

Affordable Houses for Middle and Low Income Group in Ethiopia

Self help housing with innovative construction technology



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Introduction

In most of the developing countries in general and in Ethiopia in particular the availability of alternative building materials and the introduction of advanced construction technology are very much limited. Moreover the cost of available materials is very expensive and its share is about 70% of the total cost of the construction. Besides the government policy direction is mainly focussed on the implementation of integrated housing development program that is facilitated by federal government and applied by, regional states and city administrations. Therefore the paper aims to analyse the cost of alternative building materials and suggest diversified policy approaches that considered the contribution of various actors and different income level group of the society in line with facilitating decent shelter for all. Finally the cost effective local material and construction technology of Compressed Stabilized Earth Block (CSEB) is presented as practical workable solution for the construction of affordable housing units.

1 Shelter Situation Analysis

1.1 Basic General Data

Geography and Administration

Ethiopia is the horn of African country located between 330 and 480 East longitudes, and 30 and 150 North latitude. It has a rugged and mountainous topography with the altitude ranging from a height of 4620 m above sea level at mount RAS Dejen in North Gonder to a low of 110 m below sea level in the Dalol

Depression of the Afar Region. It has an area of 111.5 million ha. Since 1993 the federal states of Ethiopia has been divided into nine regional states and two city administration.

The capital city of the country, Addis Ababa, established in 1886 with 54,000 ha. and 50,000 population. It is third highest capital city in the world with an altitude of 2200m ASL. The Cabinet members are elected by the citizens and the cabinet elects the mayor.

Demography and Health

Demography

The total population of the country is 73,918,505 and the population growth rate is 2.6%. The urbanization rate is only 16%, which is very low compared to other countries. Addis Ababa is a primate city and its population size is 2,738,248 and its growth rate is 2.1 % (census result 2007).

Health

Only 31% of the total population has access to clean water. The coverage in rural areas is 24% while the coverage in urban areas is 72%. The estimation of HIV/AIDS infected people is 2.3% (national HIV/AIDS prevention summit April 6-8, 2009. Addis Ababa). The most widespread disease in Ethiopia are related and caused by malnutrition or water borne disease, bacterial and protozoa, hepatitis A & B, typhoid fever, malaria (state of environment report for Ethiopia 2003 and world fact book 2008) infant mortality rate per 1000 live births is 77.5. The life expectancy at birth for male is 52.92 and for female is 57.97years (the world fact book 2009).

Economy

Ethiopia is a country in the process of building the free market economy since 1991. The 2007 World Bank report shows the GDP of the country is US \$ 19.4 billion; GNI per capita is US \$ 220. The strategy of developing the economy is Agriculture Development Lade Industry (ADLI). Agriculture products account for 40-50%. The main agricultural export products are Coffee, oil seeds, skin and hide, flower, fruits, sugar, etc. Based on estimates of international poverty lines USD 1 per day in the country is 26.3% and 40% of the total households are poor. (W B 2005).

The 2001, Office for the Revision of Addis Ababa Master Plan (ORAAMP) report shows that 15.6% earn less than 20.4 Dollar, 67.24% generating income between 20.40 – 126.05 Dollar and the rest 17 .6% of the total house holds income level is greater than 126.05 Dollar.

According to the 1994 census result, 79.8% of the labour force was employed in the agriculture sector, 5.9% in commercial activities, 4.4% in other production activities, and 3.5% in hotels and restaurants.

1.2 Shelter Related Facts and Figures

Access to Shelter

Housing stock

The 1994 census result shows that the total housing units of Ethiopia is 1,482,589 and 374,742 that had been estimated to rose up to 444,742 by the year 2000 for Addis Ababa.

Housing deficit

The study of Integrated Housing Development Program (IHDP) undertaken in 2006 indicated that the housing deficit in the urban area of the country is 900,000 out of which 450,000 is the share of (Addis Ababa AACAA, 2006). Similarly ORAAMP estimated the housing units to be built up to 2006 are 314,422. 50% of the urban housing stock is in poor or irreparable condition (PADCO1997).

Occupancy

The number of households of urban area at national level is 3,009,285 and house holds in Addis Ababa are 651,970. (Census result 2007).

The average national house hold size in the urban area is 3.9 while the Addis Ababa house hold size is 4.1. (Census report 2007). Persons per housing unit are 5.5 and the number of house hold per housing unit is 1.1(CSA, 1999). An average floor area per person is about 12m².

Housing standard

97.4% housing stock built with permanent structure of which 82.3% are made of mud and wood. 80% of the citizens are living in the substandard houses.

Tenure of households

Land is a common property of nations, nationalities and peoples of Ethiopia and shall not be subject to sale. Land is to be leased to commerce or made available for voluntary settlements. Freehold lands occupied by private owners are expected to pay land rent.

Rental (formal and informal)

In the particular case of Addis Ababa 37.92% of housing units are rental houses owned and administered under the government (federal government and local administrations). Individual renters have also significant role to solve the housing problem by providing rental house (either their main house or service quarter).

Ownership (formal and informal)

25% of the housing stock is informal settlement. The non slum house holds of the city are estimated only between 0.9%-15.8percent (UN- Habitat 2004). 35% and 42% of housing stocks are privately owned in urban centres of the country and Addis Ababa respectively.

Housing affordability ratio

The market rent price is high (3-6 USD) per m² for residential houses. But the rent of some local government house (kebele houses) rent is even lower than 1USD per month. This is because the proclamation 47/1975, which nationalized the urban land and extra houses declare the rent cost reduce by half. Therefore rent of the majority of 37.92% governmental houses are very low.

House price to income ratio

13.9 For mud and 29.2 for concrete houses, which are extremely high as compared to 4.8 of the average rate of low income countries. In the case of Condominium houses studio type small size housing unit costs 6,000 USD. The low income group (30 USD per month) has to pay 20USD per month, which is 66% of his/her salary.

Housing construction and formal land distribution

150,000 housing units have been built in 54 towns under the IHDP (January 2009 annual report of ministry of Works and Urban development) of which 60,000 housing units are built in Addis Ababa.

The construction of condominium houses under IHDP is subsidized in terms of the following interventions:

1. The project is designed to create jobs for low income people and save money to possibly pay at least the 20% down payment of the total cost of the condominium house. These groups are mainly organized in the form of micro and small scale enterprises (MSSE) to produce construction materials for IHDP. The enterprises assisted by facilitating land, production machineries, loan, raw materials, etc.
2. The constructors, consultants, professionals involved in the project are capacitated through loan facility to buy machineries, tools, to run the project etc. and then they are engaged in the project with fixed price.
3. The construction site is selected on the bases of criteria sated to minimize the cost of the construction. These are mainly: infrastructure developed area, minimum slop, good quality soil character, etc.
4. The construction technology of IHDP is different from the conventional one. The slab is constructed with prefabricated beam and slab block, which is mainly minimizing the carpenter work concrete, and reinforcement bar. Low cost walling material like Agrostone¹ is applied.
5. The allocation of land for this particular project is facilitated by the government with infrastructure development.
6. Foreign masons, carpenters etc. are involved in order to transfer their knowledge and skill for local builders. This is also one aspect of capacity building.

¹ The firm of the new Agrostone pad technology is established only for the IHDP

7. The supply of main materials like cement, reinforcement bar, etc. are purchased in bulk and supplied for project offices.
8. Transporters are also capacitated through the facilitation of loan to buy trucks and engaged in the transportation of materials for the project.
9. Establishing the project office at regional and local level. The central coordinating bureau coordinate, facilitate, evaluate and providing feed back for the project offices. The facilitation is mainly in terms of loan, machineries, capacity building, standard design, research and development on alternative building technologies, etc.
10. Finally the completed condominium houses are distributed to the beneficiaries through lottery. The first 20% initial payment is expected from beneficiaries, and the rest is facilitated from the bank for 20 years payment back.

Apart from the above mentioned encouragement 637.2 hectare land is distributed for individuals, cooperatives and real estate through auction, lottery and negotiation system. And 1953 construction permit is given in 2006 (CSA 2007)

Building materials

Conventionally the reinforced concrete for structural element, hollow block and fired brick for wall, corrugated iron sheet for roof, and masonry for trench foundation are very usual. But recently other materials like compressed stabilized earth block and/or Hydraform, Agrostone etc for wall and corrugated mica, clay, metal sheet for roofing are introduced.

Access to and cost of Basic Services/Infrastructure

Ensuring that land to be delivered for construction of residential houses and commercial uses has adequate provision of infrastructures². But the practice shows that most development in the expansion area is opposite. First construct the building then develop the infrastructure except water installation.

Access to and cost of Education

Except the expansion area in developed residential zone the educational facility is available. The cost of education is varied from free service, which is governmental school; minimum service cost in the community school up to very expensive private school.

1.3 Housing Policy

The national urban development policy is issued in 2005. Among other main issues housing development policy direction is focusing on enhancing the saving culture, overcoming the problems of decayed urban areas through urban renewal and upgrading, increasing the density of developed area, developing the construction industry, through the implementation of IHDP. The government intervention in line with facilitating housing finance, land, capacity building, bulk purchase of industrial product of construction material, organizing medium and small scale enterprises, introducing new construction technology that minimize

² 2005 Urban Development Policy, Ethiopia: Artistic press

cost and time, standardizing the housing could be mentioned. The policy also encourages real estate developers through the facilitation of developed land, strengthen the system for ensuring property rights, supporting the developers to utilize local materials, marketing and create forums of discussion for sustainable solving problems and encourage the investors. Similarly cooperatives have got attention through the facilitation of developed land, standard typologies, etc. Protecting the construction of illegal houses or those does not confirm to the standard and plan has got emphasis in the policy.

1.4 Actors in Shelter Delivery and their Roles

As described earlier the main actor involved in the construction of condominium buildings is government. The goal is mainly to address low and middle income group of the society through the construction of subsidized affordable houses. Affordability is supposed to be realized by constructing the low cost condominium houses.

Above 300 real estate developers are established in Addis Ababa over the last fifteen years. The level of development is varied according to the capacity of the developers. This kind of development is recent in Ethiopia and it requires 30% down payment from the purchaser of the house.

The housing cooperatives also build their houses collectively. Individuals are also construct houses with market prices. Similarly NGOs, governmental organizations are involved in the construction of housing for their employees as well.

1.5 Shelter Design

Physical Planning

There are about 926 towns in the country out of which only quarter of them has the master plan/development plan. Local development plan and neighbour hood plan are requirements for the implementation of housing development.

Land Use

25% for infrastructure development 15% for business development and the rest 60% for residential area is reserved in most urban centres.

Population Density

According to the 2007 census result the population density is 65 persons per km² at national level and in the case of Addis Ababa the density is 650 – 2500 inhabitants per ha particularly in the core area. However it is less dense in the periphery area of the city.

Shelter Quality, Function, Safety and Comfort

The condominium buildings are apartment type maximum up to 4 storey buildings with studio type up to three bed rooms. The cooperative houses are condominium type and varied from one to three storey buildings. The real estate developers construct multi storey and one storey buildings. The individual dwelling units varied from villa type to multi storey buildings. The green area is facilitated commonly and semi- public type. All blocks of condominium buildings and

cooperative houses are protected with fence. This kind of safety is common also for individual houses.

Social Inclusion

According to the urban development policy mixed land use is the basic criteria to develop a neighbourhood. Accordingly there is no segregation between poor and rich in the existing developed areas and some new development area. But In recent development some particular areas especially the real estate development areas purely designed for rich people. This may show the tendency of segregation is increasing between poor and rich.

Gender Issues

In the transfer of condominium housing units priority (30%) is given for women. 53.8% in Addis Ababa and 47% in regions women have got condominium houses.

Sustainable Development

The implementation of IHDP, real estate development, permanent housing construction of individuals and cooperatives insure sustainable development especially in new development area. Similarly the old settlements began change through urban upgrading and renewal. But the shortage of water and sanitary in most urban area and the inadequate financial capacity of citizens are questioning the sustainability of development.

Norms and Codes

The new building code, which insures safety, quality, norms and standards, is approved by the council of ministers in 2008 and consecutively by the house of people's representatives. The standard of compressed stabilized Earth Block (CSEB) is also approved by the authority of quality and standard.

2 Organisation

The ministry of works and urban development as a whole is regulating and facilitating the development activities of three main sectors namely urban development, construction and road.

There are six main line and one support coordinating bureaus. Amongst my department, which is organized under the land and housing coordinating bureau. Our bureau's main objective is facilitating, regulating and follow-up of the development of land and housing in general. Creating home ownership opportunity for low- and medium-income sections of the community and wide employment opportunities by expanding micro- and small-scale enterprises in the construction sector; strengthen the construction industry by increasing the construction material supply capacity; promote technology pertaining to low-cost housing construction; improve vocational training system to strengthen the professional status of individuals working in the construction industry.

Coordinating the bulk purchase of industrial products of construction material, preparing the standard housing typologies, Build the capacity of actors involved in

the IHDP, etc. In general facilitating, follow-up and evaluating the implementation of the IHDP and provide feedback are the main task of our bureau.

The IHDP is undertaken since 2006 in 55 towns located under five regions and two cities (Addis Ababa and Diredawa). Since the overall program lead by the ministry of works and urban development the structure is arranged in three levels namely at ministry level, regional and urban level. The ministry has established land and housing coordination Bureau with three departments and 48 staffs. Besides the housing development logistic provision project office is established under the coordination bureau with 22 staffs.

Table 1: The structure of IHDP at ministry level

Nos.	Departments and office	No of staff	Dominant profession
1	Housing development department	6	Planners, Architects, economist, sociologist, civil engineer, surveyor, GIS, IT and cadastre expert, etc.
2	Housing construction department	18	
3	Land development department	22	
4	Housing development logistic provision project office	22	Electrical mechanical engineer, civil engineer, transport economics, etc

Source MWUD, June 2006 and 2009

The housing development department is mainly engaged in undertaking the research and development on alternative construction materials and construction technology. This is mainly done by pooling resource people from research institutions, housing project offices, universities, etc. and under taking research in the laboratory by taking samples from different regions, field visit and experience sharing with different countries like India, south Africa, Morocco, etc. these all done in my department and my role was coordinating the team, preparing the research result document and submitting for higher officials to implement the findings. Simultaneously my department is working on the impact assessment of the transferred condominium houses, the real estate development, follow-up and evaluation of under construction project of condominium houses, and preparation of regulations that will facilitate the housing development of the country.

In general the IHDP has created job opportunity for about 75,284 people in 55 towns of the country.

Table 2: Job creation opportunity in regional state including Addis Ababa and Diredawa cities through the construction of condominium houses

regions	No. houses	No of constructors	Site engineers	General Forman	carpenters	masons	Finishing workers	Time keepers	Logistic suppliers	guard	Daily laborers	Total
7	105,142	1,711	1,711	1,711	6,844	6,844	6,844	1,711	1,711	6,844	34,222	75,284

Source MWUD, June 2009

3 Shelter Problem

The IHDP has been playing an important role in line with developing the inner city and addressing the middle and low income section of the inhabitants.

But it is observed that shelter problems are mainly related with the low purchasing capacity of the inhabitants and the ever-increased cost of construction of housing. Decayed houses that need replacement, upgrading and renewal program are very crucial especially in the inner city of the town. The informal settlements, which needs regularization and providing infrastructure services is also the other aspect of housing development problems. The majority of the population 82.84% earning capacity is below 126.05 USD per month. The monthly pay back of small size of condominium houses requires 66% of the salary of low income society, which is very high. The escalated price of cement, cement based construction material and reinforcement bar is taking the highest share of the challenge in housing development.

Table 3: Cost comparison for wall construction

Item	description	Unit price/m ² USD	Cost comparison against HCB	Comparison in percentage
1	Hollow concrete block (HCB) plastered and painted both side	14.52	+/- 0.00	100
2	Compressed stabilized earth block (CSEB). Interlocked, pointed and painted with water resistant chemical from exterior and varnish paint from interior.	12.5	-2.52	-17
3	Agrostone painted both side	9.10	-5.42	-38
4	Clay brick one side plastered and painted and the other side pointed.	22.00	7.48	+51

Source MOWUD research result 2008

The cost of the above listed materials includes the production and construction cost of the wall (material, labour, transport, loading and unloading, over head and profit margin and machinery depreciation cost). Therefore as shown on the table the Agrostone and CSEB type of materials is low cost materials compared to brick and HCB. Besides the concrete structural element of buildings take 40-50 % share of the total construction cost. In this regard the proposal of this paper is mainly focused on CSEB.

Therefore the costly walling materials and reinforced structural elements need to be substituted with new local material and different construction technology apart from the conventional one. Simultaneously it is very essential to consider the importance of ground plus one detached or attached residential housing units without reinforcement bar or minimum structure which will have hope to reduce the cost by half. To this end the government policy intervention in compliance with the introduction of new construction technology, which could be managed by the beneficiaries themselves, should get great attention.

The model house for cost comparison of HF and HCB

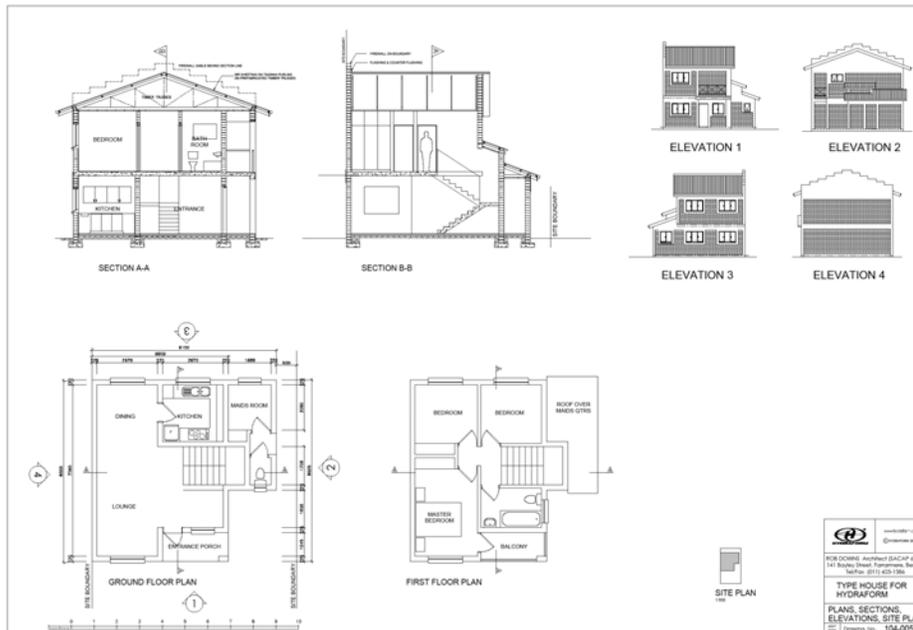


Fig 1: G + 1 model Hydraform residential unit

Table 4: Cost comparison between new construction material technique of HF and conventional HCB construction system

NO		1 USD IS equivalent to 12.88 Ethiopian Birr.	conventional construction of HCB wall & reinforced concrete structure elements	Load bearing Hydraform(HF) wall with new construction system	cost comparison of HF against HCB in %
A.	SUB-STRUCTURE				
1	EXCAVATION & EARTH WORK	Birr	6,521.55	5,663.79	-13.15
2	CONCRETE WORK	„	32,107.28	8,707.79	-72.88
3	MASONRY WORK	„	12,271.03	7,553.24	-38.45
	SUB-TOTAL A	„	50,899.86	21,924.82	-56.93
B.	SUPER-STRUCTURE				
1	CONCRETE WORK	Birr	66,027.56	35,658.37	-45.99
2	BLOCK WORK	„	30,250.09	34,910.80	15.41
3	ROOFING	„	14,296.57	14,296.57	0.00
4	CARPENTRY	„	11,728.57	11,728.57	0.00
5	JOINERY	„	7,155.00	7,155.00	0.00
6	METAL WORK	„	10,645.40	10,645.40	0.00
7	FINISHING	„	63,077.12	31,535.28	-50.01
8	GLAZING	„	1,862.06	1,862.06	0.00
9	PAINTING	„	12,077.22	12,077.22	0.00
10	ELECTRICAL INSTALLATION	„	9,163.00	9,163.00	0.00
11	SANITARY INSTALLATION	„	8610.00	8610.00	0.00
	SUB-TOTAL B	„	235,742.59	178,827.06	-24.14
	TOTAL A+B	„	285,792.45	199,567.09	-30.17

Source: calculated based on the model design and current price index

As shown on the table the Hydraform or dry interlocked CSEB construction technology is 30% economical than HCB wall with reinforced structural element.

The major cost difference is seen in the construction of sub structure of the building that accounts 57% and 24% of super structure. This shows that in every 3.31 housing unit construction of HCB additional one Hydraform housing unit could be built. The cumulative effect of this calculation indicates additional 30,211 Hydraform housing units that cost 6.029 Billion Birr or 468.10 USD is expected instead of build 100,000 housing units of HCB buildings. But it isn't still meets the 50% target as indicated in the objective. This is because minimum reinforcement structural element is applied in the CSEB model house construction that raises the cost. Besides the contribution of labour in terms of money by the beneficiaries isn't considered and dry interlocked load bearing construction technology without reinforcement bar isn't fully applied.

Therefore if the dry interlocked CSEB construction technology is widely introduced in the country both the rural and urban population can benefit a lot from the locally available construction materials and simple construction technology that can be managed by the beneficiaries themselves.

Since the CSEB or Hydraform construction materials production and construction technology is introduced recently, it needs to fill the knowledge gap, awareness creation and attitudinal change of the society, technical personnel and policy makers at different level. Therefore architects and civil engineers should train how to design both architectural and structural plan of the new technology. The construction material producers and constructors or beneficiaries also need training how to produce the load bearing material and how to apply the construction technology. And finally this kind of concept is only implemented when it is supported and facilitated by respective government institutions through policy formulation, arranging demonstration site and publicizing the material and construction technology for the public.

4 Proposal for Change and Improvement

The intervention of government in housing development through IHDP is very important and should be continued specially in large towns where urban upgrading and renewal is very crucial. In parallel the design of housing for IHDP should be revisited according to the interest of the beneficiaries and the beauty of the town. But due to the fact that the ever increasing cost of construction materials as a whole and the highest cost of cement and reinforcement bar in particular alternative solutions should be introduced. Moreover the housing policy of the government should consider diversified approach like:

1. Self help houses by individuals and cooperatives with innovative construction technology should be introduced and supported by the government through facilitating mortgage, land, local materials, capacity building, simple construction technology that can be applied by them.
2. Real-estate developer could be negotiated to construct 20-30% of their development for low and middle income group of the society. This can be

applied through the compensation of selling cost for rich and focussed subsidy of the government.

3. Encourage real-estate developers those who want to develop affordable housing units for low and middle-income group through facilitating land and infrastructure, importing tax free building material production machineries and introduce the application of low-cost materials and construction technology, etc.
4. Apply regularisation policy that will consider the careful future control of informal expansion.

Therefore applying alternative low-cost, durable local construction materials and technology, and encouraging different actors involved in the construction of affordable housing are indispensable to address low and middle income group of the society.

The middle and low income societies can benefit through direct participation in the construction work and take care of the over all construction management by themselves. This can be proved by providing sufficient training for self-help housing cooperatives and assigning technical personnel for group of cooperatives. The content of training should comprise the production technology of load bearing CSEB, the construction technique and how to manage the construction by themselves through the provision of technical skill training for selected members. “Organized self-help housing is often selected as a way of reducing the cost of construction through the participation of the households” Astrand, J., and Rodriguez, M.: 1996.

The objective of this proposal is mainly applying the new technology to reduce the cost of construction by half. This will be achieved mainly through effective management of production and construction technology of CSEB by the beneficiaries themselves.

Therefore if this proposal will be applied with full package, the beneficiaries can contribute their labour, knowledge and time that helps them to reduce the cost of the house at reasonable amount as described above. This project could be implemented in low density area by organizing cooperatives and encouraging individuals as well. With this new approach of technology it is possible to bring change in most of medium and small size of towns and the periphery area of the big cities too. The following core ideas are designed to implement the construction technology of CSEB:

1. Organize self-help cooperatives and/or organize a real-estate development with special emphasis for middle and low-income groups.
2. Provide training related to production and construction technique, and construction management for the beneficiaries.

3. Facilitate technical support like design preparation, construction technique and supervision is the most important.
4. Produce dry interlocked stabilized compressed load bearing block.
5. Develop alternative standard plans according to the interest of the inhabitants in respect to the structure plan of the town.
6. Avoid /minimize the structure element of reinforced concrete column, beam, slab, lentils and mortar.
7. apply new construction technology:
 - a. construct wall with load bearing CSEB
 - b. apply rammed earth foundation



Fig 2: rammed earth foundation

- c. use special column and beam blocks to associate minimum reinforcement bar and mortar



Fig 3: column block

- d. use wire mesh or minimum reinforcement bar and soil mortar for upper and intermediary beams



Fig 4: beam Blocks

- e. fix door and window during the construction of wall simultaneously
 - f. cast slabs with pre-cast beam and slab block and 6 cm slab concrete with minimum reinforcement bar or
 - g. construct doom and fill the upper floor with light material and cement screed finishing to make it flat
 - h. Pointing the wall from out side and paint water resistance chemical.
 - i. plastering the two course of skirting from both side
 - j. plaster and paint the interior wall
 - k. use wooden truss and corrugated iron sheet for roofing
8. Develop demonstration site, construct model houses, publicize for the public.
 9. Construct detached or attached ground plus one storey buildings for cooperatives, individuals and others.

5 Conclusion

In a country like Ethiopia where 80% of the total households live in a substandard houses and the existence of undeveloped construction industry, it needs to strengthen the existing IHDP that plays a vital role in large cities for job creation, introducing the new construction technology and cost effective building materials like Agrostone, increasing the housing stock, etc. Besides the cumulated housing problems can only be solved with the intervention of diversified approach supported by the formulation of policies and strategies that can involve different actors in the housing sector. Among different approaches the development and

introduction of alternative building materials and simple construction technology is the most important that can reduce the 70% share of housing cost to a reasonable rate in the case of Ethiopia.

Therefore by applying the aforementioned proposal the ever increasing cost of conventional building materials and construction technology could be regulated and people shall have alternative construction technology and access to affordable houses.

SWOT analysis of innovative construction technology

Strength	weakness	opportunity	threat
<ul style="list-style-type: none"> • Focus on alternative construction technology is getting attention by the government • The willingness to develop the technology by the ministry • The continuation effort to develop innovative technology and incorporation in the annual program of the ministry 	<ul style="list-style-type: none"> • Lack of human resource and laboratory • Insufficient allocation of budget • Resistance for change by different professionals • More focus for the IHDP and conventional materials 	<ul style="list-style-type: none"> • The ever-increasing cost of conventional construction materials and technology • The availability of new construction technology • The successful practice of other countries in related technology • The availability of local materials • The simplicity of the technology 	<ul style="list-style-type: none"> • Doughty on the workability and achievement in the near future • Needs a lot of integrated effort • Limitation of application for high rising buildings • Applied only in non expansion soil

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