

A Realistic Cost Assessment for a Conventional Dwelling Unit (DU), Partially and Selectively Replaced With Engineered Bamboo

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Abstract: The BPL (Below Poverty Line) definition has recently been revised. Now a larger number of households fall under this category as the income bar was raised to Rs 5000 per HH of 5 members. It has therefore been realised that unaffordability starts at a much higher income group level. A conventional Dwelling Unit is unaffordable by most households that are Below Poverty Line (BPL). A study shows that bamboo can replace steel in columns, Slabs and beams. It can replace bricks for inner walls; The DU thus designed can bring down costs without compromising on quality, safety and durability. However, even this DU is unaffordable by the BPL households in India. The urgency therefore increases, for realistic cost assessments. The research on cost estimates for a partially bamboo substituted house design has been conducted, for different built-up areas. The recommended size has been taken as the datum for assessment purposes.

Keywords: Below poverty line, Unit Cost of Construction, House Hold Income, affordable housing, Realistic Estimates.

I. Introduction

To make realistic assessments, a convergence of the general understanding of the Govt. definition of BPL and the simulated results that reveal what is possible in these incomes and what incomes are required for what can be termed as acceptable.

For the purposes of a realistic understanding of affordability a modest conventional DU with minimum requirements was designed as a framed structure. A ground floor structure with an area of 450 sq ft. G+1 being 900 sq ft. Care was however taken in ensuring that no compromises were made in the non negotiable or semi-negotiable parameters.

The simulations to begin with, make use of all the RCC items with Steel Reinforced Concrete (SRC), except roof slab of first floor. Unit cost @ Rs. 659/Sq.Ft., Area = 450 Sq.Ft. per household, in a G+1 structure. While BPL latest definition places a household monthly income at Rs. < / =5000, the simulation exercise establishes that even the cream layer of BPL cannot afford a house as per these norms that have been framed.

II. What Is BPL?

Defined as a category of households having 5 members, whose household monthly income is less than or equal to Rs 5000/- these households are those who in reality are usually homeless or those that live in shanties, or houses that are unfit for human habitation.

They are found living on unauthorized land and are non tax payers. Their informal economic status and uncertain source of livelihood, most often excludes them from the mainstream benefits. Hence the Govt. issues them a BPL card, so that small benefits can be made provisions for, in the wake of their situation.

Table I: Affordability Estimates in relation to HH income

Income Group	Monthly Household (5 members) Income Rs.	Cost As a Multiple of Household Gross Annual Income (x)	EMI/Rent As a Percentage of Gross Monthly Income
BPL	< / =5000	</= 2x	5%
Annual	< / = 60,000		

Table II: Affordability Estimates in Absolute Figures (Govt. Data)

Income Group	Income Monthly Rs.	Affordable Cost of the House (in Rs) In Absolute Terms	Affordable EMI/Rent per Month (in Rs) In Absolute Terms
BPL	<=5000	< / = 1,20,000	</ = 250

III. Arriving At Realistic Estimates

Conventional Housing: The cheapest house that could be designed in a conventional way is a 450 sq ft DU with the following description: A modest conventional DU with minimum requirements designed as a framed structure. With a footprint of 450 sq ft, the structure with an area of 900 sq ft. is G+1 meant for two households. All the RCC elements are out of SRC, Unit cost @ Rs. 659/Sq.Ft., the DU would cost Rs.2,96,550/- Conversely, if a DU were to be constructed with the existing BPL definition, then the area of a conventional DU cannot exceed 182 Sq.Ft.

Alternative Housing: The cheapest DU After rigorous cost cutting, a drop in the cost is seen. A 13.8% reduction in cost with the unit cost of Rs. 568/- making the cost Rs. 2,55,600/-Conversely, if a DU were to be constructed with the existing BPL definition, then the area of an alternative DU would be 211 Sq.Ft.

Table III: Affordability test for Steel Reinforced Concrete, (SRC)

Income Group	Monthly Household (5 members) Income Required Rs.	Cost of the cheapest DU Designed out of conventional materials	EMI/Rent As a Percentage of Gross Monthly Income
BPL	< / =12,356	</= 2x= Rs.2,96,550/-	5%=618
Annual	< / = 1,48,275		

Table IV: Affordability test for Bamboo Reinforced Concrete (BRC)

Income Group	Monthly Household (5 members) Income Required Rs.	Cost of the cheapest DU Designed out of bamboo	EMI/Rent As a Percentage of Gross Monthly Income
BPL	< / = 10,650	< / = 2x = 2,55,600/-	5% = 533
Annual	< / = 1,27,800		

It is clear that to be able to afford the cheapest designed house (Bamboo or SRC) the HH must have a minimum monthly income of Rs. 10,650/- which is more than twice the envisaged monthly HH income. Houses of the sizes 182 Sq.Ft. and 211 Sq.Ft. for a family size of 5 is unfit for human habitation. Hence most houses either designed conventionally or through alternative materials are rendered unaffordable by all HHs belonging to the BPL category and also those that have incomes more than double of those below poverty line.

IV. Realistic Estimates Through Simulation

Realistic assessment of affordability needs to be made

In the name of lawfulness, a large majority of the lawless cannot be excluded from benefits of urbanism. It is only when the assessment affordability and /or un-affordability is unrealistic that laws get violated. [1]

A small but dignified DU was designed as a simulative exercise, for the purpose of arriving at realistic estimates for an affordable house by the combined incomes of a BPL HH. Initially the focus remained on architectural design measures for cost cutting. Ref. Figs. 1 & 2. The outcome was a G+1 structure for 2 households, each with an area (Built-up) of 450 Sq.Ft. It has been designed with built – in storage and is out of conventional RCC, a framed structure. It has all fixtures, fittings, and is structurally safe and durable. No compromises have been made on services, or its stability. Any further cost cutting would amount to compromises leading to the inclusion of non negotiable parameters, transforming it into a non-habitable house. The House to be designed for minimum 30 years of life span, and a structural design that offers a minimum factor of safety = 3. It must have all toilet and electrical fixtures, fittings, built-in storage units, doors windows grills, hard ware items like latches, stays, door locks, al-drops and general specifications like terrazzo tiles, glazed tiles wherever appropriate. Water, sanitation and plumbing, is to be fixed at basic level.

On closer analysis of the National Policies it is clear that what gets promised is what is “Possible to be built in a small budget while keeping the technology constant” and certainly not what is “desirable” or “acceptable” in terms of size and number of rooms. A unilateral decision on compromise of standards is being made uniformly across the country, thereby reducing the area, size of rooms, and number of rooms. Any constraints in exploring possibilities about material, design, technology or creative financial options will affect affordability [2]

Step by Step Material Substitution

In step 1- replacing steel with bamboo reinforced in most structural elements except in foundation, first floor slab, canopy and staircase

Step 2 - all other material substitutions remaining the same as in step 1, replace bricks in all internal walls on both floors with bamboo wall panels as per design.

Step 3- use of bamboo wall panels as a substitute for brick walls in all external walls on both floors above plinth level.

Step 4- Use of fly ash brickwork external wall 1:4 cement plaster, bamboo wall panels as a substitute for brick walls in all internal walls on both floors above plinth level

Step 5- Flushed doors shutters (wooden frame sandwiched between 4mm ply on both sides) to be substituted with bamboo ply flush doors. This 5 step substitution brought down the cost of the DU by 13.8%. Refer Table 5 Figure 1. Section

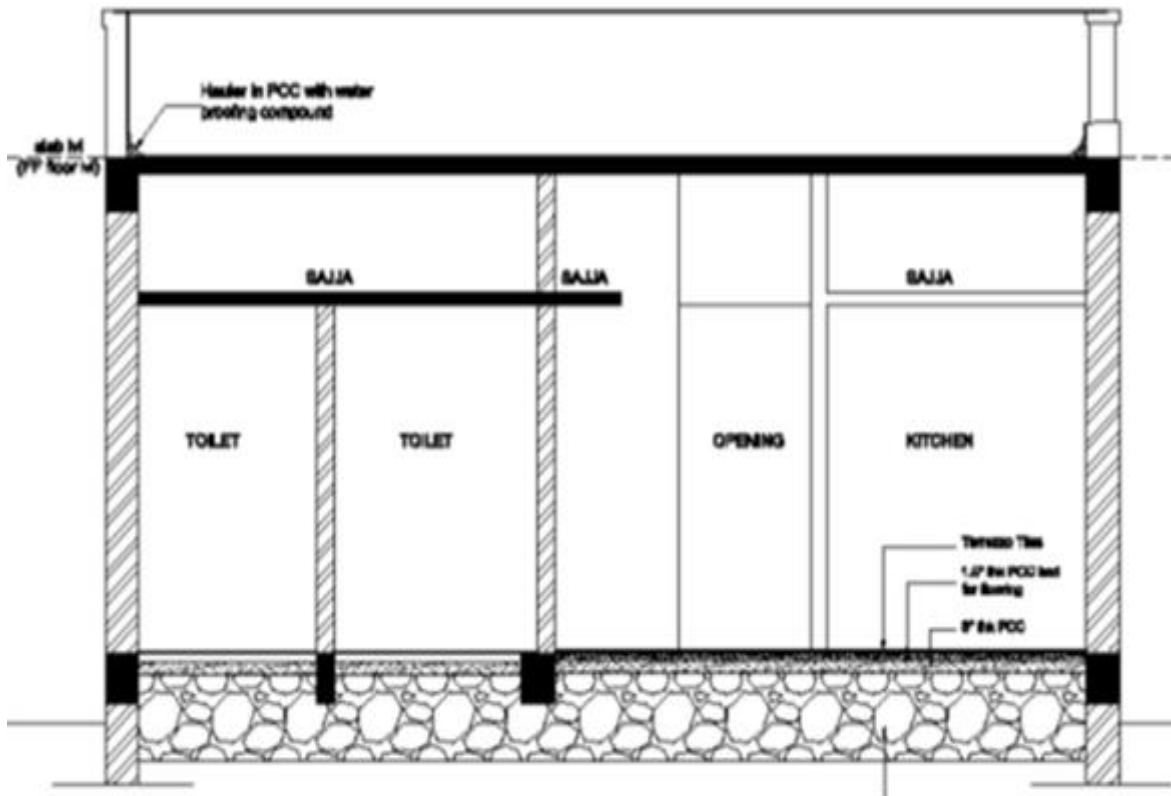


Figure 1. Section

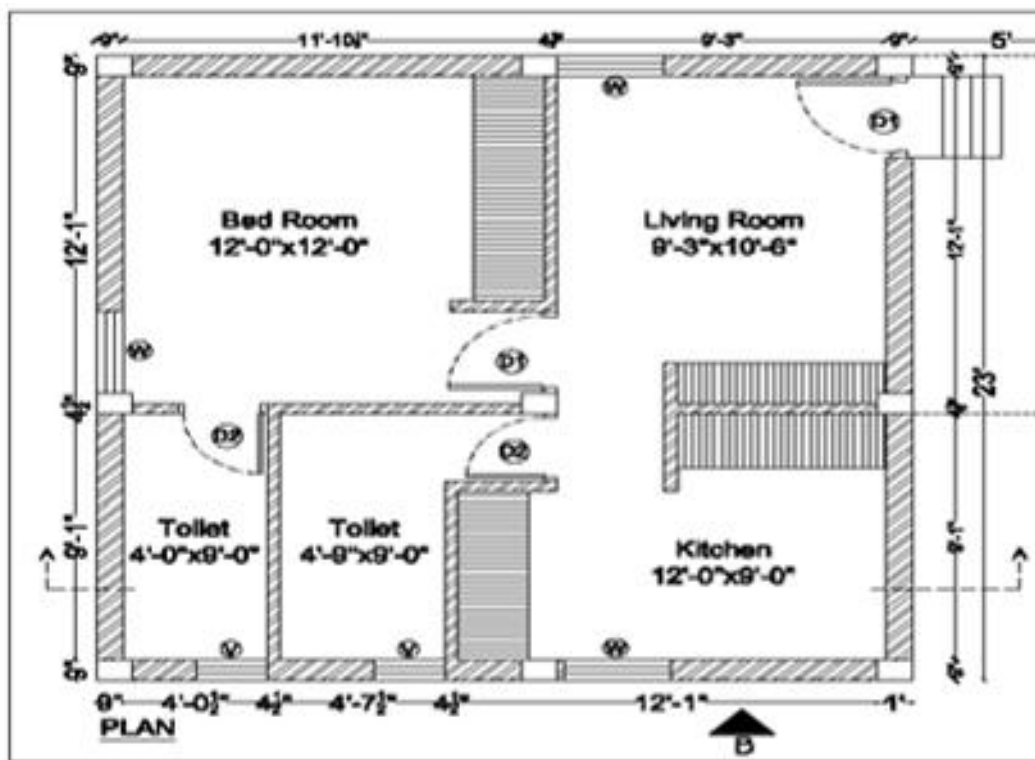


Figure 2. Plan

Table V. Summary of cost cutting

Cost Comparison SRC and BRC									
Standard Established for Comparison CASE II (A) Ground +1 Structure Using SRC									
SR.No:	Simulation Case No		Step by step Reduction in Unit Cost of Construction (Rs. Per Sq Ft)		Percentage Difference	Case wise (REAL) Cost of the DU		Monthly Income Required for Affordability of 350 Sq.Ft and 450 Sq.Ft AS PER GOI NORMS	
	From	To	From	To		↓	For 350 Sq.Ft	For 450 Sq.Ft	Rs. PM (350 Sq.Ft)
1	II (A)	II (B)	659	644	2.3%	2,25,400	2,89,800	9,392	12,075
2	II(B)	III	644	613	4.8%	2,14,550	2,75,850	8,940	11,494
3	III	IV	613	602	1.7%	2,29,250	2,94,750	9,552	12,281
4	IV	V	602	596	0.9%	2,08,600	2,68,200	8,692	11,175
5	V	VI	596	568	4.6%	1,98,800	2,55,600	8,283	10,650
6	Total Drop in highest Cost to lowest		659	568	13.8%	Inference: 1) Ground floor conventional house to G+ 1 selective bamboo substitution makes the DU cheaper by almost 25% 2) Ground +1 conventional house to G+ 1 selective bamboo substitution makes the DU cheaper by almost 14%			

Table VI: Reverse Iteration SRC

Final results at Rs.659 per Sq.Ft, for a DU of 450 Sq.Ft

Own Contribution @ 10 %+ Loan processing fee + Registration Fee Stamp duty DOWN PAYMENT	Gross Monthly Costs, (Rs.) EMI +HIDDEN COSTS	Total Monthly outgoings 0-19 years after one time payments	Total Monthly outgoings after 19th year
29,655+	EMI 2,224 +		
Loan processing fee = 111+	Maintenance 4,448/12 =371+	Rs 2,842 Increase of 27.8 %	618
Registration Fee Stamp duty = Rs.2,966	Taxes & User Charges 2,966/12 = 247		
Total = Rs. 32,732	Total = Rs 2,842		

Table VII: Recommended Affordability model for a BPL HH
Conventional SRC DU of 450Sq.Ft

Income Group	Monthly Household (5 members) Income Rs.	Cost As a Multiple of Household Gross Annual Income (x)	EMI/Rent As a Percentage of Gross Monthly Income
BPL	12,356	$\leq 2x = \text{Rs.}2,96,544$	23% = Rs. 2,842
Annual	$\leq 1,48,272$		

Tables 6 and 7 reveal that even in the case of steel reinforced concrete (SRC) other costs get added for loans, fees etc. these make the proposal of taking loan for a house, seem unattractive to the BPL house hold. Even through a subsidized loan channel it amounts to an increase of 23 % in the EMI (Equitable monthly installment). There is no respite for this income group unless there are waivers and subsidies integrated into the system.

Table VIII: Reverse Iteration BRC
Final results at Rs.568 per Sq.Ft, for a DU of 450 Sq.Ft

Own Contribution @ 10 %+ Loan processing fee + Registration Fee Stamp duty DOWN PAYMENT	Gross Monthly Costs, (Rs.) EMI + HIDDEN COSTS	Total Monthly outgoings 0-19 years after one time payments	Total Monthly outgoings after 19th year
25,560+	EMI 1,917+		
Loan processing fee = 96 +	Maintenance 2014/12 = 320 +	2450	533
Registration Fee Stamp duty = 2556	Taxes & User Charges 2556/12 = 213	Increase of 27.8 %	
Total = 28,212	Total = 2450		

Table IX: Recommended Affordability model for a BPL HH
Recommended BRC DU of 450sq.ft

Income Group	Monthly Household (5 members) Income Rs.	Cost As a Multiple of Household Gross Annual Income (x)	EMI/Rent As a Percentage of Gross Monthly Income
BPL	10,650	$\leq 2x = \text{Rs.}2,55,600$	23% = Rs. 2,450
Annual	$\leq 1,27,800$		

Similarly, a rise in monthly outgoings is seen (Ref tables 8 & 9) in the monthly outgoings which increase the cost burden on the beneficiary. These amount to 28 % more than the regular EMI that is expected to be paid, as EMI.

V. Conclusion

It is therefore concluded that unless the term “EMI” is replaced by “monthly outgoings” and subsidies waivers and grants are built into the housing finance system for the BPL category, no housing can be made available to the urban poor leave alone bamboo housing.

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