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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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CONSTRUCTION AND BUILDING MATERIALS INDUSTRY IN NEPAL

Background Paper

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CONSTRUCTION AND BUILDING MATERIALS INDUSTRY IN NEPAL

by

P. B. Singh Pulmidar

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C O N T E N T S

ABSTRACT

Nepal having its population of 11.5 million,ie a small Himalayan Kingdom with an area of 145,302 sq.km.in southern Asia.The varing topography,the different kinds of ethnic group and the traditional social system all these make difficult for its development.The country has only 80 dollers per capita and very backward in social,economic and technical fields,so the development should be in line with the endeavour to raise the effectivity of production,and to reduce the differences of living standards of population living in different parts of the country,nearly in 30,000 settlements.At the same time the population growth in the country has taken so rapid rate that it makes 1.5 times of the present number after 10 years,which requires a great progress of housing construction and several other social amenities.The need to keep urban and rural development and the increasing demands of population in harmony,has required a plan,which provides in close consideration of social interests,a frame work of housing well-balanced in every respects of development,determining the utilisation of traditional construction technology by improving the local building materials.It is also necessary to standardise and industrialise the construction and building materials to meet present and future housing requirements by mass production. Training of skilled manpower,introduction of new building materials and a correct location of micro construction industries in each regions should be undertaken by establishing the lines of transport and public utility networks.

I N T R O D U C T I O N

This paper has been prepared on the invitation of the United Nations Industrial Development Organisation for its International Forum on "Appropriate Industrial Technology" to introduce a case study for Nepal including its geographical conditions, targets of planning, housing requirements, construction activities and some development ideas. It deals in detail specially with the different kinds of technology, and the application and situation of local and imported building materials. It is taken into consideration the problems seperately in the three brond geographic regions due to its varing topography; mountain, hill and plain.

It would serve to provide a complete frame work about the country for this conference, which can be used in respect of the conceptual and practical application of appropriate technology in developing countries. It could met the objectives of the forum to determine critical industrial sectors for the application of alternative techniques and processes from the viewpoint of socio-economic and technological development in urban and rural areas. It also contains the traditional construction method with its running technology and the present construction activities considering an appropriate policy resources which may need to develop and to adopt an effective application of modern technology.

I. THE LAND AND THE PEOPLE

A. Location,size and extent:

Nepal is a small Himalayan Kingdom which is located on the southern lap of the mighty Himalayan Ranges in southern Asia,wedged between the Tibet Region of the Peoples' Republic of China in the north and the Republic of India in the south,Nepal is located between 80° 15' and 88° 10' East longitute and between 26° 21' and 30° 10' North latitute.It is a mountainous,land-locked country,with an average length of 800 km. and an average width of 200 km. which make an area of 145,392 sq.km.It ranges in altitute from a more 50 metres above mean sea level at the southern foot of the hill to well over 8000 metres at the northern crestline.

B. Physical features and natural divisions:

The physical setting of Nepal,encompassing the high mountains/13%/,rolling hills/64%/ and the low-lying "Terai",yields three broad geographic regions,each with its own distinctive environment.The Himalayan Region, with altitutes varying from 5000 to 8000 metres,including the temperate highlands and trans-Himalayan Bhotea or Sherpa valley has been a marginal area for human occupance because of its harsh environmental conditions.Population is sparse and the economic activities are barter trade,

animals and some agriculture. The hill regions lie at an altitute between 600 to 5000 metres. These regions traversing the inner sub-Himalayan belt has traditionally been the most highly populated zone of the country. Subsistance agriculture is the basis of the hill economy, accompained by considerable pressure of population on land resources. The Terai Region with maximum altitute of 600 metres refers to the tropical plains along the southern part of the country. The Terai region, once a harsh zone due to malaria, has since acquired greater economic importance because of its rich forest and agricultural resources. Its comparative advantages in transportation and consequent industrialization has further enhanced the regions growth potential.

C. Human and social aspects:

In Nepal due to the lack of transport and communication system, a social collaboration or co-existence could not take place between the tribes immigrating from the two cardinal points, from the north and from the south. That is why many small settlements developed scattered in valleys, abysses, on mountains, plains and on other areas where the land conditions were favourable to agricultural production, where water and arable soil co-exist and may give rise to certain commercial connections. Human beings live, in general, by groups, createsettlements which are developed, enlarged and installed with the projects requ-

ired by the living standard according to the development of the social-economic situation of the societies.

D. Population:

The 1971 census puts Nepal's total population at 11,555,183 and the annual growth rate at 2.07 per cent. Of them only 4% live in urban areas and the remaining i.e. 11,093,877/3044 is in the rural areas. This clearly shows that the development of rural areas is the real development of the country.

The people can roughly be sub-divided into two distinct ethnic groups: the Indo-Aryans and the Mongoloids. Generally speaking, the mountainous and mid-hill regions of the country are inhabited by people of the Mongoloid stock like Rais, Limbus, Magars, Gunuwars, Gurungs, Tamangs, Sherpas, Lepchas, etc., Brahmins, Thakuris, Chhetris and people inhabiting the Terai lowlands may be grouped under the Indo-Aryan category.

E. Climatic aspects:

In topography, Nepal is mainly made of mountains and hills of varing altitude running in an east-west direction, so they have exerted a good deal of influence on the climate of the country. Topographical features exercise a tremendous influence on the economic life of the country. Considering the conditions of the country as a whole, Nepal is said to possess monsoon climate. However, the climatic conditions vary from region to region depending on the configuration and altitude of land surface in various zones

of the country. As such, temperature goes on decreasing from south to north. In the summer the temperature exceeds 30°C in the Terai, but touches only 10°C on the high mountains. In the hill regions it varies from 10-30°C. In winter, the Terai belt is just cool with temperature around 10°C, but always below than 0°C on the mountain sides. In the hill regions it is between 0-10°C. Most of the rainfall in Nepal is during summer season. In the Terai areas, the annual rainfall during summer varies from 1500-2000 mm. while on the mountain sides it is below than 500 mm. The hill regions get between 500-1500 mm. of rainfall during the summer season. On the whole, the influence of climate on the economic life of Nepal is found to be quite favourable.

F. Economic resources:

Economically, Nepal is still an underdeveloped country, having 66 dollars per capita. About 94 per cent of Nepal's economically active population are employed in agriculture and allied activities, where the contribution of agriculture to the country's GDP stands at over 66 per cent despite the fact that where 17 per cent of the country's total land area has been brought under the plough. Agricultural products also sum to about 80 per cent of the country's export. Because of irregular mountain topography, the country has very poor transport facility. As such, Nepal is backward in the sectors of industry and trade. On the other hand, Nepal rich in natural resources like water power, minerals, forests and natural grandeur, but because of limited capital resources and technicians, they

have not yet been used for economic purposes.

C. Administrative Division:

Administratively the country is divided into 14 zones and 75 districts. Each district is further divided into various townships and villages. There are, in all, a total of 19 towns and 3330 village Panchayats in the country, where nearly 30,000 settlements exist.

II. GOVERNMENT POLICY-TARGETS OF PLANNING

A. Regional actions and developments:

With a view to ensure balanced economic growth and equitable development to all regions, four Development Regions have been established in the Kingdom. The Eastern Development Region comprises Mechi, Koshi and Sagarmatha zones, and the Central Development Region of Janakpur, Narayani and Bagmati zones, Lumbini, Gandaki and Dhawalagiri zones constitute the Western Development Region and Rapti, Bheri, Karnali, Seti and Mahakali zones come under the Far Western Development Region.

For the balanced development of all the regions, national level development programmes and plan outlays are also disaggregated by four development regions of the country. National targets call also for regional action in order to avoid unbalanced development in housing, building as well as in planning. Regional policies and programmes

should be based on the identification of regional technical and physical complexes to be related to the national development plan e prepared in terms of production and investment in various sectors of the technology and economy. In establishing regional technologies and economies, emphasis should be placed on the technical relationships within the regions, where there is diversity of the resources and economic activities. The regional development strategy for Nepal needs corridors linking the diverse regions such as north-south growth axes. This development corridors help for generating the greater inter-regional circulations of goods, services, construction and technology to the people. Comprehensive regional development programmes have been initiated in the following four growth axes during the Fourth Plan:

1. Koshi Growth Axis : Biratnagar to Hedanga,
2. Gandaki Growth Axis : Bhairawa to Jomsom,
3. Karnali Growth Axis : Nepalgunj to Jumla,
4. [illegible] Growth Axis : Birgunj to Dhunche/Sarabise.

The four growth axes outlined above offer the suitable prospects for the integration and the co-ordination of the different development programmes in all over the country. Through agricultural extension and development, social services as education, health programmes as extensive and cater for rural development, infrastructure constructions for housing development,

communication network services could not still be extensive in respect of three ecological regions of mountains, hills and Terai.

B. Targets of Fifth Plan/1975-80/

The initial movement of Nepal in the sphere of planned development, and her first Five Year Plan/1956-61/ involving an outlay of dollars 27.27 million was indeed a maiden venture. At present Nepal is in its Fifth Five Year Plan of national construction and development. The principal objectives of the current Fifth Year Plan /1975-80/ with minimum and maximum outlays of 760.1 million dollars and 942.5 million dollars respectively, dividing into three sectors: public, private and Panchayat, are to emphasize on mass-oriented production, with stress on labour intensive approach and to bring about national integration and balanced development. This Plan has accorded topmost priority to agriculture while transport and communications, industry, commerce and power, and social services follow immidiately in order of priorities. The following tables show the allocations of the Fifth Plan Outlay:/Table nos. 1 & 2/

Allocation of Fifth Plan Outlay /Minimum Programme/

Dollars in million — Table No. 1.

Serial nos.	Sectors	Government sector amount /%/	Panchayat sector amount /%/	Private sector amount /%/	Total amount /%/
1.	Agriculture, Irrigation, Land Reforms, Forest, etc.	152.0 /29.8/	23.1 /30.0/	86.6 /50.0/	261.7 /34.4/
2.	Industry, Commerce and Power	114.1 /22.4/	- *	34.6♦ /20.0/	148.8 /19.6/
3.	Transport and Communication	118.4 /23.2/	38.4 /50.0/	52.0* /30.0/	208.9 /27.5/
4.	Social service /Health, Education, Drinking water etc./	125.4 /24.6/	15.4 /20.0/	- /-/	140.7 /18.5/
	T o t a l :	509.9 /100.0/	76.9 /100.0/	173.2 /100.0/	760.1 /100.0/

♦Including loans for investment from Government Sources.

*Including Government Grant.

Allocation of Fifth Plan Outlay /Maximum Programme/

Dollars in million **Table No. 2.**

Serial nos.	Sectors	Government sector amount/%/	Panchayat sector amount/%/	Private sector amount/%/	Total amount/%/
1.	Agriculture, Irrigation, Land Reforms, Forest, etc.	108.3 /30.2/	29.4 /30.0/	110.4 /50.0/	328.2 /34.8/
2.	Industry, Commerce and Power	124.5 /20.0/	- -	44.2✦ /20.0/	168.6 /17.9/
3.	Transport and Communications	164.5 /26.4/	49.1 /50.0/	66.2° /30.0/	279.8 /29.7/
4.	Social Services /Health, Education, Drinking Water, etc./	146.3 /23.4/	19.6 /20.0/	- -	165.9 /17.6/
	T o t a l :	623.6 /100.0/	98.1$ /100.0/	220.8 /100.0/	942.5 /100.0/

✦Including loan for investment from Government Sources.

°Including Construction.

$Including Government Development Grant.

III. HOUSING REQUIREMENTS

Housing need has qualitative and quantitave aspects. Actually, they occur parallelly, and are to be met simultaneously. In Nepal, the concept of quality of housing units for rural area is different from that for urban area. Because of extremly rugged topography and rather low density of settlements to provide and propagate essential facilities such as public utilities/Water supply, electricity and solid waste disposal/, production of building materils and new building technology has become a difficult task. The quality of rural houses in terms of obsolescene does not pose a serious problem mainly because the cost of construction or repair has been kept minimum with the use of local materials and self-help technique. Any research or statistical information has been done to show the use of building materials for rural areas. But by observation the type of rural house in terms of building materials and its technical use, may broadly be classified into three categories according to the three geographic regions viz the Mountain belt in the north, the Hill belt in the middle and the Terai belt of the south/flat plains/. The use of building materials and its technology in the construction also depends on the different types of ethnic groups, which reflects to the nature.

The analysis of housing condition in Nepal is mainly based on 1961 -National Census, which provides info-

rmation about household and housing unit for the nation as a whole. A direct comparison between 1952/54 and 1961 -Census regarding the number of houses and household indicates that there has been no growth in the quantity of houses. In the urban areas specially at Kathmandu Valley the increase in number of houses exceeds the increase in number of households between 1961 and 1971. In the 1971 Census the annual growth rate of the population is 2.07 and in near future the population of Nepal is expected to increase by 1,301,260; 1,457,737 and 1,735,651 each quinquennium starting from 1971 and the annual average geometric rate of growth would be as following:

Period	Average annual rate of growth
1971-76	2.16%
1976-81	2.16%
1981-86	2.30%

So up to number of housing need resulting only from the population growth will be 6-900 thousands. Besides this in the estimation of the number of housing units to be built in the future two more factors should be considered. First, the current housing requirements has to be fulfilled. Second, housing units to be demolished in the future have to be substituted for.

During the current Fifth National Plan Period, a housing agency with a purpose to help maintain and increase housing stock in urban area will be established. Various

Financial institution in the past five years have shown increasing interest in housing by making it possible to take loan /at least for employees/ at reasonable terms and conditions. In urban areas, it will be increasingly important to relate housing with the overall morphology of the town so that with due consideration to basic infrastructure such as water, sewage, roads, etc., substantial savings could be achieved in term of community cost. It has also become urgent to create a system of rural centres, as a first step, to provide needed facilities and infrastructure.

In addition, in the course of the present Five Year Plan, untill 1980 a new resettlement plan will be worked out for 22,500 families for whom an area of 57,150 hectares will be made suitable for cultivation. The project deals, for the time being, with production of areas of tillable land and with their distribution. No plans are worked out for the construction of order infrastructural projects or rendering of allowances for building of dwelling houses but the IDA contributes in working out a resettlement project for 7,900 families which will be finished in 1980.

Scrutinizing the distribution of the population, it is to be seen that from the total of the families, which makes up 2,009,690;1,303,001 families live in the mountainous regions and only 705,009 families are living in the flatland/Terai/ while in the mountainous regions a family has only 0,422 hectare of ground and in Terai 1,56 hectares of tillable land. Considering the unbalanced a settlement and

agricultural conditions, the HMG of Nepal tries to resettle the underdeveloped mountainous settlement into the TERAI regions.

IV. STATUS OF THE CONSTRUCTION INDUSTRY

A. Himalayan regions:

In the Himalayan region, the mountain settlements with its extreme climate and hostile topography are mostly clustered together in a terraced from due to the lack of agricultural land. The houses as such are one storey or two stories depending upon the slope and location of building site. The main problems of the construction are the lack of building materials and the unskilled workers. The only building material easily available in that region is stone. One of the big problems in the binding material and without that massive structure is impossible. The walls, made of stone in mud mortar are not capable for having enough openings, as a result the rooms are usually dark. In case of multistorey building, houses are built with stones only up to the floor and with wood beyond that where the roof is covered by the locally made shingle elements. The roofs are often composed of stones and are flat, which provides a much needed sunny terrace to next row of houses above.

In this region more than 90 per cent of the households need repair their their dwellings. Most of the households living in stone houses, stated that their dwelling needed repair walls, roofs as well as terrace floor.

B. Hill regions:

Hill settlements have more choice in building materials than its northern counterpart. Houses are usually loosely scattered along hill slopes, on hilltops, in flat valleys or along ledges, as the terrain allows. Thus according to the style of the areas they live in, their houses are built in a standard which varies from place to place. Most traditional houses are the two-storey having the walls made of stone in mud morter roofed with local state or in some cases thatch roofing. In a few places, burnt bricks have been extensively used for wall with the red clay tiles.

In these areas so far the building is concerned the main problem seems to be concentrated on structure. Nearly one third of the households needed major repairs of their dwelling. more than 50 per cent of the dwellings have thatch roof, which have to be repaired frequently. Similarly there is a need of repair of wall, beam, floor and several other components. These repairs are owing to the poor house construction in this region. This is mainly due to unpaid labour/family members and relatives/ employed in the house construction. The main factor behind its existence is definitely the lower cost compared to other alternatives or in other words the inability to afford other building materials. Free labour are used for supervision bringing wood, mud, etc. Even new building activity seems to be unsatisfactory. To solve the problem strong measures should be taken to control

and guide the building activity stimulating proper constructions and to improve the environmental quality as well.

C. Terai regions:

In the southern plain, generally the houses have temporary looking, because of the building materials used primitively in the structure. Most of the standard rural houses are one level, with the ground floor having bamboo walls which are plastered with cowdung and mud. The roofs are mostly thatched and a few tiled. Houses are usually grouped together in a clustered form near the river or stream to solve the difficulties of public utilities. In the house construction in this region there is a great problem of dampness. Because of high water level and lack of damp-proof material moisture penetration has been formed in the plinth-footing and the walls which is obviously related to the construction materials used also. In more than 90 per cent of such cases like straw/leaf huts are found to be penetrated by moisture. Next are bamboo-mud houses and the dwellings with walls made of bricks with mud mortar moisture penetrations are reported on. Similarly due to the application of organic building materials in the roofing more than 60 per cent of all households reported that there is a need of immediate repair. So in this region foundation, wall as well as roof construction have to be prepare by many percent of the households.

V. TECHNOLOGICAL ASPECTS IN CONSTRUCTION

A. Construction problems in rural areas:

In rural areas almost all the individuals have to build their dwellings themselves,because until now there are no such agencies at sub-national level involved in the preparation of regional development plans.So for the implementations of regional development plans are concerned,almost all the departments of the government are involved in. Until now there are no institutions as such which provide housing loan,construction aid,technical guidance while most of the developing countries have already started to establish such institutions.In the absence of such institutions and construction industry,one has to have full cash and full labour in hand to build a house.So they construct the building in different phases due to the lack of labour and shortage of money.Skilled labour cannot be provided by the head of household.all the construction works and repairing works will be done by the family members themselves.Masonry and carpentary works are done by themselves,whatever they can do.It is the only possible way of building as well because firstly they do not find any technicians there , secondly they can not afford to hire them.It has direct impact on the quality of dwelling.The same factor is responsible for the slow rate of increase in the house construction compared to the increase in population.

In rural areas where more than 90 per cent of the population are living in subsistence agro-economy. The low level of living does not permit popular methods of bringing improvement in housing. Therefore an ingenious method is needed to organize the collaboration of cheap village manpower resources and to aid with cash. As an experiment, a small/10 units/ self-help housing project lunched at Surkhet District in the Far Western Nepal has successfully demonstrated the feasibility of combining local materials, local manpower and outside technical help to desired end. Similarly the Local Development Department also must start rural scale projects in housing construction. It should be tried to establish some housing institution and micro construction industry which can increase the rate of growth of housing construction with standard or acceptable quality.

In rural areas the problem of construction price takes entirely different shapes. Profuse use of self-processed local materials such as stone, timber, slate, bamboo, thatches, etc. has positive impact on reduction of the price in housing market. Moreover in such areas, households without technical knowledge, traditionally mobilize their collective labour for the construction-purpose. As a result problems appear to modify or improve the existing housing conditions. Such improvement the rural-economy permits only with the external help of cash. So home-builders are expected to arrange suitable land, collection of materials, labour and lastly the finance

necessary for the purpose of construction.

To recognize the problems of developing the building industry in rural areas of Nepal will be necessary to open new areas of experiences, that also may have significant role concerning the problems of materials will be locally available to choose the appropriate technology for construction. It should not forget the time factor, which influences the choice of mechanised method, but standardization and modular system must be considered even in the begining of industrialization. In this connection the training problem can be met by simplyfying industrial process to reduce the need of training by improving the traditional construction method.

B. <u>Construction problems in urban areas</u>:

In most of the urban areas burnt bricks and stone are the two most frequently used materials for wall. Roofs are almost always of slate, clay tiles, CGI sheets. Recently RCC and RBC slabs are frequently used to roof the houses.

Generally the existing houses have defects in foundations, walls as well as in roofs. Because most of the towns are concentrated towards the centre of valley so that water level is high enough. People cannot afford damp-proof materials in one side another side they are out of knowledge for implementation. So foundations and pliths are not damp-proofed. The main defects in foundation are the uncorrect ways of uses of binding materials, such as mud morter. Because of the lack of damp proof materials, even in dwellings with walls made of bricks with cement or lime morter,

moisture penetration are found. People are constructing houses with burnt bricks walls, for half of which mud mortar are applied and for the other half cement or lime mortar. Those dwellings with mud mortar had, in half the cases, asbestos or tin roofs, the other tiles or RCC or ABC roofing structure. All these types of construction methods are happening by monolith process. All building structures including door-windows, stairs, roofing structures are prepared in the building sites. Often some experienced workers are used in carpentry works as well as in masonry. Very few skilled labour has been provided by the head of household. In most of the cases they themselves participate for supervision of the construction works, because the problem is that an ordinary family can not afford to hire an architect or an engineer.

Directly related to the scarcity of materials is their allocation. It is very difficult for the private sector to obtain the bricks produced by the factory. Development of construction sector is only possible if the production and import of the required materials is sufficient and a proper share of the total production is alloted to this sector. The scarcity and the increasing /10-20 % per annum/ cost of the building materials like good quality bricks, cement, timber, roofing materials etc. are the two difficulties in the traslation of need into demand. The use of local materials, traditional construction method should be applied as far as possible. It is the building material which is responsible

for the long and big building construction process in the country

Even in the urban area there are still difficulties in the production of building materials and progress of building technology. This can be proved bythe percentage showing the existing ratio of three different types of building according to the construction technology, as:

-permanent	.....	69 %,
-semi-permanent	.....	11 %,
-temporary	.....	20 %,

where permanent houses can be defined as the one made of stone or burnt brick or wood in mud, cement or lime, brick dust morter with slate, tiles or RCC-RbC roofing. Similarly house is said temporary when it is made of thatch roof and and with sundried brick. If either roof or wall is made of permanent materials, in such case houses can be enumerate in the category of semi-permanent house.

Ability of a household to acquire adjacent housing unit depends upon a number of variable such as:

-cost of the housing unit,

-income and expenditure of the household,

-possibilities of credit system.

It is very difficult to generalise the cost of building in National Scale because of basic differences in the topography, accessibility to market, availability of standard materials and requirements. With the help of the existing nature

of construction, it can be estimate roughly of a housing unit to accomodate an average household for urban areas. Excluding the cost for development and for land, only the construction price of a standard housing unit /detached about 100 sq.metres area/ would normally cost at existing price and running technology more than 5-6thousand dollars, which exceeds more than three times the annual income of a household. This means that more than 90 % of the household in urban areas can not normally afford a house of normal standard.

It is apparent that the dimension of problem of construction in urban areas is quite different from that in rural areas. Whereas in urban areas the problem becomes visually conspicuous because of share conglomeration of population, in rural areas it is more hidden. Moreover due to the concentration of resources in selected urban areas the rural house construction problem is magnified, as the rural environment does not hold basic ingredients for lunching successful housing improvement programmes. During the current Fifth National Plan Period, a housing agency with a purpose to help maintain and increase housing stock in urban areas will be established. Various financial institutions in past years have shown their interest in house construction programmes by making provision to take loan, at least for employees, at low interest.

VI. BUILDING MATERIALS INDUSTRY AND THE PROBLEMS IN SUPPLY

The use of building materials is quite different in rural areas and in urban areas. Generally there is a difference in its use and in the building technology. Due to the lack of infrastructure there is also problem in the difference of prices in different parts of Nepal.

A. Building materials and their applications in rural areas:

Most of the building materials used in rural areas are local. Rural housing draws almost entirely on indigenous material. No systematic survey of building materials resources has so far as is known, yet been made. The traditional as well as present building materials in the rural areas are as follow:

— earth and its allied products,

— stone and its allied products,

— timber and other forest products.

1. Earth and its allied products: In this group these are the main materials in building construction:

/i/ earth,

/ii/bricks,

/iii/roofing tiles,

/iv/flooring tiles.

/i/ Earth: In rural areas, earth is abundantly used as a building material, because it is available locally in most cases and has the cost need only for labour. The building

material;earth is specially used,

- as morter for masonry work with stone or bricks,
- for the production of sundried bricks as well as burnt bricks,
- for the production of roofing tiles like "shingati",
- as filling materials in bamboo walls,mud-and-daub walls,ceiling or floor,
- for plastering on walls,ceiling or floors /in this case earth is generally mixed with cowdung and rice husk/.

/ii/ Bricks:Still there exist sundried bricks and are extensively used for walls in rural areas.Sometimes also used for foundation and floor filling.Local burnt bricks are used only in comparatively developed rural areas or by those families who are relatively well-off.Burnt bricks are used for foundations,structural walls,partition walls,flooring, pavement of court-yards,and so on.They are also used to make brick-powder,which is mixed with lime to make morter.This morter is used as a binding material for brickworks and stone-works,because cement is not available in those areas.In this category there are other products also besides the ordinary bricks: a/ telia bricks and b/ roofing tiles.

a/ Telia bricks: Telia bricks are made from earth.The speciality is that,the surfaces are first oiled and burnt in the kiln.They are only 1" /=2.54 cm./in thickness,but have more stability and are stronger than ordinary bricks.They are

extensively used for pavements in floors/corrider,staircase, terrece,etc./,courtyards,and similar to other functions.These tiles are very famous and mostly found in the rural areas of the Kathmandu Valley.

b/ Roofing tiles: Roofing tiles,the best meterials for roof covering,are very cheap and popular,but there is a decling trend in its use in favour of CGI sheets, due to the demand of regular maintainance and its high cost caused by them.Jhingati roofing tiles are very popular in Kathmandu Valley.The covering technology or the construction method is special one.These tiles are laid on the roofs over a layer of mud.The mudlayer insures the airtightness but causes heavy weight to building.There is hardly any research in the improvement of these roofing tiles. This method of manufacturing and use are still in traditional ways.

2. Stone and its allied products: Under this heading the main building materials for construction are as follow:

/i/ block stones for load bearing structure,

/ii/ stone slabs for pavements,

/iii/slates for roofing,

/iv/ crushed stone,

/v/ lime /binding material/.

/i/ Block stones: In the hilly regions specially in the north mountain sides,where soil is very rough and not suitable for making any allied materials like bricks,

stone is the only building material for masonry work. These stones are either quarried from the mines or collected from the river bed or found in the ground mixed earth as boulders. In many parts of the country except Terai region, stone is easily available for the purpose of construction. The stone masonry is constructed either in mud mortar or lime morter, but where mud and lime are not available, specially in the extreme Himalayan region, the walls are constructed drily without the use of the binding materials. In such case the shearing stress is cleared by the horizontal beams put in the walls in every meter, which shows the good facade.

/ii/ Stone slabs: The country is very rich in different types of stones, limestone, marble, granite, etc. Stone slabs suitable for pavement in floor - porch, ground floor, terrace, etc.-and courtyard are abundent, but the transportation of stone slab is difficult and costly-weight/value ratio. So its use is limited within the effective area of its delivery. There is a great need of development in its working process and execution. For this it is necessary to have qualified technicians, machines, transport and power.

/iii/ Slates: Slate is very popular in the parts of western Nepal, particularly in the hilly region like roofing tiles, there is a declining trend in its use in favour of GCI sheets. Also the production of slate is happened by local people and not available in every time.

/iv/ Crushed stones: Crushed stones are used as

stone chips to make cement concrete. This use is limited in the important structure like offices, hospitals, and similar important public buildings. As cement is a luxurious material in rural areas, its use is still out of reach of general public. This is because the factor of production and transportation.

/v/ **Lime**: It can be find in different parts of Nepal. Good quality limestone is available in more than 50 places of the country, such as Dhainse Dobhan, Jogimara of Dhading, Sankhu, Godavari, Chovar, and so on. Lime is one of the old and cheap binding material, which can be manufactured in small scale and can be made locally available in almost all the parts of the country, where limestone can be carried. Inspite of these facts the manufacture of lime could not develop well due to the lack of technical know-how, machines, transport and means of transport. The existing process of manufacturing lime is as primitive as it used to be a century ago. It is for this reason that people prefer to use cement whenever possible economic condition and the availability. The current five Year Plan of His Majesty's Government, has given an emphasis to develop and improve the process of manufacturing lime and encourage people to use lime instead of cement.

3. Timber and other forest products: Under this title, the following items are the main materials in the building construction:

/i/ timber,

/ii/ bamboo,

/iii/ thatch.

/i/ **Timber:** The climatic conditions vary from region to region depending onthe configuration and altitude of land surface in various zones of the country .The country comprises of almost all the climatic zones of the world,like:

- tropical monsoon climatic /below 1200 m./,
- warm temperate monsoon climate /between 1200-2100 m./,
- cool temperate climate/between 2100-3300 m./,
- alpine climate /between 3300-5000 m./,
- tundra climate /above 5000 m./.

According to these climates,the forest wealth of Nepal has been classified in three different ways:

- tropical evergreen forest,
- deciduous monsoon forest,
- evergreen coniferous forest.

The concentration of forest is mostly along the southern part of the country,the rest being scattered over different parts of the country.The southern forest iscommercially important due to relatively better transport facilities. About one third /34%/ of the total area of the country is covered by forest,though only 31000 sq.km.is believed to be commercially exploitable,the rest being shrub.The pri-

ncipal forest species in Nepal are Sal, Sisau, Khair, Deodar, Simal, Piv, and Junipus. Sal is one of the most important timber both for homemarket and for export. The forest is in the following ratio according to the species of trees:

Kinds of forest		Percentage
a/ Deciduous Oak Forest	.....	45.7%
b/ Sal Forest of Terai	.....	20.0%
c/ Old Riverian Forest	.....	6.9%
d/ New Riverian Forest	.....	4.6%
e/ Softwood Coniferous Forest	.....	11.4%
f/ Other forests	.....	11.4%
T o t a l		100.0%

Timber is a common construction material in all the parts of the country. It is used as a structural members for columc, beams, roof structures, and so on. It is also used for doors, windows, staircases, floorings, roofings, and wall panels. The use of timber for buildings can be seen at the ancient palaces, residential buildings and temples that illustrate the ingenious use of wood for building construction. But the method of technique for the utilization have not developed from those of the ancient times. In most of the cases, green timber immediately after felling down, is used for the purpose of construction. There is no provision of any type of seasoning of timber. Also there is no developed modern technical design for their proper use.

The Department of Housing, Building and Physical Planning have produced some typical timber structures using modern technical design to be used for some public building in rural areas, but their implementation is not yet successfully carried out due to the lack of skilled manpower. Hence in many places, particularly the remote areas, the method of utilisation of timber is still in the traditional pattern, resulting an unnecessary wastage of lot of timber.

/ii/ Bamboo: It is one of the important building material in the southern parts of Nepal. It is extensively used as a substitute for timber in the rural areas. There are many varieties of bamboo used as construction materials, of them the widely available variety in the hills is Malbans. The strength and durability depend upon maturity. It takes about 5 years to mature for construction. Matured bamboo is used only for permanent construction. The other variety is Dhalubans which thrives in damp climate. In those hills, where there is a shortage of timber, bamboo is generally used for building construction, which is not however used for good class of work but for the less important works. It is used in thatched roof as rafters and split bamboo as partition wall, in floors instead of planks, as a spanning member and runner, as posts and joists, as straps/bamboo fibre straps/ for temporary fencing, for scaffolding and temporary support works. Different bamboo products also find used in

construction works.Also skilled labour in the traditional style in the field of construction is available in almost all the parts of the country.

/iii/ Thatch: It is locally called khar,which is the term used to denote the dried straws of reed obtained from a variety of grasses,which is widely used as the roofing material in the hills.Thatched roofing is cheap and and hence very popular.The most common types of khar are: Colombo khar,Giru khar,Arthunge khar,Kans khar,Jade khar, Pherke khar and rice straw.The life of the thatched roofing depends upon the type of khar used and the method of application.The maximum useful life with best quality of khar is only 12 years by the knowledge of practical.Khar roofing is popular mostly in hilly areas because it is the most redily available local material in cheap price and because it can be collected in winter when people are without work.

B. Building materials and their uses in urban areas:

Urban dwellings are usually of clay bricks,stone or concrete.Both local and imported materials are used for permanent urban type construction jobs.So building materials used in urban areas can be divided into two parts:

- local materials,
- imported materials.

1. Local building materials: Mud,sand,surki,stone,bricks, roofing and flooring tiles,timbers are the main local materials .Out of these,there are many other allied products

of earth and stone, and other forest products, which are still used in the fringe of the towns.

Mud mortar is still used in the urban housing either in brick works or in stone works. So the uses of mud in the cities are similiar to those of rural areas. So for sand is concerned river beds and its tributaries are the main source. Irrespective of the quality, the available quantity of sand seems to be sufficient. Even quality is considered as quite good. Brick bats are traditionally used as surki which is one of the component of lime concrete and lime mortar. Its production is declining steadily as lime mortar is replaced by cement mortar and lime concrete is replaced by cement concrete. No study on such has been made to make use of this local material or to encourage its use. Stone is used also in the town for making foundation and wall. For example in Pokhara, the housing survey reveals that almost all of the houses /93.9%/ are made of stone walls.

/i/ Brick industry: Bricks are mass produced and quality is not good enough except those produced in Harisiddhi brick and tile factory. In the whole country there is only one factory called Nepal Brick and Tile Factory established in the year 1907, which produced only 14 million pieces of bricks and tiles during the first nine months of the beginning year. The following table gives the rough idea of annual brick production in Kathmandu Valley:

Annual brick production

Table No. 3

Serial nos.	Means of production	Nos.	Production
1.	Brick and Tile Factory	1	25,000,000
2.	Continuous type kilns	33	132,000,000
3.	Intermittent type kilns	150	45,000,000
	T o t a l :	184	202,000,000

Though approximately 202 million bricks are produced in Kathmandu Valley every year it does not seem to be sufficient. This shows there are only 17.5 pieces of bricks for one person. Specially there is a great demand of bricks produced by the factory. For general public it is very difficult to get these bricks. Besides bricks, the brick and tile factory produces red clay floor and roofing tiles. It produces 500,000 roofing tiles and approximately same amount of floor tiles. The quality of each element produced by the factory is better and has more stability than that of traditional brick and tile. So a new brick factory is scheduled to go into production during the current Five Year Plan Period.

/ii/ Timber industry: The most important local building material after bricks and tiles is timber. The country, specially the southern plane, is quite rich in forest

resources,..aving high quality timber like sal and sissoo. K.thm..du Valley is mostly supplied with timber from Terai, especially Hetaunda,but due to the lack of facilities a.d the means of transport other towns are not provided with these timbers.Timber is generally used for making doors and wi..dows,for floor support and roofing structure,etc. These days the use of timber for roofing and flooring is going to decrease because of the popularity of reinforced cement concrete.

Though timber is available in abdundences it does not seem that it is easy to get it.Timber is distributed in the valley by the timber corporation and other enterprises. There is almost 100 per cent difference in the cost of timber in Timber Corporation and other enterprises.Probably it is because of this cost difference it usually takes months to get timber from Timber Corporation whereas it is readily available outside,at approximately twice the cost.This proves that there is no balance betweeb demand and supply,so that the supply should be increased.Another problem regarding timber is that they are not seasoned,so good deal of drying and warping takes place in timber structures.Other products of wood such as plywood,block-boards,hard-boards,etc.has not yet started in by commercial scale.There are a few small plywood and bobbin factory in Terai,but their products are suitable only for packing purpose.One factory in Butawal is trying to produce plywood for building proces.

Besides these products, several other saw mills have been installed in various centres like Bharatpur, Birgunj, Nepalgunj, Kuwakot, Jhapa, and Dhairawa. All of these are located in Terai and Inner Terai areas. Most of the timbers produced there are exported to India. This timber industry proved to be an important source of Indian currency for Nepal.

2. Imported building materials: Because the local building materials are not enough in the supply for the building industry, so the people have to depend on the import of building materials which constitute a major portion of total import figures for Nepal. The main item of such import are:

/i/ Non-metallic products- cement; clay products; asbestos-cement products; cement products including pipes, prefabricated units etc.; flat-glass products;

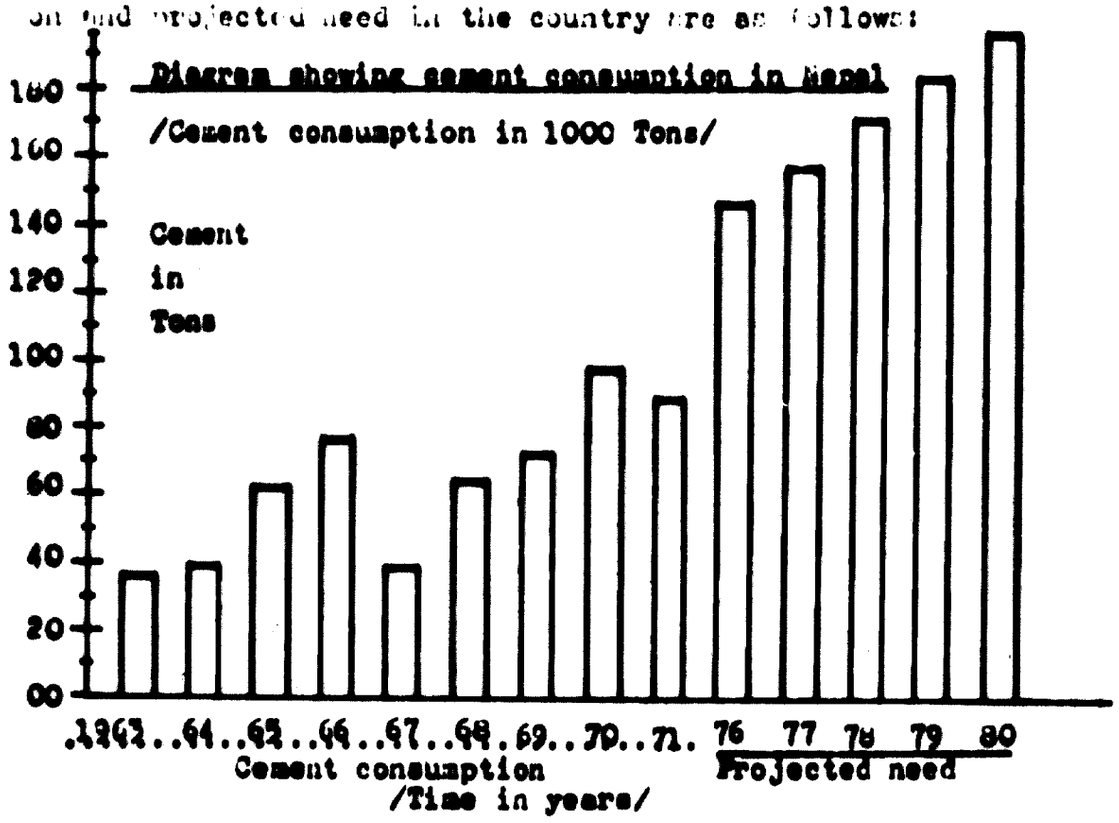
/ii/ Wood-based building products- plywood; board products;

/iii/ Metal building materials and components- iron and steel products/bars, rods, light and heavy sections, sheets and plates, tubes and pipes, etc./; non-ferrous metal products/aluminium sheets and pipes, tin sheets, lead and zinc pipes, etc./; finished structural parts of all metals;

/iv/ Building fittings and fixtures- heating fixtures, sanitary wares in all meterials, fitting and fixtures in all metals, lighting fixture and fittings.

a/ Cement industry: Cement is one of the most important building material in this era. The massive and big structure are impossible without cement. For the development of permanent urban structure cement is needed as basic building material. So its production should be improved as possible to introduce the prefabrication system and to apply new technology appropriately for the development of construction activities in urban areas. At the time of growth of population in urban areas, the housing need can be solved only by the development of building materials, specially cement.

At present in the market of building materials cement is one of the most important item, which is badly needed by house-builders. The datas about cement consumption and projected need in the country are as follows:



Cement consumption in Nepal
/1962 - 71/

Table No. 4

Fiscal Year	Cement consumption in 1000 Tons
1962 - 63	36.27
1963 - 64	39.57
1964 - 65	61.34
1965 - 66	74.15
1966 - 67	56.00
1967 - 68	69.16
1968 - 69	71.56
1969 - 70	97.20
1970 - 71	88.33

Thus Nepal had to depend only on the imported cement upto 1974. Nepal's first cement plant of dollars 1.7 million authorised capital, went into production about the close of Fiscal Year 1974 - 75. It has a daily production capicity of 150 MT. It produced 23,560 MT of cement during the first nine months of Fiscal Year 1975 - 76, but this production also not fulfill the demand of the people. So according to the demand in the market, HMG of Nepal is going to establish an ahother cement plant with an annual production capacity of 170,000 MT during the current Fifth Five Year Plan Period, because the present production of cement met only the 20% of the demand. The projected need of cement

from 1975 - 1980 during the Fifth Five Year Plan Period is given bellow:

Projected need of cement in Nepal
/1975 - 1980/

Table No. 5

Fiscal Year	Projected need of cement in 1000 Tons
1975 - 76	145.1
1976 - 77	157.5
1977 - 78	170.6
1978 - 79	184.3
1979 - 80	196.6

So far other imported building materials are concerned at the moment, there is not any reliable information. It is usually seen that there is big scarcity of all these imported materials. Due to the scarcity of local materials and since the technology of using local material is not yet developed, people are forced to adopt imported building technology and even building material and consequently the demand exceeded supply. The problem is not only the shortage but also the increasing cost. Cost of building material has increased by 50 - 60 per cent in the last five years.

C. Infrastructure and its impact on building materials:

The development of construction in the country depends mainly on the efficient means of infrastructure. The urgent need for increasing the building activity is a cre-

ation of favourable infrastructure throughout the country. Transport is the means of carrying building materials and people from one place to another. Without efficient means of transport the country can not prosper in the field of construction and building activities. The development of construction and building industry and several other aspects of the countr hinges on the degree of transport development. It is essential for integrating different natural regions and for breaking down all the physical barriers separating human communities from one another.

Transport development is very important to a hilly country like Nepal. It is the lack of transport facility that lies so seriously and hindered the technical growth of the country. So one of the essentials of organised construction and building industry and of balanced economic as well as technical growth of natural economy is the development of efficient and well-organised or well-coordinated transport system. Nepal is suffering from the extreme difficulty of transport. The main cause for this is the unfavourable nature of topography. Because of being a hilly and mountainous country with irregular and rugged topography, the construction of infrastructure is not only difficult, but also very expensive. In the country, the rivers are not navigable, and suitable plain land for airports is not available in the mountain region. Many bridges are necessary to build across the rivers, which flow from north to south.

Though a formidable task due to the mountainous topography, Nepal has accorded a high priority to road-building in all the development. In April 1976, this total had reached 3,444 km. and the current Fifth Five Year Plan is expected to add 1,590 km. Still due to the lack of infrastructure, to settlements of entirely primitively way of life were given rise. In such settlements also the society remains unchanged because there is no influence on the social, trade and commerce, and income of the family. Still there are many settlements where the people can approach only by foot through several days. In such places where there is no transportation system in developed form at all, only the possible means of transportation is animal.

The transportation and its means are very difficult and complicated. Sometimes it can be solved only by helicopter. So the prices of building materials are not uniform through the country. Generally the cost of value depends upon the distance of the transport. The country is divided into 7 main areas which consist of the towns and districts. For every limited areas some constant number is fixed, then the prises of Kathmandu should be multiplied by a constant number, whose value depends upon the places. The present cost of the main building materials at Kathmandu Valley, and the constant values for the different areas of the country are given bellow:

General unit prices of building materials
at
K a t h m a n d u

Prices in Dollars — Table No. 6.

S.Nos.	Materials	Unit	Prices	Local/Imported
1.	Sand	100 cft.	3.26	Local
2.	Brick 1st class	1000 nos.	14.88	Local
3.	Brick 2nd class	1000 nos.	12.40	Local
4.	Tile	100 sft.	12.39	Local
5.	Lime	1 cft.	0.58	Local
6.	Surki	1 cft.	0.25	Local
7.	Cement	50 kg.	4.96	Local
8.	Cement	50 kg.	7.44	Imported
9.	Building Stone	100 cft.	14.50	Local
10.	Plain Cement Concrete	1 cft.	1.46	Local
11.	Reinforced Cement Concrete	1 cft.	5.30	Local + imported
12.	Timber	1 cft.	4.13	Local
13.	Plywood	1 sft.	0.37	Imported
14.	Asbestos sheets	1 sft.	0.41	Imported
15.	C.C.I. Sheet	1 sft.	0.30	Imported
16.	M. S. Bars	1 kg.	0.33	Imported

Constant values with respect to areas

Table no. 7

S.nos.	Nature of places, valley /according to transportation/	Place located	Multiple values of the constant
1.	Valley	Area No. 1	1.0
2.	Terai plain connected by train/railway/lines	Area No. 2	0.9
3.	Terai plain with motorable roads	Area No. 3	1.1
4.	Hilly areas connected by motorable roads	Area No. 4	1.25
5.	Hilly areas not connected by motorable roads but can be approached within one day or two days walk	Area No. 5	1.5
6.	Remote areas	Area No. 6	2.0
7.	Very remote areas	Area No. 7	2.5

Table No. 8

Area Nos.	Places/Districts or Towns/	Nos.of District
1.	Kathmandu, Lalitpur, Bhaktapur	3
2.	Morang, Parsa, Bara, Rupendehi, Banke	5
3.	Jhapa, Sunsari, Siraha, Dhanusa, Mohattari, Sarlahi, Rautahat, Makwanpur, Chitwan, Nawalparasi, Kapilbastu, Dang-deukhuri, Bardia, Kailali, Kanchanpur and Baglung	16
4.	Kavre, Tanahu, Palpa, Syangja, Kaski, Dandeldhura	6
5.	Illam, Dhankuta, Udayapur, Sindhuli, Parbat, Baglung, Arghakhanchi, Gulmi, Pyuthan, Rolpa, Surkhet, Baitadi	12
6.	Panchthar, Bhojpur, Khotang, Okhaldhunga, Ramechhap, Sindhupalchok, Nuwakot, Dhading, Gorkha, Lamjung, Myagdi, Rolpa, Jajarkot, Dailekh, Doti, Darchula, Bolkha	17
7.	Taplejung, Terathum, Sankhuwasabha, Rasuwa, Manang, Mustang, Dolpa, Mukhum, Tibrikot, Mugu, Humla, Jumla, Achham, Bajura, Bajhang, Solukhumbu	16

VII. CONCLUSION WITH RECOMMENDATIONS FOR THE COUNTRY

From all these it should come to the conclusion that there is a great need of building material industry which is an important step towards industrialisation. Yet its stage of development is very far from the level of

satisfactory. In the past years, the shortfall in supply for the country as a whole was made up by imports of the order of very few percentage of the value of total consumption, which was moreover considerably higher in most subregions of the country. Observation of long-term trends further indicates that the situation has not improved appreciable from that in past years.

Though Nepal launched her industrialization programme in the mid-thirties, most of the industries that were then set-up particularly in some of the main industrial towns/Biratnagar and Birgunj/areas could not be profitably run for long. Planned industrial development got underway only during the First Five Year Plan in 1956 and has continued in successive plan periods. This programme received a fresh impute with the adoption in 1974, by a new industrial policy which provides, among other things, that His Majesty's Government will start only large industries except in case of pilot projects and leave the rest to the private sector to promote. This policy also lays down that except defence and public utility industries, all industries are open to public, private or joint ventures. However, should private capital fight shy of venturing into the field of essential goods industries, HMG will take them up in the joint sector as far as possible. The Government is the largest client of the industry, in addition to being its regulator and material supplier. Facilities including soft loans, relaxation of customs and excise duties, income-tax relief and hard currency

allocation for the import of machinery,raw materials,etc., are other highlights of the new industrial policy.

The balanced development of the whole country,however,requires the deconcentration of building materials industry.As a result of a deconcentration policy,the overweight some towns and the unbalanced development in the special field of building materials industry can be reduced.Location of building material industries should be in line with the endeavour to raise the effectivity of production in different regions of the country.This helps to deconcentrate construction technology throughout the country.It also improves the technology with the perspective adoption of industrial construction.In this way large-scale housing construction can be taken into consider,which changes the nature and physical structure in town and their regions,whereas at present the bulk of housing construction is individual and only in the form of single family houses which are all private.

There is a great need of proper estimation of the required quantites of building materials production as well as for innovation and improved production methods.Technical association must be established to concentrate the design and research aspects,which will also give attention to improve construction methods.The effect of development of the improved construction industry depends upon the development of building materials industries,which should not be neglected.However,the deconcentration of construction and build-

ing materials industries in small scale units are economically attractive at the local level in rural areas.The possibility of introducing various construction and building material industries and the use of strategies in major public work construction offered an excellent opportunity for transfer and adoption of technology.The indigenous industry makes the construction industry attractive for creation of jobs to local people conservation of foreing currency and a training medium for transformation from agricultural used employment to manufacturing.This fact is complied with the labour intensive nature of the construction activity.The management problems of supervising large-scale labour-intensive construction projects are quite considerable,because most of the utilizable manpower in the industry will be drawn from agriculture sector,mostly untrained people,especially in the site management.

The economic structure of Nepal is mainly based on the agriculture/30%/,but it does not mean that the construction should be only on the traditional level.Considering the future growth in house building,new technology should be introduced to the rural area to support the construction activity.The existence of labour force in such areas in great quality must be considered,in relation to the shortage of skill and capital.Therefore the existing technical skill and the traditional knowledge must be utilized,the application of the modern technology will be extended in accordance

to the need of the country. In rural areas, unskilled labour force forms a basic capital, which is possible to make useful for the supporting efforts in the adjustment of technology. For all these ruralconditions, appropriate technology is suitable which can be applied in the processing of the building materials industries.

In Nepal, out of the total population there is only 0.1% people, engaged in construction industry, where qualified technicians and skilled workers are neglible. So first of all there is a great need of vocational training or the training of skilled workers. The Government must give the directives, rules, stimulants to the etension of the house building.

The country had free access to the modern techniques of science and technology only less than two decades ago. But the rapid demand of construction and building materials industry and the slow development of technical knowledge have led to the haphazard application of these materials and their technology. Because of varied topography and the difficulties of transportation and communication, proper planning in the utilization of building materials and in the establishment of construction indrustry are extremely important in Nepal. The basic building materials of to-day like cement and iron have been used in construction not only in those areas with the transport facilities but also in other parts where the transport of these materials are extremely difficult. The main causes for these facts are the lack of research works on the local building materials and the esteblishment

of micro-building materials industry.Also it is because of having not any skilled workers,or qualified technicians and the lack of training for their utilisation.The realisation of these facts led the Department of Housing,Building and Physical Planning of His Majesty's Government of Nepal to establish the Building Materials Research unit within the department.

The curent Five Year Plan /1975 - 1980/,of His Majesty's Government allocated nearly 63 thousand dollar for the purpose of establishment.By the end of the Plan,it can therefore be expected that research work will be carried on by the Department of Housing,Building and Physical Planning. The department will also endeavour to do a detailed survey on the building materials throughout the country.So after having the sufficient information of building materials,there must be the control of quality standard of building materials and components,which will make help to improve and develop the building technology.For the construction industry,by the standardization and quality control,training of skilled workers and cost control in the market also are badly needed.In this way,Nepal is still in the first step in the development of construction and building materials industry,due to the number of following difficulties,such as;

- lack of basic industries like iron-steel,engineering and chemicals,
- shortage of capital resources,
- shortage of personnels with managerial skill,

- lack of efficient means of transport and communication,
- shortage of suitabe mechanical power,
- paucity of foreign exchanges,
- irregularity in the supply of quality raw materials,
- shortage of research and training facilities,
- lack of testing and research institutes,
- few number of construction workers,

and so on.

VIII. SUMMARY

Nepal is a small Himalayan Kingdom with an area of 145,392 sq.km. located between China and India in southern Asia. It ranges in altitude from a mere 50 metres to well over 8000 metres. The varied topography provides it with a wide range of climatic conditions, varing from freezing cold of Himalayan region to the sweltering heat of Terai region. So Nepal is fairly rich in natural vegetation and in forest resources. The total population of Nepal at present is 11,555,983 with an annual rate of growth at 2.07 per cent. The two distinct ethnic groups of people, Indo-Aryans and Mongoloids, are scattered in about 30,000 small and big settlements. Of the total population only 4% live in urban areas and the remaining in rural areas. About 94% per cent of Nepal's economically active population are engaged in agriculture and its allied activities, and the contribution of agriculture to the country's GDP at over 66% despite the fact that only about 15% of the total land of the country is under the plough.

Administratively Nepal is divided into 14 Zones and 75 Districts. For balanced economic growth and compresive regional development, four Development Regions are established linking the diverse regions. The principal objectives of the current Fifth Five Year Plan has accorded topmost priority to agriculture, industry, commerce, power, transport and communications, social services, and so on. It is also emphasised

on massorriented production with stress on labour intensive approach and to bring about national integration.

It is supposed that there will be increase of population in Nepal at the rate of 2.% at the end of 1986 which makes the population 16,050,651. The population growth is one of the main factor in housing problem. In Nepal the housing problem is quite different between rural and urban areas, due to the differences in climate, local building materials and building technology, public utilies, and so on. The problems of house construction effect the development of human society. Almost all the people construct their houses by self-help practice. That is why the existing buildings have defects in foundation, walls as well as in roof due to the uncorrect way of applying building materials.

Due to the difficulties of transportation the prices of building materials are not uniform in different regions. The method of their application also quite different in each regions. The main building materials like earth, stone, timber, etc. in rural areas are local while in urban areas most of them like cement, steel, glass, plastic, etc. are imported. To prevent and to diminish such import, the establishment of new building materials industries and also the improvement and expansion of existing industries must be given a higher priority in the comming development plan, which should include timber based building materials industries, the improvements of the clay brick and tile industries, and the expansion of cement factory. Concerning the strategy for the development

of the building materials industry, attention should be given to the development of traditional materials also, and efforts should be made to popularize non-traditional materials and components.

The construction and building materials industry in Nepal is very important to give higher priority to see the availability of necessary imputs and the ability of people to afford for building activities. The regional strategy for the development of construction and building industry conceives of a set of micro industries and of four major north-south development corridors in order to link the diversed geographic regions of the country. One of the industrial problems facing the country is to mobilize the existing natural resources to meet the rapidly increasing building construction demand.

Hence to reduce the cost of construction and maintenance to improve the quality of buildings and workmanship and to accelerate the building construction for maximum results, it should be undertaken the measures like:

- development of non-tradional and non-conventional building materials and construction techniques;
- mass production and standardization of building materials, elements and components by improving their qualities,
- standardization of design, construction methods, building contract and procedures;

- building legislation,regulations and code of practice;
- training of skilled manpower,for construction and building materials industry;
- research and development of the stage in the field of research work about the appropriate industrial technology.

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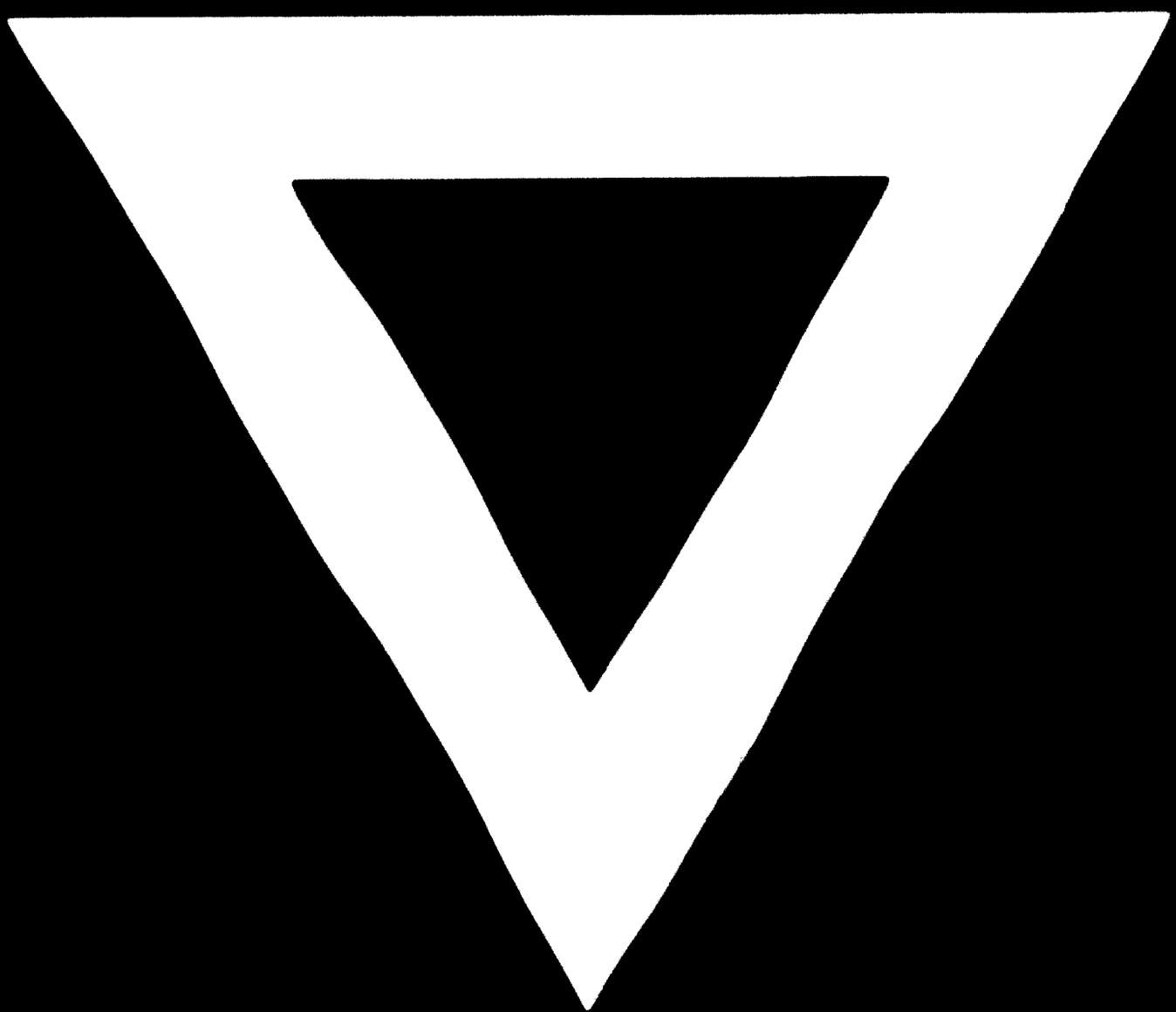

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