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Cost Benefit Analysis of Ewall Panels in Construction and its Comparison with AAC Blocks

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ABSTRACT: In this paper, a new ALC panel connector was proposed. It has a good engineering economy and high fault tolerance. A quasistatic loading experiment was carried out to verify the feasibility of the external ALC panel steel frame under seismic loading. The test phenomena, hysteretic curve, skeleton curve, stiffness degradation, and energy dissipation of two sets of full-scale specimens were analyzed and discussed. Moreover, the simulation of pendulous Z-panel connectors with different thicknesses was carried out using ABAQUS software. The comparison reveals that the semi-rigid connection has a full hysteresis curve, good energy dissipation capacity, and a 15% increase in peak load capacity. Finally, similar results for different thicknesses in the use of pendulous Z-panel connectors reveal that using the 6 mm connector may be the most economical solution.

The rapid development of the construction industry has promoted the emergence of autoclaved aerated lightweight concrete slab wall (ALC panel wall) materials. This new type of building raw material has excellent use characteristics: its light weight, fire resistance sound insulation performance, environment protecting, economic, convenient construction and other advantages, so it has been widely used in the field of construction. For example, it can be used in all kinds of residential housing, apartments, office buildings, underground garages and other buildings in the wall enclosure construction, making the above-mentioned buildings with higher
quality and practicality. In this paper, based on the analysis of the basic performance of ALC panel walls, the construction process, transport storage and technological innovation are combined to demonstrate the quality and anti-cracking control methods in the installation process
of ALC panel walls, and the reinforcement measures to improve the construction efficiency of ALC panel walls, in view of the cracking and quality problems.

KEYWORDS: Autoclaved lightweight aerated concrete (ALC) panel/eWall, Cost Analysis

I. INTRODUCTION

ALC plate is the abbreviation of autoclaved lightweight concrete (autoclaved lightweight concrete) plate, which is made of silica sand and water Mud, lime and other main raw materials, through high temperature, high pressure, steam curing and high performance, multi-purpose porous concrete forming plate, is a kind of performance Superior new building materials ALC plate

is the abbreviation of autoclaved lightweight concrete (autoclaved lightweight concrete) plate, which is made of silica sand and water Mud, lime and other main raw materials, through high temperature, high pressure [1], steam curing and high performance, multi-purpose porous concrete forming plate, is a kind of performance Superior new building materials

II. APPLICATION SCOPE AND CHARACTERISTICS OF ALC PANEL:-

2.1 Scope of application:-

ALC board is suitable for new, reconstructed or expanded steel structure, reinforced concrete structure, roof panel and non-load

2.2 Characteristics

1) ALC board is 1 / 4 of ordinary concrete and 1 / 3 of clay brick in light weight. It has great strength but is lighter than water, so it is known as "high strength" Concrete floating on [4] the water.

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2) ALC microstructure is composed of numerous unconnected and uniform micro pores, which makes it have excellent insulation performance Its thermal performance is 10 times that of ordinary concrete, 6 times that of glass and 7 times that of clay brick [5].
3) ALC board is incombustible silicate material with high thermal resistance coefficient, good volume thermal stability, high fire resistance and high thermal stability The fire resistance of the wall panel is 3.23h for the thickness of 100 mm and more than 4H for the thickness of 150 mm; 50mm.
The fire resistance limit of thick plate protection steel beam is more than 3 h, and that of 50 mm thick plate protection steel column is more than 4 h, which all exceed the first class fire resistance standard
4) The ALC plate has the characteristics of light weight and high strength, and its scientific and reasonable installation node design and installation method make the plate have a certain value.
The wall can adapt to large horizontal displacement and angular displacement, so it has superior seismic performance.
5) Construction convenience. Aerated concrete products are accurate in size and light in weight, which can greatly reduce manpower and material input.
High efficiency can effectively shorten the construction period.

3. Rate of Plaster:-

As per BoQ - 398 Rs/Sq. m means 36 Rs/ Sq. ft.
1:6 Ratio for wall 12 mm thickness

4. Rate of Panel:-

For 50 mm Reinforced:-

- Rates only supply = 55 Rs. per Sq. ft
- Channel = 200 Rs. per nos.
- Compound = 800 Rs. per bag
- Mesh tape 100 Rs. per nos.
- screw = 2 Rs. per nos.

For 75 mm Reinforced:-

- Rate only supply = 80 Rs. per Sq. ft
- Channel = 220 Rs. per nos.
- Compound = 800 Rs. per bag
- Mesh tape =100 Rs. per nos.
- Screw = 2 Rs. per nos.

For 100 mm Reinforced:-

- Rate only supply = 105 Rs. per Sq. ft
- Channel = 240 Rs. per nos.
- Compound = 800 Rs. per bag
- Mesh tape = 150 Rs. per nos.
- Screw = 2 Rs. per nos.

Note: - Cost for block & plaster are as per BoQ

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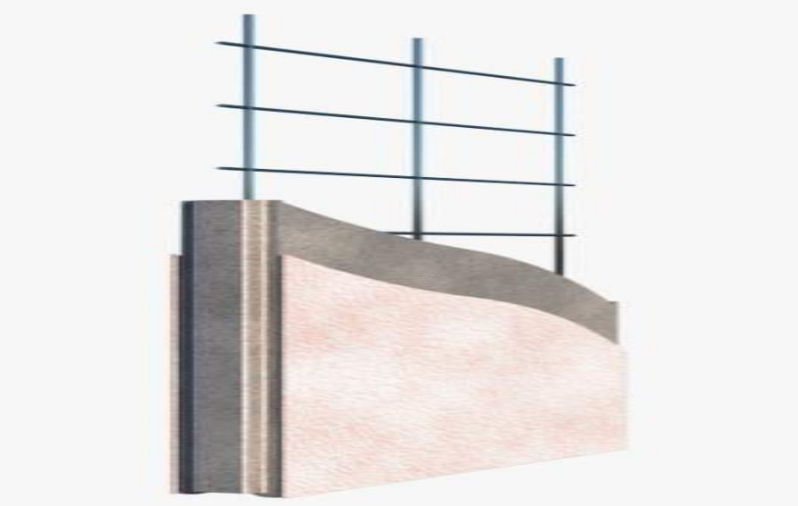

Image:- eWall Panel/ ALC Wall Panel (Without Foam or Thermocol)

5. Data Calculation for 100,150,200 mm Blocks:-

5.1 Cost of 100 mm block as per BoQ:-

Sr. No.	Thickness of wall	Wall Area		Rs. per Sqm	Rs. per sft	Amount
		Sqm	Sft			
1	**100 mm**	388	4174.88	1550	144.05	601400
		58	624.08	933	86.71	54114
		97	1043.72	1096	101.85	106312
Total		543	**5842.68**	3579	332.62	**761826**
Avg Sq. ft. rate of 100 mm block (without plastering)					**Rs. 110.87**	

5.2 Cost of 150 mm block as per BoQ:-

Sr. No.	Thickness of wall	Wall Area		Rs. per Sqm	Rs. per sft	Amount
		Sqm	Sft			
2	150 mm	1693	18216.68	1134	105.39	1919862
		506	5444.56	1176	109.29	595056
		740	7962.4	1219	113.28	902060
Total		2939	**31623.64**	3529	327.97	**3416978**
Avg Sq. ft. rate of 150 mm block without plastering					**Rs. 109.32**	

5.3 Costing of 200 mm block as per BoQ:-

Sr. No.	Thickness of wall	Wall Area		Rs. per Sqm	Rs. per sft	Amount
		Sqm	Sft			
3	**200 mm**	8791	94591.16	1312	121.93	11533792
		3074	33076.24	1368	127.13	4205232
		8130	87478.8	1414	131.41	11495820
Total		19995	215146.2	4094	380.48	27234844
Avg Sq. ft. rate of 200 mm block without plastering					**Rs. 126.82**	

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5.4 Plastering (12 mm thk, 1:4)

Sr No	Thickness	Sqm	Sft	Double Face Coat	Total Area (Sqmt.)	Total Area (Sqft)	Rate Per Sqmt	Rate Per Sft	Amount Rs.
1	100	543	5842.68	2	1086	11685.36	398	36.9	432228
2	150	2939	31623.64	2	5878	63247.28	398	36.9	2339444
3	200	19995	215146.2	2	39990	430292.4	398	36.9	15916020
Avg. Sqft Rate for Plastering = Rs. 36.98									

6 Cost Analysis (if Block replace with the eWall Panel)

6.1 100 mm thickness block replaced by 50 mm reinforced panel (eWall Panel):-

Only supply	55 Rs per sft			
	5842.68	55	321347.4	321347.4
Channel	**Wall area x height of wall *2/8**			
ht of wall 4.2 m = 13.6	5842.68	13.6	429.6088235	-
	429.6088235	2	859.2176471	-
	859.2176471	8	107.4022059	-
			110 nos	-
No of channels x rate of channel				
	110	200	22000	22000
Compound	**Wall area / 200 x Rate per bag**			
	5842.68	200	29.2134	-
	29.21	-	-	-
	30	800	24000	24000
Tape	**Wall area /2.7 / meter of tape**			considered 150 m
	5842.68	2.7	2163.955556	-
	2163.955556	150	14.42637037	-
	14.42637037	-	-	-
	15	100	1500	1500
Screw	**Number of chennel x 4 x rate**			
	110	4	440	-
	440	2	880	880
	-	-	-	-
Total				369727.4
Labour	20 Rs per sft			
	-	116853.6	116853.6	-
Miscellaneous	2%	369727.4	-	-
	-	7394.548	-	-
Transportation	5%	18486.37		
Grand Total		**Rs. 512461.918**		
50 mm Rate per Sft		Rs. 87.7100779		
50 mm Rate per Sft		**Rs. 90 per Sqft**		

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6.2 150 mm thickness block replaced by 75 mm reinforced panel:-

Only supply	Rs. 80 per sft			
	31623.64	80	2529891.2	2529891.2
Channel ht of wall 4.2 m = 13.6	31623.64	13.6	2325.267647	-
	-	-	4650.535294	-
	-	-	581.3169118	-
	-	-	585	-
	585	220	128700	128700
Compound	31623.64	200	158.1182	-
	158.1182	-	-	-
	160	800	128000	128000
Tape	31623.64	2.7	11712.45926	-
	11712.45926	150	78.08306173	-
	78.08306173	-	-	-
	80	100	8000	8000
Screw	585	4	2340	-
	2340	2	4680	4680
	-	-	-	-
	Total			2799271.2
Labour	20 Rs per sft	-	-	-
		632472.8	-	-
Miscellaneous	2%	2799271.2	-	-
	-	55985.424	-	-
Transportation	5%	139963.56		
Grand Total		**3627692.98**		
75 mm Rate per Sft		Rs. 114.714593		
75 mm Rate per Sft		**Rs. 120**		

6.3 200 mm thickness block replaced by 100 mm Reinforced panel:-

Only supply	105 Rs per sft			
	215146.2	105	22590351	22590351
Channel ht of wall 4.2 m = 13.6	215146.2	13.6	15819.57353	-
	-	-	31639.14706	-
	-	-	3954.893382	-
	-	-	3960	-
	3960	220	871200	871200
Compound	215146.2	200	1075.731	-
	1075.731	-	-	-
	1080	800	864000	864000
Tape	215146.2	2.7	79683.77778	-
	79683.77778	150	531.2251852	-
	531.2251852	-	-	-
	535	100	53500	53500
Screw	3960	4	15840	-

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	15840	2	31680	31680
	-	-	-	-
	-	-	**Total**	24410731
Labour	20 Rs per sft			
		4302924		
Miscellaneous	2%	24410731		
		488214.62		
Transportation	5%	1220536.55		
Grand Total		30422406.2		
100 mm Rate per Sft		141.403409		
100 mm Rate per Sft		**Rs. 145**		

6.4 Cost of AAC with Plaster

Sr. No.	Thickness	Block Area	Plater Area	Rate of block	Rate of plaster	Total	Rate per sft
1	100	5842.68	11685.36	761826	432228	1194054	204.3675163
2	150	31623.64	63247.28	3416978	2339444	5756422	182.029077
3	200	215146.2	430292.04	27234844	15916020	43150864	200.5653086
Total		252612.52	-	31413648	18687692	**Rs. 50101340**	-

6.5 Costing of ewall Panel with installation

Sr. No.	Thickness	Area sft	Amount	Rate per sft
1	50 mm Reinforced	5842.68	525841.2	90
2	75 mm Reinforced	31623.64	3794836.8	120
3	100 mm Reinforced	215146.2	31196199	145
Total			**Rs. 35516877**	

6.6 Result Analysis:-

As per the Cost analysis and Comparison of Cost of eWall Panel with AAC Blocks following Results are found:-

- **Cost of AAC block with plaster = Rs. 5,01,01,340/-**
- **Cost of eWalls with installation = Rs. 3,55,16,877/-**

Difference amount = Rs. 1,45,84,463/-

Conclusion:-

eWall panel wall has excellent practical performance and meets the requirements of national green and sustainable development and can meet the design standards of higher requirements. Cost of panel walls is less than AAC (Autoclaved Aerated Concrete) blocks depend on various factors such as material prices, labor costs, transportation expenses, and the specific requirements of the construction project. Here are some key Concluded points:

Material Cost: Panel walls may have lower material costs compared to AAC blocks, especially if the panels are made from inexpensive materials such as plywood, fiber cement, or gypsum board. AAC blocks, on the other hand, are manufactured using cement, sand, lime, and aluminum powder, which can be relatively costly.

Labor Cost: Installation of panel walls may require less labor compared to AAC blocks since panels are typically larger and easier to handle while AAC block installation may require more labor due to the need for precise laying and alignment.

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Transportation Cost: Panel walls, especially prefabricated ones, can be transported more efficiently compared to AAC blocks, which are heavy and bulky. This difference in transportation cost can affect the overall cost of the materials.

Construction Time: Panel walls, especially prefabricated ones, can be installed quickly, reducing labor costs and potentially accelerating the construction schedule. AAC block construction may take longer due to the need for mortar curing between layers.

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