www.rcenggstudios.com	DESIGN OF ROOF DECKING SHEET AND CONCRETE ROOF SLAB	Rev:	
		Date:	

MATERIAL DATA:

Concrete	fck	=	25	N/mm^2
Reinforcing Steel	fy	=	500	N/mm^2
Young's Modulus of Profiled Sheet	E	=	200000	N/mm^2
Yield Strength of Profiled Sheet	Fy	=	250	N/mm^2
Unit weight of Wet Concrete		=	27	kN/m^3
Unit weight of Concrete		=	25	kN/m^3
Unit weight of Foam Concrete		=	10	kN/m^3
Unit weight of Cast-in situ panel		=	25	kN/m^3
Thickness of Foam Concrete layer		=	75	mm
Thickness of Cast-in situ panel		=	20	mm

PROFILED SHEET SPECIFICATION:

Thickness	t	=	0.8	mm
Height of rib	h	=	44	mm
Spacing of ribs	s	=	130	mm

GEOMETRY DATA:

Shorter Span (Spacing of secondary beams)	Lx	=	1.000	m
Longer Span	Ly	=	5.4	m
Concrete Slab Thickness above sheet		=	100	mm
Total Slab Thickness		=	144	mm
Effective depth of Concrete Slab	d	=	114	mm
Average Depth		=	122	mm
Dia of bar		=	10	mm

1. CASE (1) DURING CONCRETING:

(1.a). Load Calculation:

Self weight of Sheeting		=	0.0778	kN/m^2
Weight of Wet Concrete, for average thickness		=	3.294	kN/m^2
Total Dead Load	Wd	=	3.3718	kN/m^2
Live Load (lesser Live load during concreting)	Wl	=	1	kN/m^2
Total Load	Wd+Wl	=	**4.3718**	**kN/m^2**

(1.b). Check for Allowable Load - Bending Stress Criteria:-

(i). Check for Single Span Arrangement:

As per sheeting catalogue, for 0.8mm thickness and Single-span arrangement, allowable loads are as below

For 1m span, allowable load	=	15	kN/m^2	**REFER CATALOGUE**
For 1.5m span, allowable load	=	5.25	kN/m^2	
Max span used in drawing	=	1.000	m	
Interpolating for the square of spans				
	=	5.25+{[(15-5.25)/(1.5^2-1^2)]*(1.5^2-1^2)}		
Max. allowable load for the span used	=	**15.00**	**kN/m^2**	

> Actual load = **4.3718** **kN/m^2**

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(ii). Check for Multi Span Arrangement:

As per sheeting catalogue, for 0.8mm thickness and Multi-span arrangement, allowable loads are as below

For 1m span, allowable load = 18.9 kN/m^2

For 1.5m span, allowable load = 8.4 kN/m^2

Max span used in drawing = 1.000 m

REFER CATALOGUE

Interpolating for the square of spans

= 8.4+{[(18.9-8.4)/(1.5^2-1^2)]*(1.5^2-1^2)}

Max. allowable load for the span used = **18.90 kN/m^2**

> Actual load = **4.3718 kN/m^2**

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<u>(1.c). Check for Allowable Load - Deflection Criteria:-</u>

<u>(i). Check for Single Span Arrangement:</u>

As per sheeting catalogue, for 0.8mm thickness and Single-span arrangement, allowable loads are as below

For 1.5m span, allowable load = 15 kN/m^2

For 2.0m span, allowable load = 5.25 kN/m^2

Max span used in drawing = 1.000 m

Interpolating for the fourth of spans

= 5.25+{[(15-5.25)/(1.5^4-1^4)]*(1.5^4-1^4)}

Max. allowable load for the span used = **15.00 kN/m^2**

> Actual load = **4.3718 kN/m^2**

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<u>(ii). Check for Multi Span Arrangement:</u>

As per sheeting catalogue, for 0.8mm thickness and Multi-span arrangement, allowable loads are as below

For 1.5m span, allowable load = 18.9 kN/m^2

For 2.0m span, allowable load = 8.4 kN/m^2

Max span used in drawing = 1.000 m

Interpolating for the fourth of spans

= 8.4+{[(18.9-8.4)/(1.5^4-1^4)]*(1.5^4-1^4)}

Max. allowable load for the span used = **18.90 kN/m^2**

> Actual load = **4.3718 kN/m^2**

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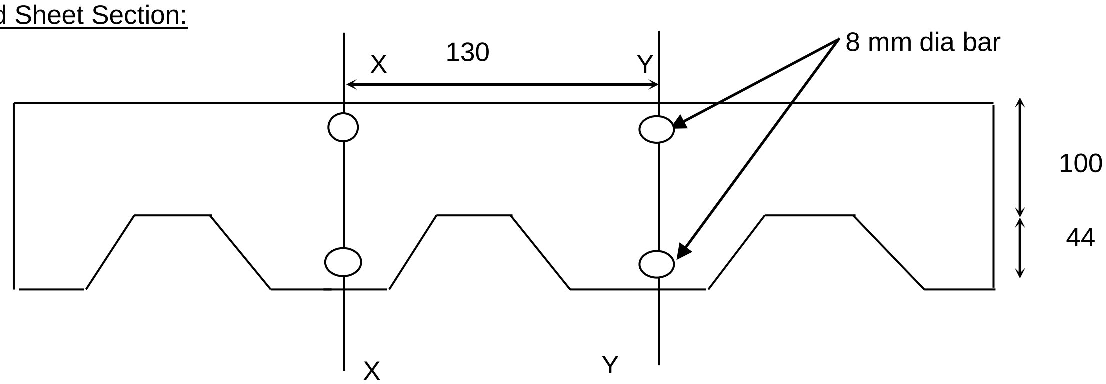
<u>2. CASE (2) AFTER CONCRETING:</u>

<u>Profiled Sheet Section:</u>



The slab between the sections X-X and Y-Y of 130 mm width is considered for design calculations.

<u>(2.a). Load Calculation:</u>

Weight of Structural Concrete	Wc	=	3.05	kN/m^2
Screed (75 thk average)		=	1.80	kN/m^2
Weight of Foam Concrete - 75 thick	Wf	=	0.75	kN/m^2
Weight of plaster - 15 thick		=	0.32	kN/m^2
Weight of water proofing membrane		=	0.15	kN/m^2
Weight of wearing course - 25 thick		=	0.625	kN/m^2
Total Dead Load	Wd	=	6.690	kN/m^2
Live Load	Wl	=	1.5	kN/m^2

Total Load	Wt	=	**8.19**	**kN/m^2**

(2.b). Reinforcement Calculation:

Bending Moment	M	=	$wl^2/10$	
		=	0.82	kNm
	k	=	M_u/bd^2	
		=	1.5 x 819000 / (1000 x 114^2)	
		=	0.095	
Percentage of tension reinforcement required	$(P_t)_{Req}$	=	0.022	
Minimum percentage of steel		=	0.12	
Area of steel required	A_{st}	=	136.8	mm^2/meter width
Required spacing of 10mm dia. bars	S_v	=	574 mm c/c	
Provided spacing of 10mm dia. bars		=	130	mm c/c
Area of steel provided		=	604.15	
Percentage of steel Provided	pt	=	0.530	%

Hence Provide 10mm dia. bars @ 130mm c/c spacing

(2.c). Check for Shear:

Total Shear Force per m width of slab	V	=	8.19*1	
		=	8.19	kN/m
Factored shear force, Vu		=	1.5 x 8.19	
		=	12.29	kN/m
Shear Stress m width of slab	τ_v = Vu/bd	=	12.29*1000/(1000*114)	
			0.108	**N/mm^2**
Shear Strength	τ_c	=	$\frac{0.85\sqrt{(0.8*fck)}\sqrt{(1+5\beta-1)}}{6\beta}$	

Where β=0.8fck/6.89p_t

(Ref. Pg. no. 92 of "Limit state design of Reinforced concrete" book by P.C.Varghese) **0.501 N/mm^2**

> τv = 0.108 N/mm^2

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Nominal reinforcement of 8mm dia @ 300mm c/c spacing is provided as Shear Links

(2.d). Check for Deflection:

Deflection is checked for average thickness		=	122	mm
Considering as simply supported slab				
Gross moment of inertia $(I)_{gr}$		=	$bD^3/12$	
		=	151320666.67	mm^4
Modulus of Rupture of Concrete	$(f)_{cr}$	=	0.7sqrt(fck)	
		=	3.5	N/mm^2
Neutral axis from top	(Y)t	=	D/2	
		=	61.00	mm
Modulus of elasticity of concrete	Ec	=	5000*sqrt(fck)	
		=	25000	N/mm^2
Moment of Resistance	Mr	=	fcr*Igr*/yt	
		=	8.68	KNm
Moment at service load	M	=	0.82	KNm
Since Mr>M, Ieff = Igr				
Actual deflection		=	$5Wl^4/(384EI_{eff})$	
		=	**0.03**	**mm**
Allowable deflection (Span/250)		=	**4**	**mm > 0.03 mm**
				SAFE