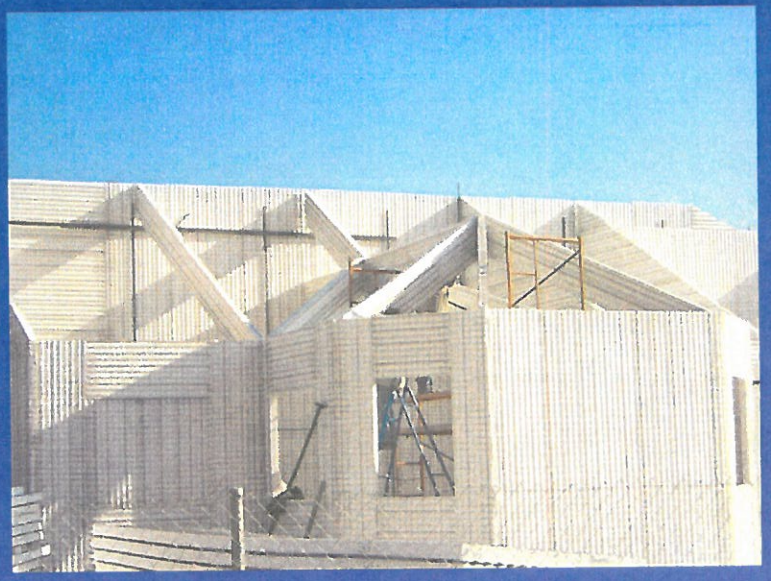
EMMEDUE BUILDING CONCEPT

Advantages

VERSATILE

The **EMMEDUE®** panels can be used for any kind of structure. The panels can be employed as load bearing vertical elements, partitions, curtain walls, floors and staircase flights.





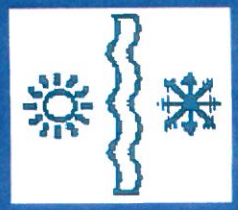
EMMEDUE BUILDING CONCEPT

Advantages

RESISTANT

A lot of laboratory tests carried out in several countries of the world as well as in Italy have shown the high load resistance of the **EMMEDUE®** panels. For example, tests carried out on a finished single panel having dimensions equal to **cm 112x15 and cm 270 high**, have shown that the same panel can sustain loads above **1.700 KN**.

M2 EMMEDUE



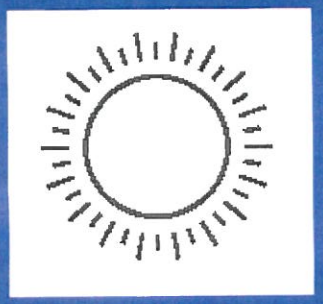
EMMEDUE BUILDING CONCEPT

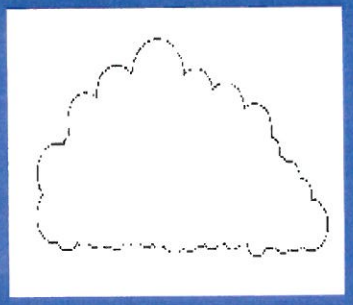
Advantages

ENERGY SAVING

The value of the **K** (Kelvin= heat measure) total heat transmittance of a wall realized by a panel made up of a polystyrene slab of **4 cm** (**density 15 kg/m3**) applied with plaster **3 cm** thick on both sides for a total thickness of **10 cm**, is equal to **0.78 W/m2 K** (Watts per meter Kelvin).

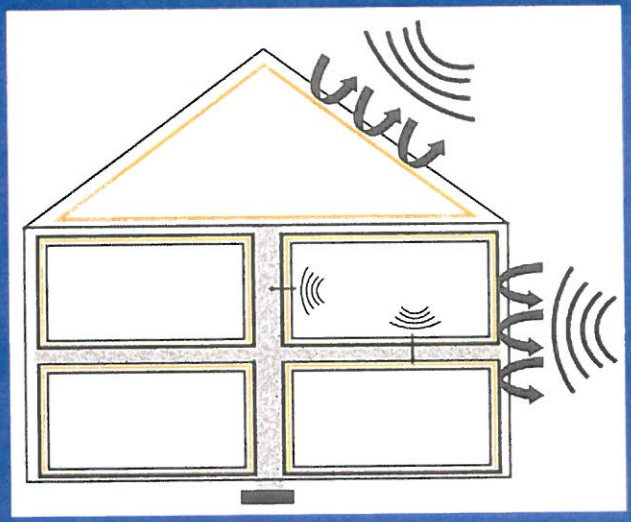
Such a heat insulation degree exceeds in a remarkable way the peculiar values of the partitions or curtain walls obtained with the traditional systems; this produces energy saving equal to **40%** both while heating and while cooling.





EMMEDUE BUILDING CONCEPT

Advantages



EXCELLENT ACOUSTICS

The soundproofing of the **EMMEDUE®** panels is one of the advantages of the building system. Verifications carried out on **EMMEDUE®** panels have given very good results, thus demonstrating the suitability of the panels under the most difficult whether conditions, in compliance with the technical set of rules in force.

EMMEDUE BUILDING CONCEPT

Advantages

FIRE RESISTANT

The quality of the foam polystyrene used is **F** type, self-extinguishing in compliance with the **DIN 4102** rules. Fire resistance tests carried out on **PSME80** panels have shown a result higher than **REI120**.

NOT AN M2 BUILDING

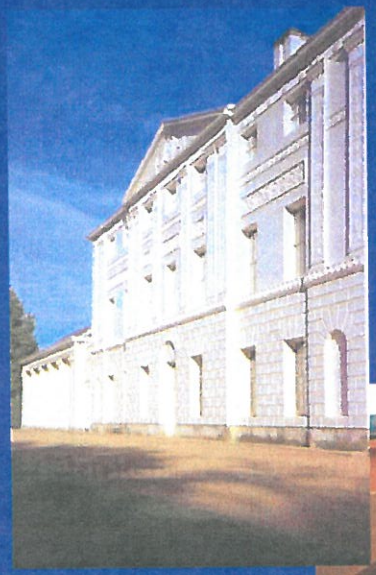
TIMBER FRAME

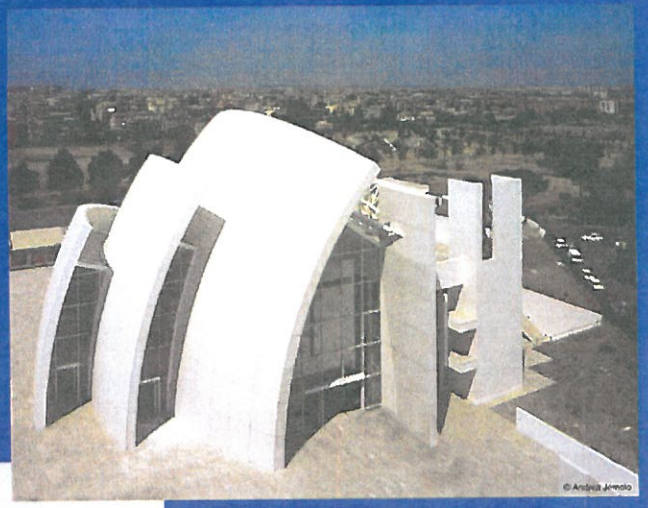
EMMEDUE BUILDING CONCEPT

Advantages

CHOICE OF FINISHES

The walls realized by the **EMMEDUE®** panels can be completed with the most various finishing's. It is possible to apply a thick coating right on the raw plastering or, as an alternative, ordinary painting on the smooth plastering. Any type of coating is possible, without exception.



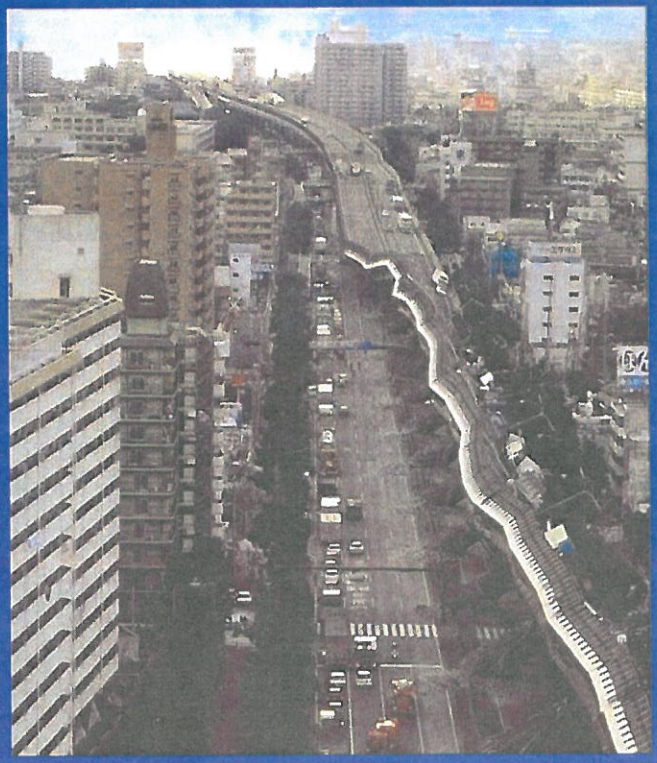


EMMEDUE BUILDING CONCEPT

Advantages

EARTHQUAKE RESISTANT

Laboratory tests carried out on one **EMMEDUE®** two-storey prototype, true scale, have shown that the structure resist and is not damaged by strains higher than those calculated for a **First Category Earthquake** that is the maximum provided for by the Italian seismic Standards.

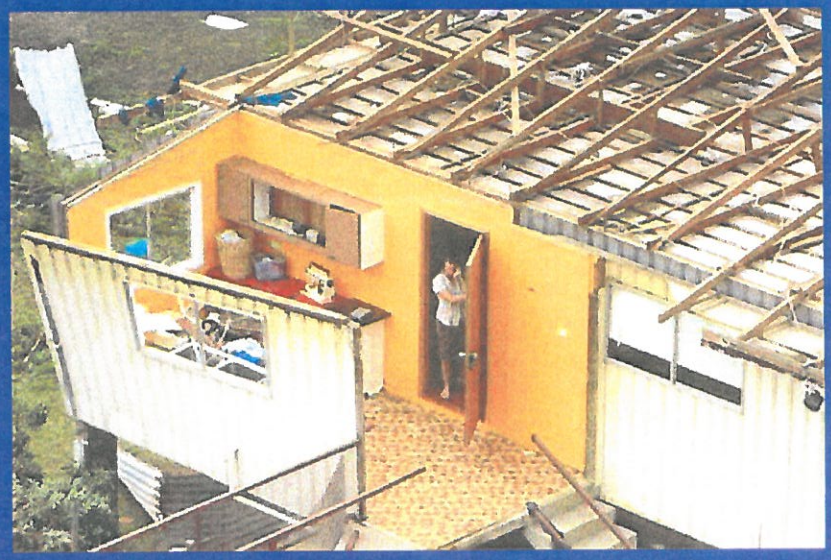


EMMEDUE BUILDING CONCEPT

Advantages

CYCLONE RESISTANT

Buildings realized with the **EMMEDUE®** system in areas at high risk of cyclones have demonstrated their ability to withstand the most devastating cyclones throughout the years; thus empirically confirming the results already obtained by calculation, that is to say that the **EMMEDUE®** buildings are extremely resistant to the complex strains and thrusts due to the force emitted by cyclones.



Stick Built Construction

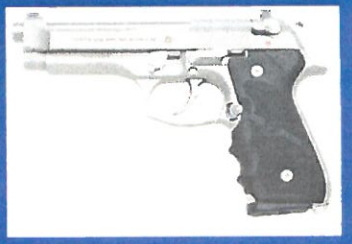
EMMEDUE BUILDING CONCEPT

Advantages
Bullet Proof

Bullet Proof buildings built with the **EMMEDUE®** system

The **EMMEDUE®** DVD demonstrates the ballistic tests carried out on the wall system.

Occupiers can have the comfort of knowing that their house has been constructed utilizing our wall panels properties.



Some of the guns tested on M2 walls

Comparison

Emmedue v Traditional Build

Time Savings

M2 panel
1.125m x 3m

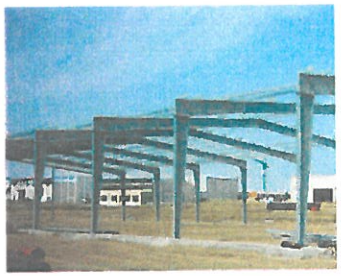
v

Block Work 1.125m x 3m
= 68 blocks (double leaf)

V

EMMEDUE COMMERCIAL PROJECTS

The EMMEDUE panels are light and versatile, ideal for the erection process, and strong and robust once the concrete has been applied.

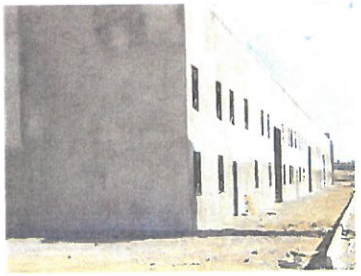


1. Steel frame erected

2. Any worker, even by himself, can easily handle our wall panels without difficulty

3. Wall panels erected

4. Spraying of concrete onto the building



5. Finished concrete sprayed building

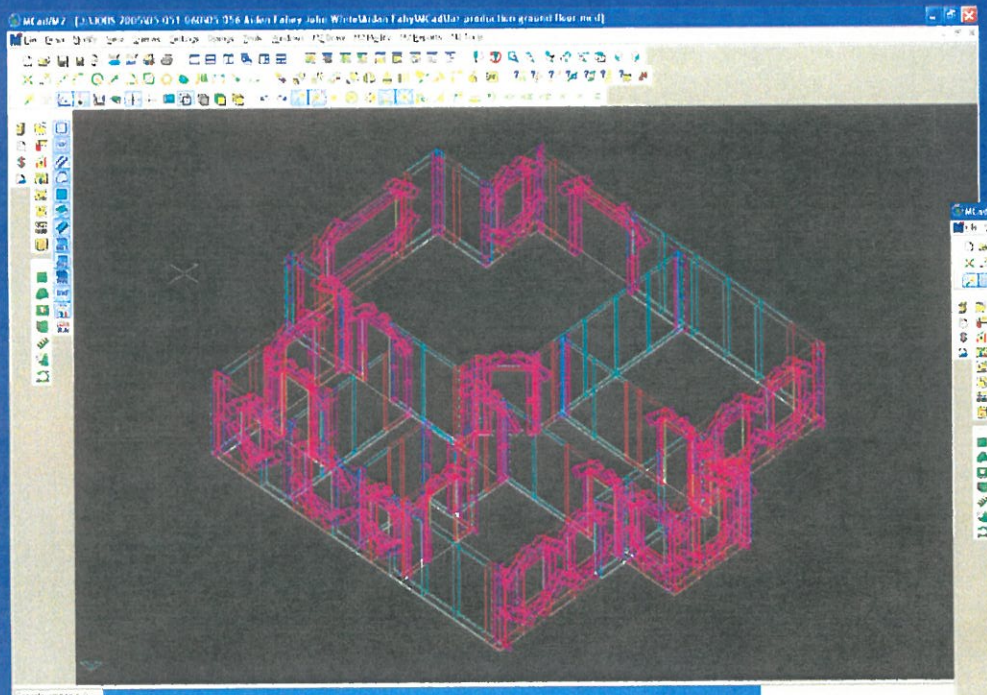
Advanced Building System

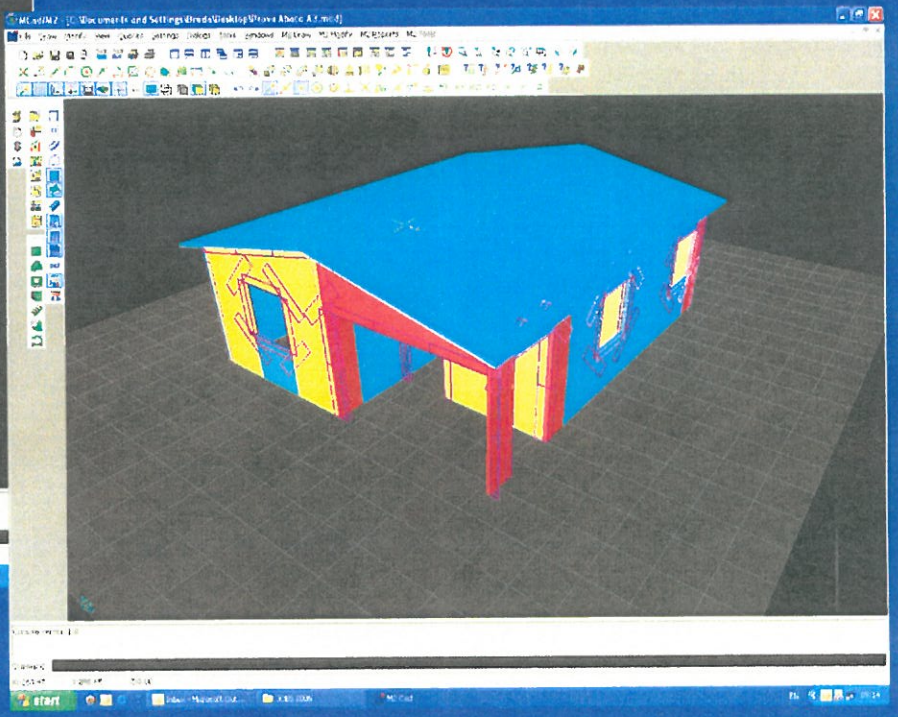
EMMEDUE MULTI STOREY PROJECTS

EMMEDUE is an innovative insulating building system enabling the construction of buildings from 1 up to 20 storeys as well as architectural structures from the simplest to the most complex

Advanced Building System

Drawings to Cad to Construction





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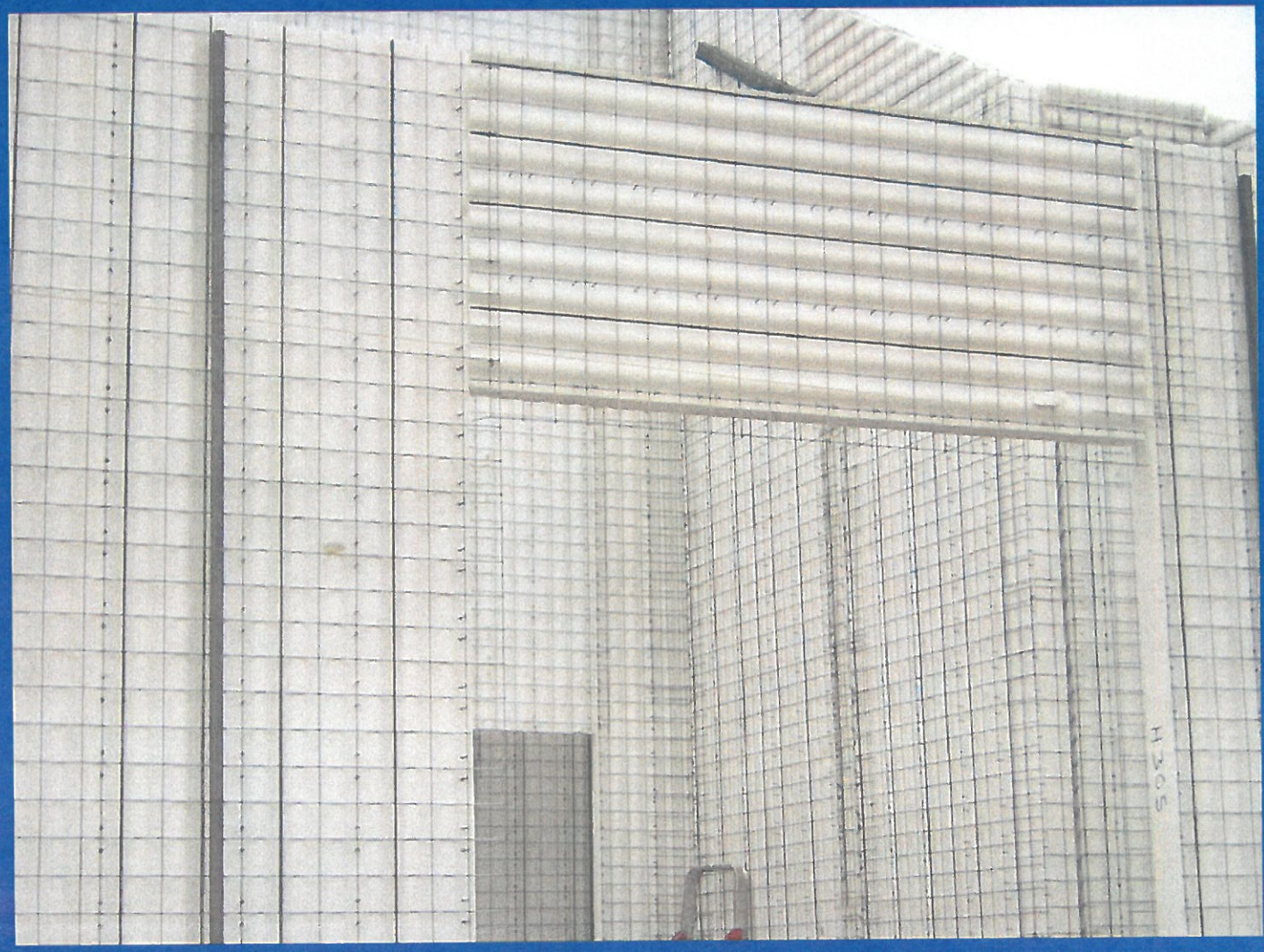
EMMEDUE



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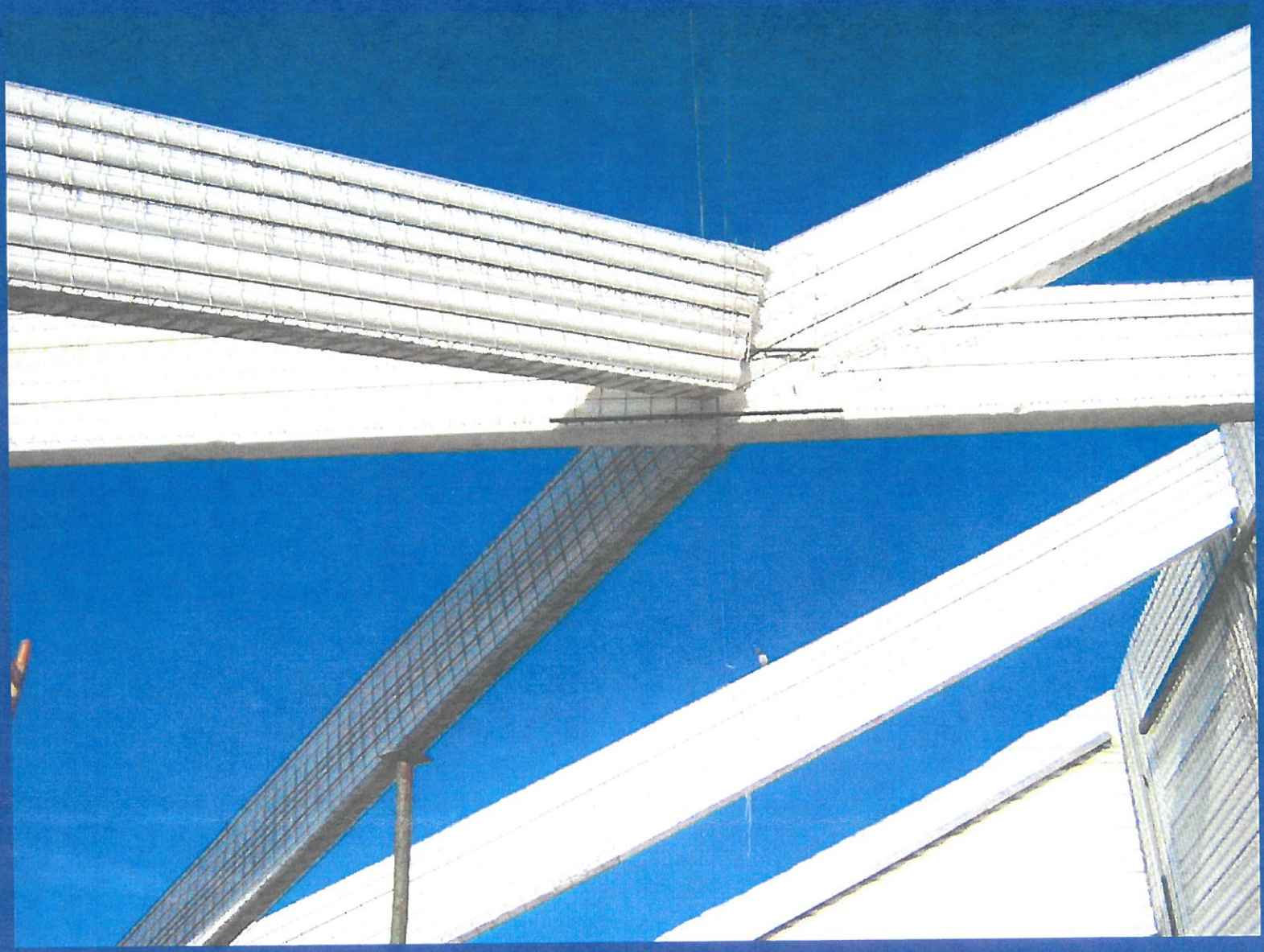

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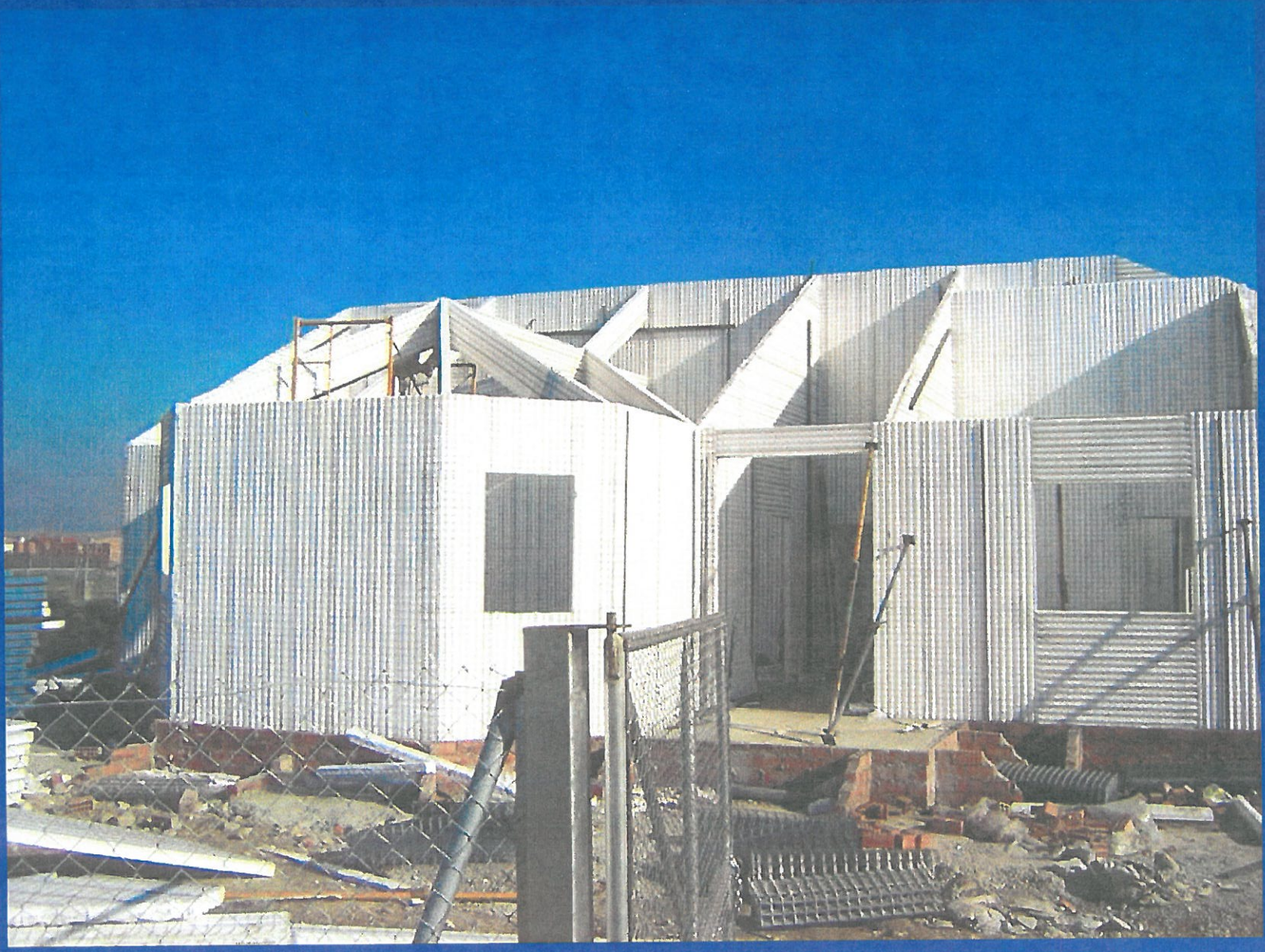

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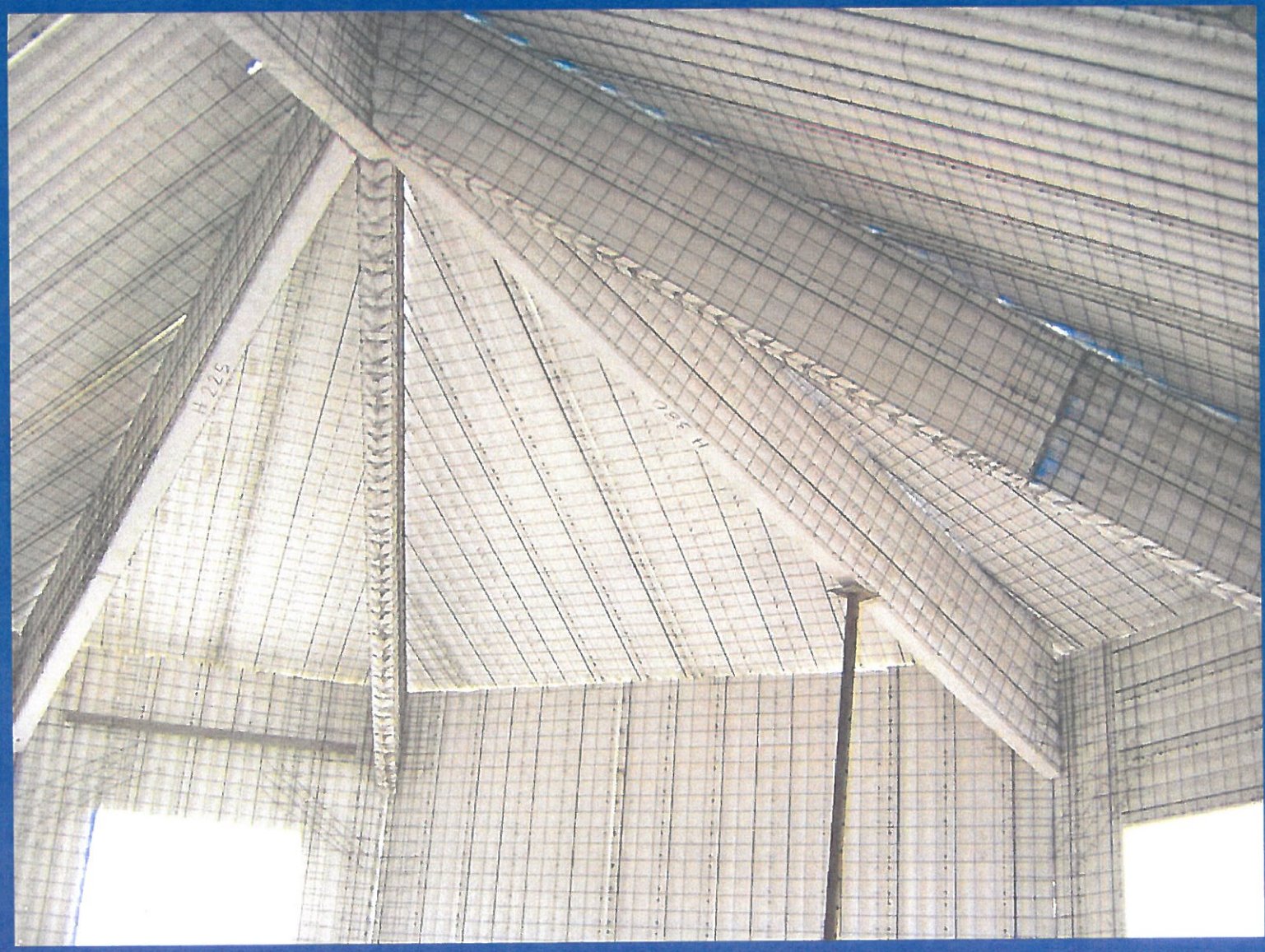

M2 EMMEDUE

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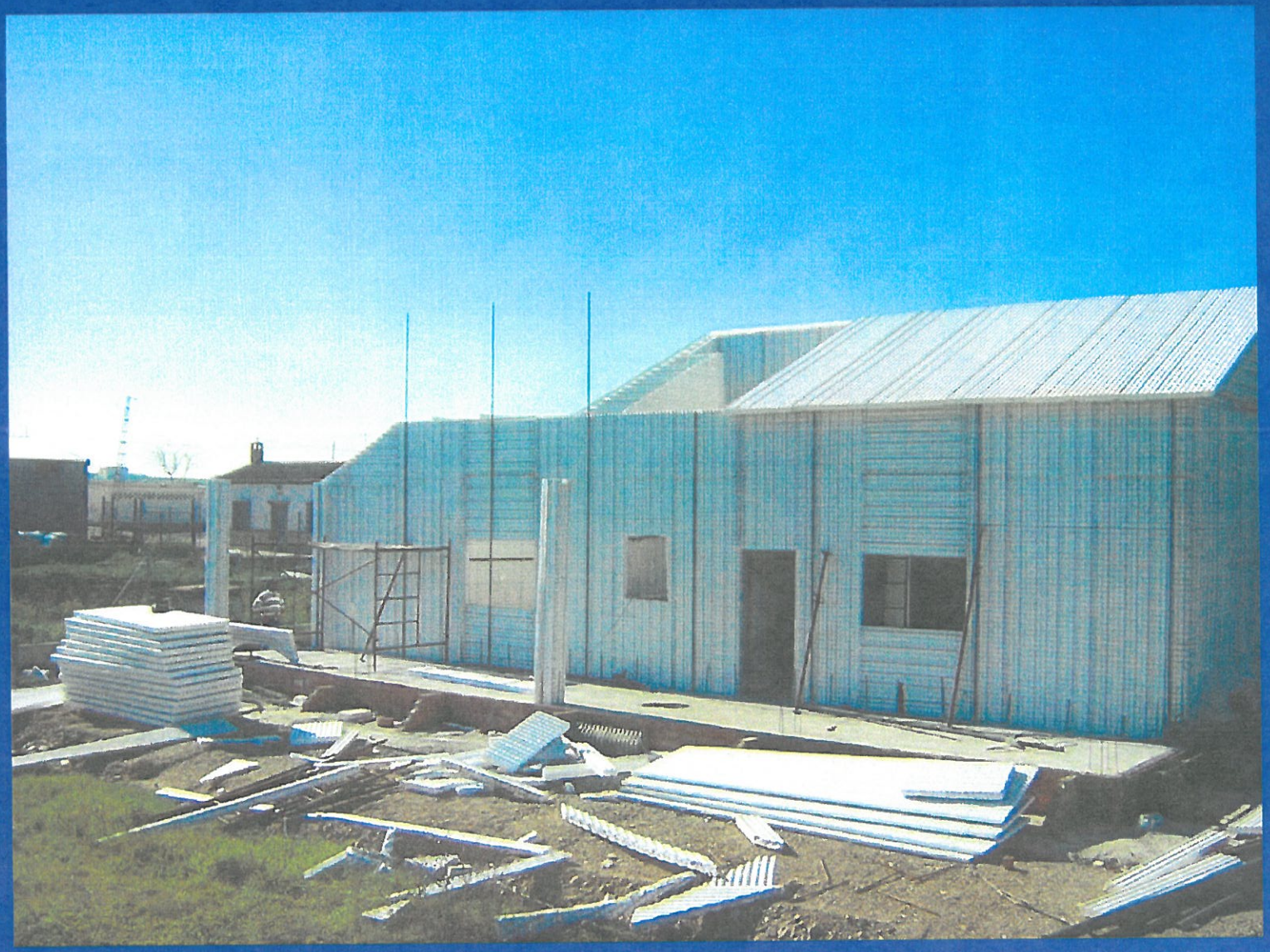

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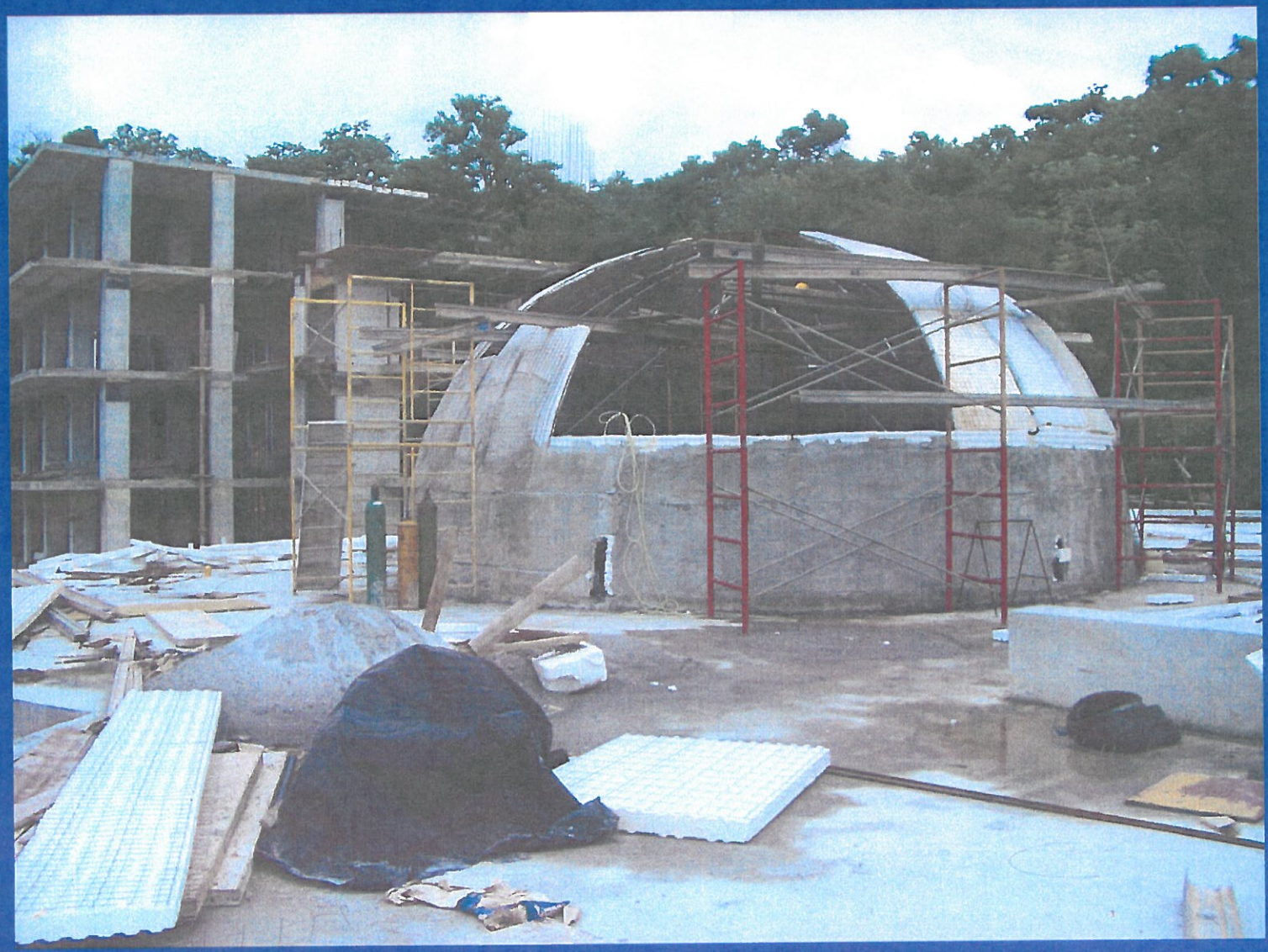

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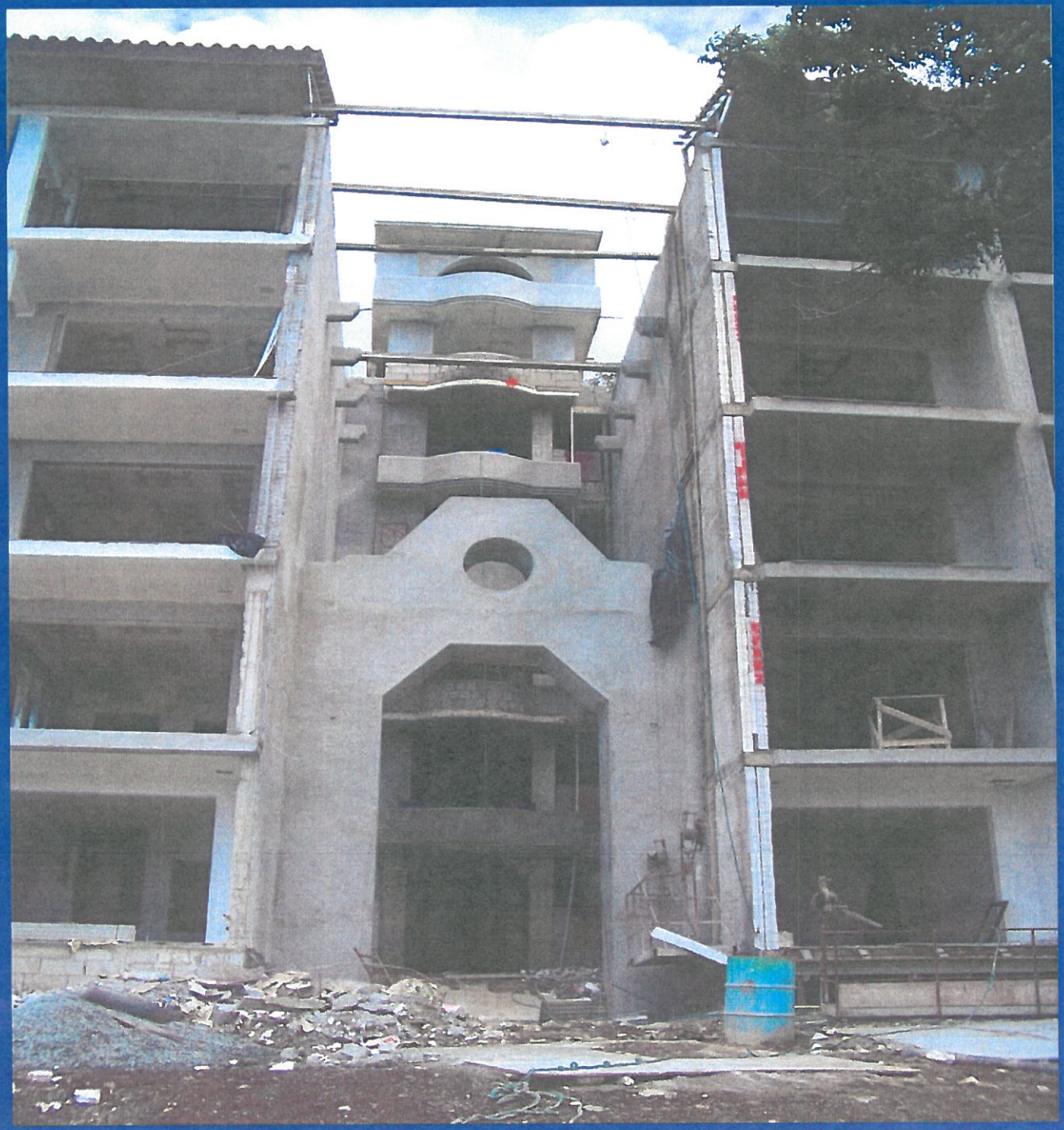

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Photo: Peter Barrow, 27th October 2005, Tel: 0872-559638

M2 EMMEDUE

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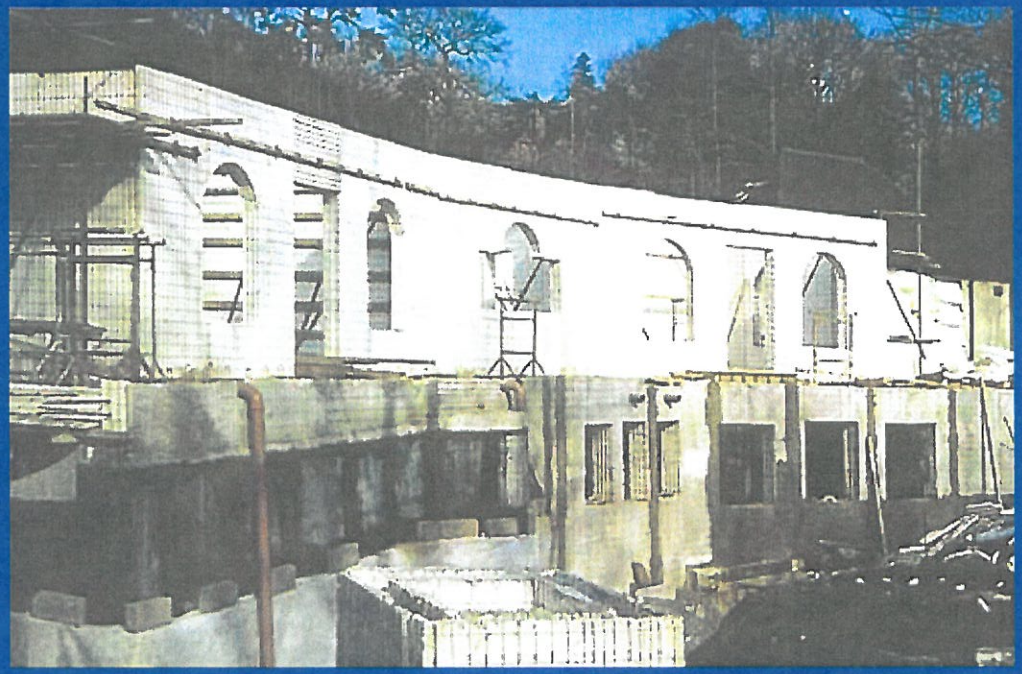

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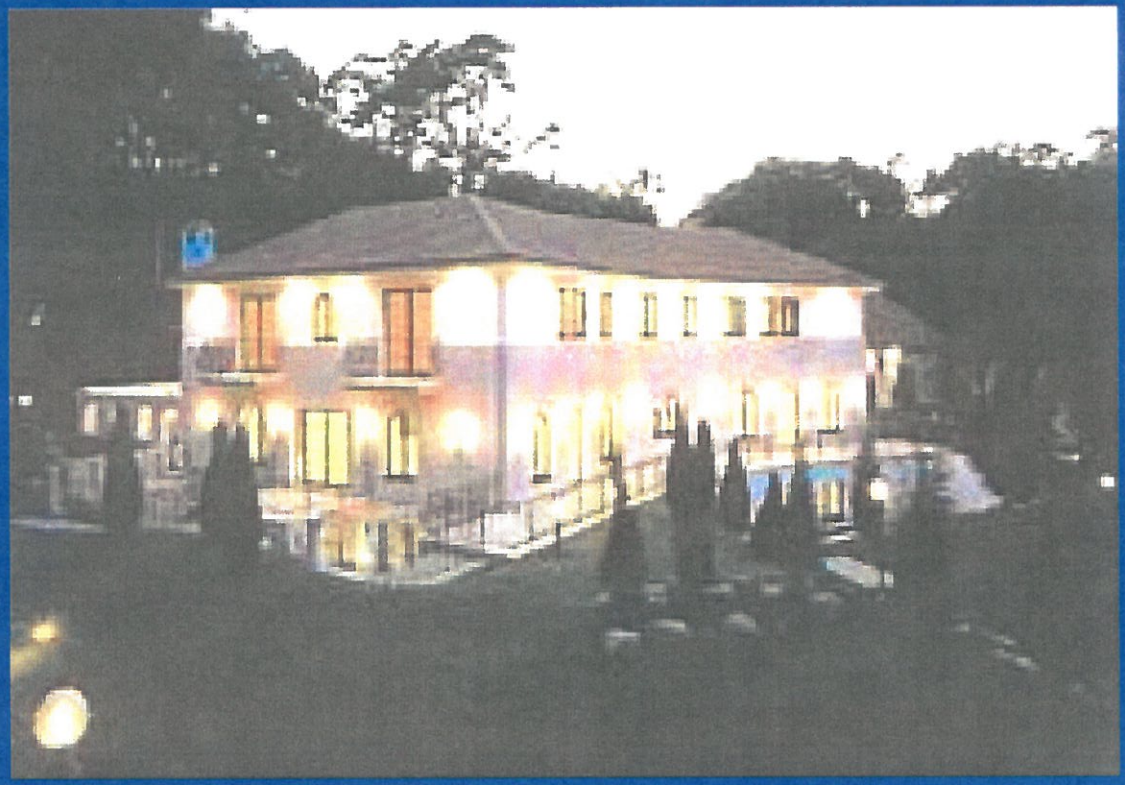

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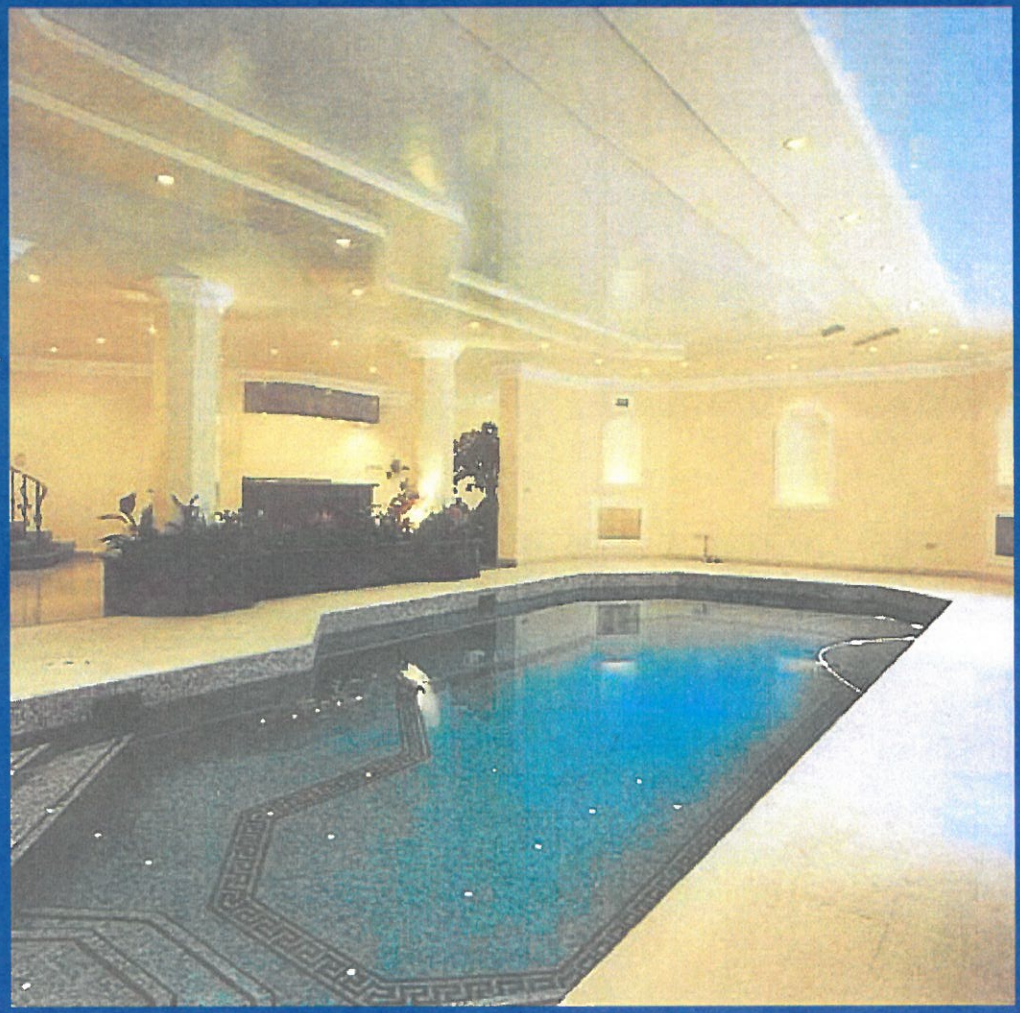

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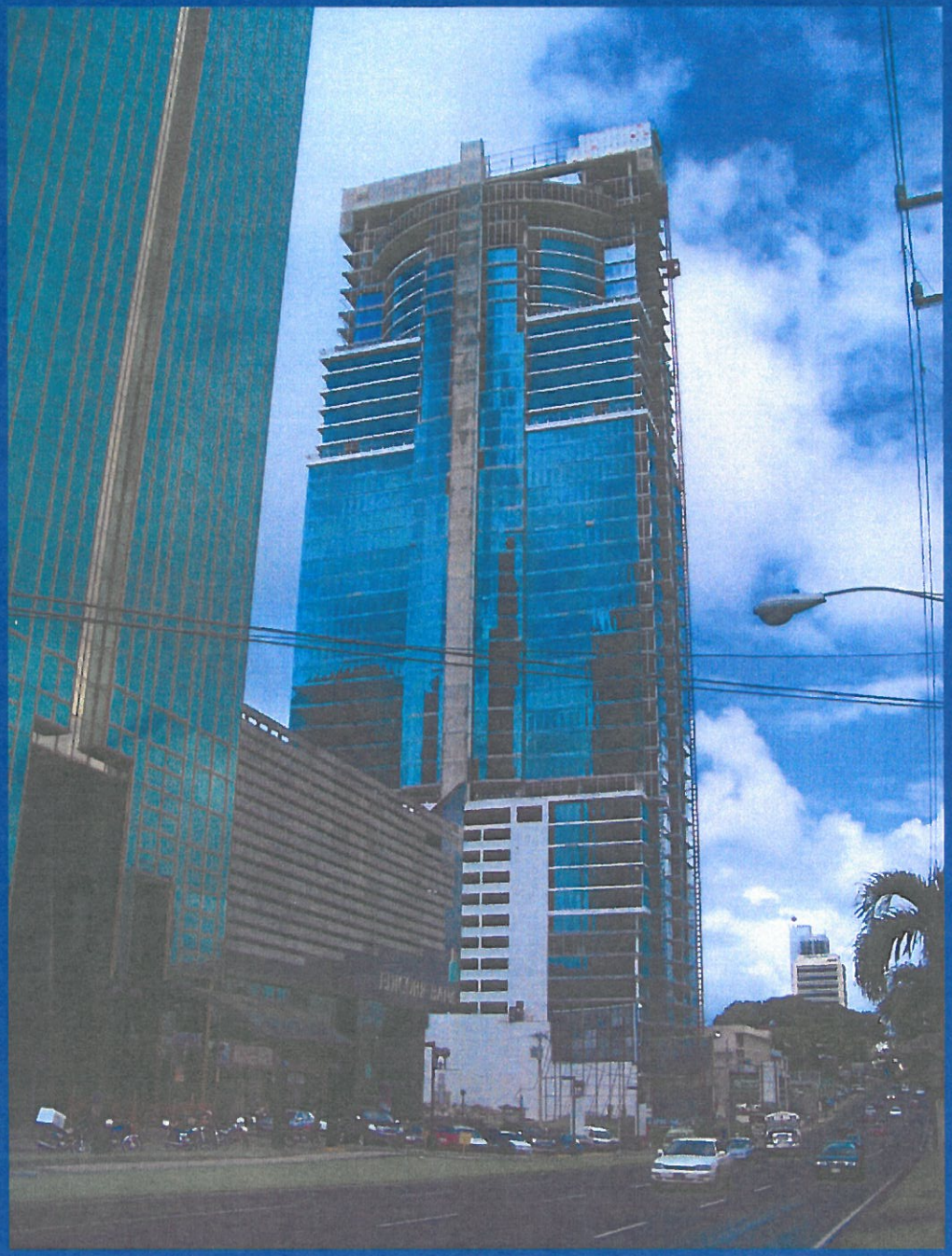

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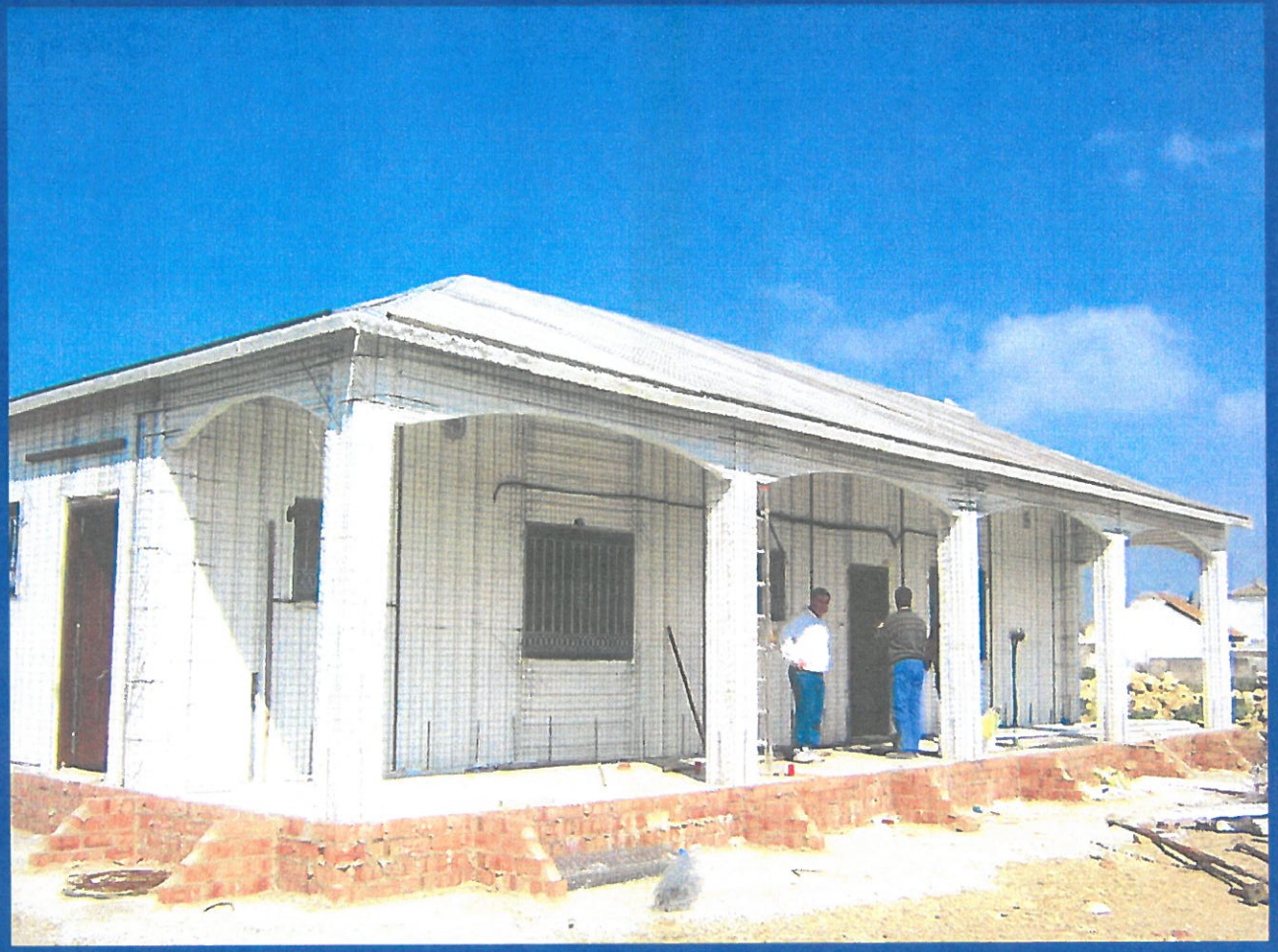

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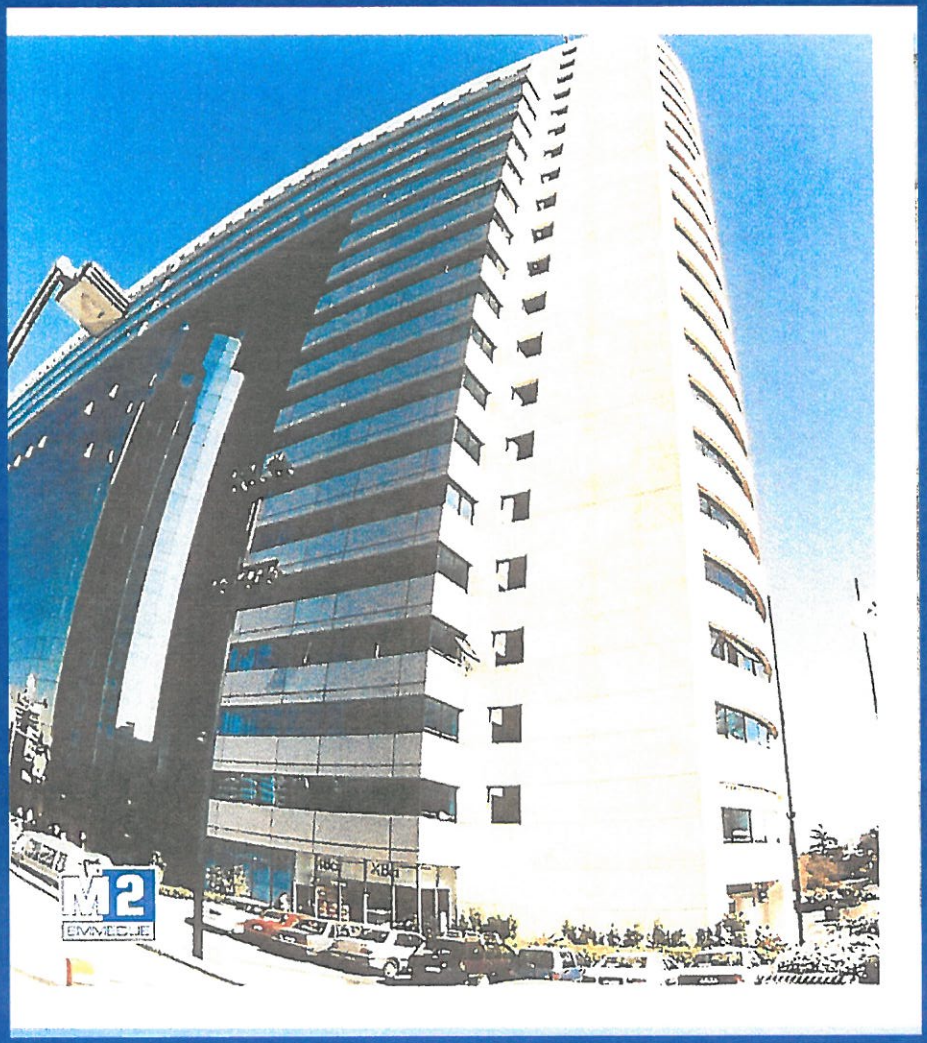

M2
EMMEDUE

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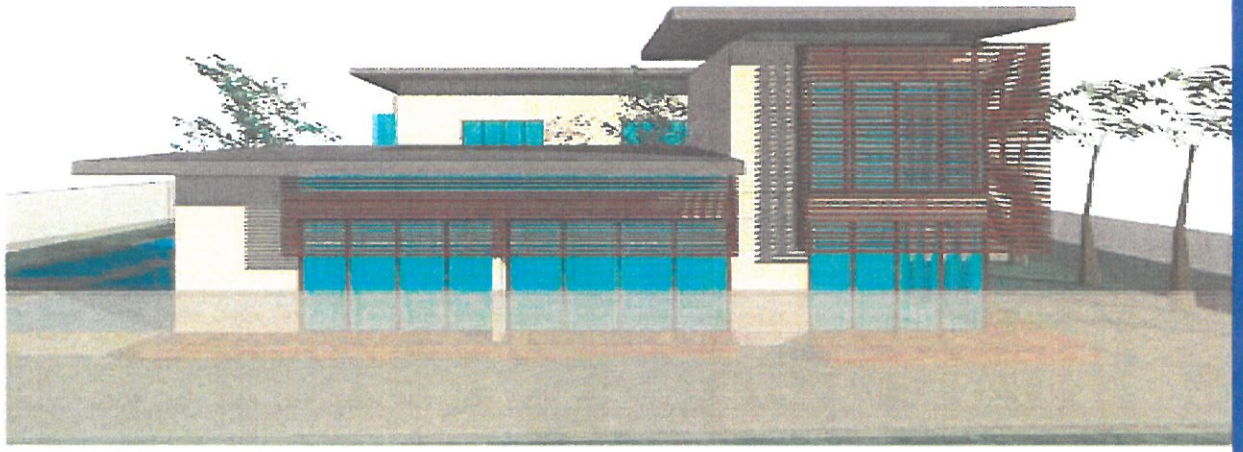
M2 EMMEDUE

VILLA TYPE A

ELEVATION _ FRONT



ELEVATION _ LEFT

VILLA TYPE A 1070 Sq Meters

EMMEDUE BUILDING CONCEPTS

Thank you for your Time