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DP/ID/SER.A/805
4 Feburary 1987
ENGLISH

FAO/ECA/UNIDO FOREST INDUSTRIES
ADVISORY GROUP FOR AFRICA

DU/RAF/82/006/11-51

Technical report: Increasing timber construction in Africa*

Prepared for the Governments of Africa
by the United Nations Industrial Development Organization,

Based on the work of C.R. Francis,
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United Nations Industrial Development Organization
Vienna

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I. INTRODUCTION

The objectives of the FIAG project are stated as:

- To assist member states in developing their capabilities for identifying, defining and solving problems related to the development of forest industries;

- to assist in promoting the growth of forest industries in a way that would assure their optimum contribution to economic and social development of the member states.

The use of timber as a construction material has been an integral part of the objectives of FIAG from its inception and this aspect has been promoted all along. The response has been disappointing yet the Project Manager in his Terminal Report FIAG/86/50 has written:

> "In Africa timber has not been used in construction to a degree commensurate with forest resources. Yet there is an acute shortage of housing, school buildings and other institutional accommodation and an urgent need to conserve and expand agricultural production."

There are considerable areas of exotic plantations in East and Southern Africa and very large areas of native hardwood forest in West Africa, although these are rapidly becoming depleted.

In spite of the efforts of FIAG over many years, the use of timber in African construction has remained disappointingly low. The expert was recruited to try and pinpoint reasons for this and to make recommendations so that future UN work could be more efficient.

The Job Description is attached (Annex I). It was made clear during briefing in Vienna and Rome that the detailed requirements should be regarded as a general guide only and the actual investigations pursued would be left largely to the expert's discretion.

Investigations were confined to study of FIAG reports over the last six years, study of documents collected by FIAG and discussions with FIAG staff and others, plus the expert's personal knowledge.

The picture which emerged is described in the following sections.

II. SCOPE OF INVESTIGATION

The region of Africa divides into several subregions. From a forestry point of view these are:

- North Africa-Sahel belt northwards. This has effectively zero forests.

- West and Central Africa - tropical rain forest hardwoods.

- East Africa - Ethiopia southwards - plantation forests of pines, cypress and eucalyptus.

The East Africa subregion only has been included in this report since:

- Only a few species of very similar sizes and properties are involved;
- English is a unifying language, with the exception of Madagascar (French) and Mozambique (Portuguese).

A maximum output for minimum input can therefore be expected, since a result in one country is likely to be relevant to neighbouring countries which all have similar problems.. Another reason for this limitation was lack of time and funds to travel to other parts of Africa.

III. RECOMMENDATIONS

Recommendations have not been separated out since it is assumed that this is an internal document, but have been indicated in the margin by vertical lines as this paragraph.

A. General

There appear to be several reasons for the low consumption of timber in African construction:

1) Low availability of suitable timber
2) Social aversion to wood
3) Lack of skill in design and specifying professions
4) Low carpentry skill levels
5) High price of suitable timber.

All these reasons interact, thus a poorly made item from poor quality timber does nothing to enhance the desirable status of a timber product, and lack of demand keeps unit production costs high. There is no incentive for either technologists or tradesmen to learn timber techniques. Breaking into this interlocking set of barriers has not so far been successful.

The expert is convinced that physical demonstration is essential for any constructional utilization programme. Unfortunately such projects have been unsuccessful so far. For example the expert's earlier project in Kenya was a complete failure due to the inability to get electricity connected to the fully equipped demonstration workshop during the two years duration of the project. Attempts to influence specifiers by direct contact or technical papers failed because the recipients were

(a) disbelieving of the expert's opinions,
(b) without sufficient timber engineering background to understand the technical manuals which he prepared.

In the absence of any demonstration buildings, neither of these barriers could be overcome.

Setting up a complete demonstration project is very expensive in terms of both manpower and equipment. Also a large amount of an expert's time will be taken up with administrative duties rather than with actual training and transfer of technology. It cannot be guaranteed that any physical investment will continue to be used effectively, therefore this part of the project cost may be wasted.

The expert recommends:

- Demonstration projects should be confined to places where suitable workshop facilities exist;

- Suitability of facilitites may be evaluated from:

  Staff mission reports or personal knowledge,
  FIAG mission reports,
  inspection by the local SIDFA.

In the case of SIDFA inspections, since they may not be familiar with woodworking operations a detailed check list of required facilities should be provided, also the names of appropriate agency project staff. For example. there might be a FAO sawdoctor expert who could advise on a joinery factory's capabilities or a UNIDO project woodworker who could advise on a saw shop, though neither is an expert in the other discipline.

Notwithstanding the above, provision of minor equipment could be included.

Where a project is arranged, a complete check on projects which could have mutual benefit should be made, and co-operation arranged between agencies at agency level. This check could be done by the SIDFA from the UNDP telephone directory.

For example, in Ethiopia, there is ILO RAF/78/010 "Jobs and Skills Programme for Africa". How much of this is concerned with carpentry training and where?

There is also ILO project ETH/80/01A "Labour Intensive Rural Road Construction and Maintenance". Does this project require bridges or culverts? If there were a demonstration timber project in Ethiopia, liaison between these could well result in mutual benefit.

These two examples were found from a few minutes' study of the UN Ethiopia telephone directory. No attempt has been made at follow up due to lack of time.

That any such interproject co-operation is approved should be made clear to the Governments concerned. The situation should never arise where contact with a closely related project was formally prohibited by a national project director. This once happened to the expert though not in Africa.

B. Timber

The intrinsic wood properties of the plantation forests are perfectly adequate for structural use. This is evident from the widespread and sometimes spectacular use in developed countries of species with very similar characteristics of wood properties, grade, durability and permeability. The argument that the plantation timbers are of poor quality and are therefore unsuitable for construction is not tenable.

The physical appearance of the timber as presented to the construction industry leaves much room for improvement and is a major factor inhibiting its use. Inhibiting factors include:

1) Dimensional uniformity

Nearly all country reports and the expert's experience comment on the poor condition of most sawmills. A poorly maintained or operated mill cannot produce truly sawn timber. Faults will include out-of-square, dimensional inaccuracy and taper.

In developed countries which use timber for construction, even with their better standards of sawmilling, sawn surface timber is rarely used for construction. Almost all of it is planed to accurate dimension as an integral and normal part of the milling operation. There are two reasons for this:

(a) The quality of buildings or components made from unplaned timber is markedly inferior to that made from uniform dimensional timber and is unacceptable, whether in houses or institutional buildings.

(b) Attemps to rectify inaccuracies on site, whether by site planing or by packing and fitting are uneconomic.

In the writer's and other's experience there are hardly any integrated planing facilities in East Africa. Planing is regarded as customer's option. The result is delay in supply, high cost due to short runs and additional handling and transport and differences in dimension (though less than the sawn variations) due to frequent resetting of the machines.

It was noticed in the report FIAG/86/36 that the planned pine sawmill at Mangaro, Madagascar, does not contain any planing facilities, yet the activities of the Société Fanalamanga include the construction of 40 socio-administrative buildings, 6750 dwellings, and 30 forest look-out towers. This is apart from any production buildings. It would appear that provision of planed timber for these 700 odd buildings alone could justify the installation of a planing facility.

The expert strongly recommends that any sawmilling projects either commenced from start or rehabilitated should have planing facilities included as an integrated part of the sawmill. If other facilities, e.g. joinery or prefabricated housing are being installed which would have planing as part of their operation, consideration should be given to moving the planing into the sawmill area of responsibility.

In summary, it could be said that there is too much cut-to-order sawnwood and a general lack of sawnwood markets with stock sizes.

2) Chemical protection - blue stain and preservation

Plantation timber, especially pine and eucalyptus grow quickly. On the other hand the very nature of fast growing wood makes it susceptible to insect and fungal attack and one of the trade-offs which must be made is the cost of chemical biocides against these agents.

(a) Blue Stain

The first protection which should be given is superficial protection against blue stain. Depending on circumstances this may have to be provided to timber in log or sawn form or both.

Until recent years the universal agent employed against blue stain was sodium pentachlorophenate - NaPCP. It has been shown that continued exposure to NaPCP is a definite health hazard and its use has been banned in many countries. There are several other chemicals which are equally as effective against blue stain, but unfortunately their price is higher and their application may be more complicated than NaPCP. Nevertheless, in the labour intensive and less well controlled conditions likely to obtain in African mills even more importance should be paid to minimizing health hazards to workers.

Protection again blue stain is superficial and temporary. It is only intended to be effective during the period in which the timber is green and it should be regarded as a processing requirement only. Stained timber looks unattractive and is difficult to market. Its presence contributes to widely held views of timber as a second class material.

Sawmill rehabilitation or construction programmes should include anti-stain facilities unless there are very strong reasons to the contrary.

There are numerous protective chemicals besides NaPCP available and a large body of research literature. No new research need be undertaken on this subject. At the most, confirmatory tests of recommended practices could be undertaken for local wood/climate combinations. Anti-blue-stain treatments have a minimal effect on durability and should be regarded as a marketing aid and image improver. Minor staining may be acceptable but heavy staining makes timber unmarketable.

Blue stain in itself has no effect on mechanical properties, but it frequently precedes fungal infection and possibly facilitates it. Experts could perhaps emphasize this when dealing with specifiers at the same time as sawmillers, thus providing a two-pronged approach.

b) Preservation

The first approach to preservation is one of economics - a cost saving versus a short life. In some cases the need for preservation is obvious and accepted, e.g. power poles. In other cases, e.g. roofs built of moderately resistant timbers, its benefit may be marginal in low cost structures. In these cases the extra cost may prove the ultimate inhibiting factor and it might be best to wait for structural acceptance before trying for increased performance the second time round.

There is a fair amount of experience in Africa with various timber-preservative-hazard combinations and reasonable durability predictions are capable of being made. Unfortunately most of this information is scattered and it would require a major effort to assemble it on a data base. Natural durability and permeability are being assembled on to the FIAG data base.

A few countries (Kenya, Tanzania) have proposed draft preservation standards, others appear to be considering the matter. At the UNIDO Expert Group Meeting on Timber Construction in December 1985, the expert recommended the use of the Fiji Code with parts of the Papua New Guinea code as a sound basis for a developing country's preservation standard.

For much building work, pressure treatment with CCA[1/] seems to be the only process/preservative combination considered. Kenya has well established experience of BFCA[2/] diffusion. Where insect attack (other than carpenter bees) is the major hazard, diffusion treatment is sufficient for the bulk of building timber. Diffusion is attractive because of its low capital cost. Its major disadvantage is the cost of working capital for the cost of the timber in diffusion storage. It is also possible to treat by diffusion some species (e.g. cypress) which are resistant to pressure treatment.

Because of the requirement for the timber to be absolutely green before diffusion treatment, it is essentially a sawmill process. Only a few days of storage and transport are enough to prevent diffusion taking place.

Neither of the pine sawmill proposals examined had provision for diffusion treatment, but pine is very susceptible to insect attack. The argument that diffusion takes a long time and pressure treatment does not is hardly valid when one bears in mind the drying necessary before pressure treatment. It leads to the suspicion that green timber is being pressure treated.

It is recommended that requests or proposals for pressure treatment plants especially in cypress areas, should be viewed with caution and that every endeavour should be made to ensure that a diffusion plant is installed unless clearly shown to be inappropriate.

In agricultural building situations, where less efficacious preservation may still be effective, processes such as butt treatment by hot and cold bath or by sap displacement, possibly using natural features like a cliff to get the necessary head, should be considered, and advice should be offered to basically agricultural projects on these methods.

C. Buildings

1) Institutional buildings

This group of buildings includes schools, ward annexes of hospitals, single or two story offices, barracks; sometimes called "sausage buildings" because of their long uniform shape.

Such buildings have a medium span (8 - 10 m) and are frequently built with masonry walls and steel roof trusses at moderate centres (2.5 - 5 m).

1/ CCA = Copper-Chromium-Arsenic
2/ BFCA = Boron-Fluoride-Chromium-Arsenic

An immediate opening for timber construction is the use of trussed rafters in the roofs. Trussed rafters have the advantages of import substitution and the provision of most of the ceiling framing. Several developed countries have reported cost savings of 30 - 40 per cent when timber trussed rafters are substituted for steel trusses in such construction.

UN projects in Africa should keep in close contact with Government departments which have institutional construction programmes, particularly those for education, health and works. This can be either directly or through local timber or construction interest. The aim would be to use "sausage" buildings in development programmes as the base of a trussed rafter industry, since an ensured market within the scope of Government planning would permit a base production level to be maintained during the initial stages in any given country.

Numerous designs of trussed rafters exist for almost every conceivable situation from truss plate companies. The expert has previously prepared a report "A trussed rafter system" UNIDO DP/ID/SER.A/353. This was prepared for medium quality Kenyan plantation timbers and should be directly relevant to most East African countries. UNIDO is also considering the preparation of a design manual of wider scope.

No detailed knowledge of timber engineering is required to implement the manufacture of trussed rafters from readily available information. The expert considers that the capital cost of special factory equipment to manufacture trussed rafters could be recouped in full in a contract for 1200-1500 trussed rafters. If sawing facilities already existed, or if some sawing were done with portable power saws, the number of trusses to cover equipment costs would be only a few hundred.

The expert is enthusiastic over trussed rafters as a major booster to timber engineering and the idea is well received by developing country builders once they have seen it done. After a trussed rafter factory is established on the basis of "sausage" buildings, then smaller markets such as housing, commercial, agricultural and industrial construction can be penetrated from this base.

It is strongly recommended that institutional building programmes should be closely monitored in order to establish trussed rafter industries.

2) Agricultural buildings

Agriculture is the basis of African existence. Agricultural aid programmes are numerous from all sorts of agencies, not only FAO. Buildings of various type are an important factor in agriculture and various traditional, conventional and unconventional building techniques are being tried.

The main uses for timber in agriculture are in building poles and in roof structures. Due to extreme low cost requirements centrally produced items such as pressure-treated poles and prefabricated trusses are not appropriate. In fact in many applications trusses of any sort are not appropriate because they are a relatively expensive and sophisticated form of construction.

Any work in agricultural buildings should concentrate on:

- Field methods of pole treatment, e.g. hot and cold bath treatment in oil drums or sap displacement.

- Ultra low cost roof construction, e.g. braced propped beams or beams trussed with fencing wire.

D. Housing

Housing is strongly affected by tradition and social acceptability. Where possible, householders will live in the type of houses they are used to, or to which they have social aspiration. The widespread use of masonry by the richer colonists in East Africa has left a social cachet which still strongly persists. Equally, widespread use of packing case and other scrap timber for shanties has imparted a strong prejudice against the use of timber for exterior cladding (where it is most obvious) if not necessarily for the structure where it may not be seen.

These factors have been frequently raised in various reports and publications, and in discussions.

1) Traditional housing - rural areas

The only scope for plantation timber in traditional mud and stick construction appears to be in roof components and then incompletely, as a sawn timber truss supporting pole rafters and in doors and window shutters.

Operations in the rural housing field are rather outside the fields of UNIDO and FAO due to the major social component, but they fall directly within the ambit of HABITAT.

It is recommended that proposals for the use of timber in traditional housing should be followed up in co-operation with HABITAT, and that close consultation with them should be maintained before and during any wood utilization project. The more technical agencies can offer advice and support, but are unlikely to achieve much in this field by their own efforts.

2) Low cost housing

The expert does not believe that good quality low cost houses can be built of timber. Wood is not a cheap material, even less so when it is completely processed. It appears illogical to try and build a cheap structure out of a relatively expensive material unless heavy subsidies are available.

An example of the failure of timber to provide low cost housing is found in a prefabricated house company in Kenya. This company went to major lengths to provide small cheap timber houses and produced excellent value for the price. However, it has been in difficulties for some years, being sustained only by occasional contracts where speed of erection was a major consideration and by sideline activities.

The use of timber in low cost housing is therefore likely to be confined to:

a) Roof and joinery items, and

b) major housing development projects, Government funded and guaranteed where the capital cost of factory production can be covered.

Mass production lowers labour costs, and transport costs for timber are relatively low, also prefabrication of numbers of houses close together offers the possibility of savings due to good site organization. It is these fringe fields only which can allow timber to compete with other materials.

Factors working against the use of timber in low cost housing schemes are:

a) The prejudices of the low income owners or tenants, and
b) the prejudices of the approving and financing officials.

The latter could possibly be covered by study tours to countries where high class timber housing is normal, but unfortunately most of these are far from Africa.

Changing the prejudices of a low income probably poorly educated stratum of society is much more difficult and the expert has no suggestion in this field.

The above comments on timber costs apply to the situation as it generally exists in East Africa, with low efficiency small mills, fragmented processing and lack of standards inhibiting bulk production. If these restraints are removed by development and rehabilitation programmes, then ex-mill prices should reduce, and timber should be able to capture a larger share of the low cost house structure.

3) <u>High cost housing</u>

At the upper end of the housing market, the customer with his architect decide on most materials. Social considerations will most likely override economics or performance. Use of timber is confined to roof structures, doors and parquets.

A major constraint apart from prejudice is the scarcity of skilled carpenters and joiners to produce acceptable precision and finishes so that even if finance and materials were available to build a demonstration high quality timber house, it would be difficult to find tradesmen to build it.

The expert has observed roof construction in large masonry buildings which appeared extremely old fashioned and wasteful of timber. Modern trussed rafter methods could reduce the timber volume in such structures by possibly 50 per cent. Such houses are unlikely to be available for early market penetration at the introductory stages of a trussed rafter operation but later the use of trussed rafters in a few prestige houses could give such an industry a tremendous boost.

4) Rural housing

There is some possibility of increasing structural timber usage even in traditional rural dwellings.

In some African areas the traditional mud walled house is covered with a hipped roof as shown in Figure I (see next page). All members are composed of round poles. The covering may be of thatch, flattened drums or corrugated sheets. These structures are rickety due to the difficulty of making strong joints between round poles and non-durable due to insect attack in unpreserved sap wood. Also, a considerable amount of skill is required to erect such a roof due to its unstable condition until completed, in fact most of the stability seems to come from the cladding.

If a single ridge truss were used, the pole, hip and common rafters could be attached to it more easily and the structure would be stable as soon as a single rafter were attached to the truss. The durability problem of pole rafters would still be there, but these could be replaced piecemeal as need arose. The truss itself should last the life of the house and the usually extortionate fee demanded by the "fundi" carpenter would instead be spent on the cost of the timber. The "fundi" would make the trusses so is not being displaced from his job.

Work of this nature has a large sociological component and is probably best undertaken by HABITAT or a similar socially oriented agency, rather than a technically oriented agency such as UNIDO or FAO, who in these circumstance would probably stop at the level of upgrading timber processing to a suitable level, advising on preservation and grading or training vocational instructors in the necessary techniques. In other words, HABITAT would help create the market for trussed rafters by promoting them in this type of use.

E. Wall Construction

Walls rather obviously display their construction and in general a building is characterized by its wall covering.

As mentioned under "Housing" there are strong prejudices against timber walls. To some extent this can be overcome by replacing weatherboards with stucco or similar coverings on metal mesh. This gives a house a non-timber general appearance.

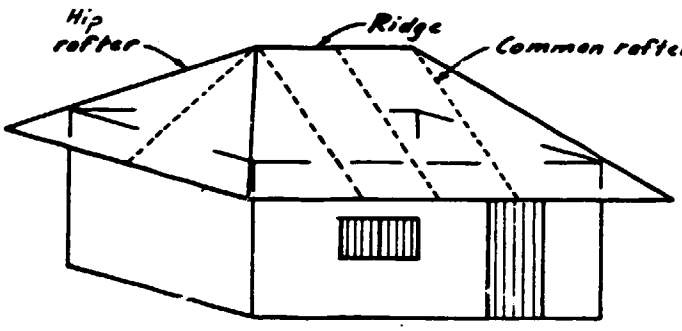
A point which has been raised many times is the combustibility of timber walls. In fact, this is much more a function of rate of surface spread of flame of linings than wall structure material. This was dramatically exemplified during the expert's mission when the office at the Wood Utilization and Research Centre at Addis Ababa burnt completely to the ground. This building was timber frame lined completely with a low density particle board.

Gypsum sheets covering internal wall surfaces are widely used in developed countries for wall lining and a sheet of gypsum board 9 mm thick provides a fire resistance rating of about 30 minutes in the international standard test.

Unfortunately wallboard machines cost many millions of dollars and their output is so large that they could produce almost any African country's annual requirements in a matter of a few days.

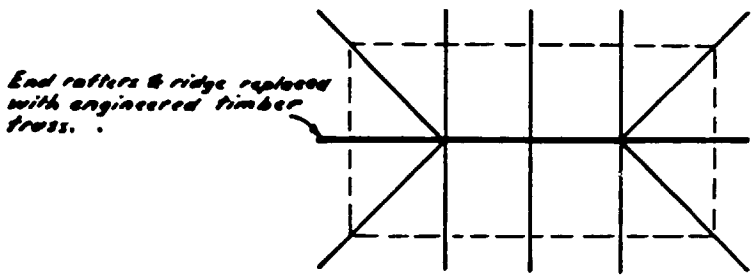
Figure I

ROOF TRUSS TO REPLACE TRADITIONAL FRAMING

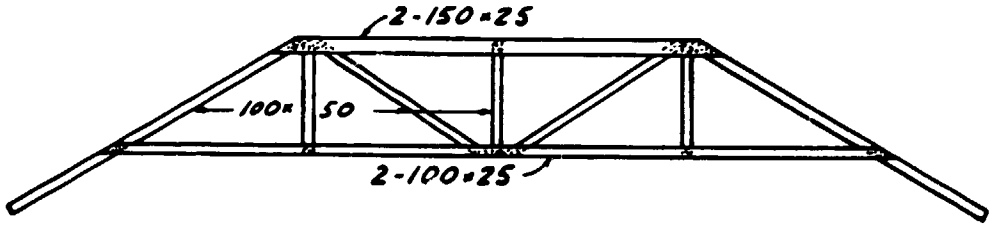


TRADITIONAL ROOF FRAMING

All roof members round poles



FRAMING PLAN



RIDGE TRUSS 6-8 m.

A similar gypsum material is "fibrous plaster". This is gypsum reinforced with fibres. Glass fibre is generally used these days, but originally sisal was used.

The manufacture of fibrous plaster sheets is simple, moderately labour intensive and has low capital requirements, the major cost being the building. Sisal and gypsum are readily available over most of East Africa. Manufacture of fibrous plaster sheets appears a logical complement to timber framed wall construction

A factor which is very appealing is that the manufacture scale could be as small as a single 8 x 4 feet casting table. This makes the process suitable for even a backyard cottage industry for supplementary income, and manufacture can extend from this scale upwards.

It is recommended that in any country where interest is shown in timber wall construction, fibrous plaster manufacture should be investigated and if possible a pilot scale factory established.

Cement-bonded particleboard has been investigated to a major feasibility study stage in Ethiopia by the Ministry of Construction. The technical findings appear to be applicable to many other East African countries since similar raw materials situations exist.

Cement-bonded particleboard is an excellent wall lining material for both internal and external surfaces. It is fire resistant, termite and decay resistant and is a suitable substitute for a variety of finishes.

The major problems are:

a) The high capital cost - $US 15 million, and
b) the high selling price - $US 16.95/$m^2$.

Both these constraints appear to eliminate cemend-bonded particleboard as a likely construction material in any East African country in the near future.

Wood wool-cement board has been tried in several housing schemes in Kenya and Tanzania and was not acceptable for several reasons. These included:

- Low resistance to break in by burglars,
- cavities were ideal breeding places for cockroaches, bed bugs, etc.
- low heat and
- low sound insulation.

The situation was improved slightly by plastering inside and out but even so the acceptance by the inhabitants was poor. Wood-wool-cement panels are manufactured in the Kenya Industrial Estate in Nairobi but their sole use is office partitioning.

After the Kenya and Tanzania low cost housing experience, it is unlikely that any other country would find this material acceptable as a house wall material.

Other non-timber finishes are available for timber framed walls. These include stucco on wire mesh, mineral fibre cement sheets and at a higher price bracket, brick or concrete masonry veneer.

It is recommended that if timber frame construction is contemplated in any country in the region, these types of finishes should be considered rather than wood-based finishes, with non-combustible linings.

IV. CONCLUSIONS

A. Regional project "Development of Building Material in Africa" (RAF/86)

This UNECA project has the primary function of "Development of small scale manufacturing facilitites for the production, testing, standardization and utilization of building materials as well as training of technicians and entrepreneurs for the production and use of same".

The materials proposed are basically inorganic and timber per se is not mentioned. However, discussions with the Project Manager revealed that there would be necessary timber inputs particularly in the roof structure component of the project in the 10 demonstration houses to be built. At that stage, co-operation particularly with UNIDO would be welcome. The project has a component of 42 man-months for consultants; some of this could be advice on timber structures.

B. Project Staffing and Activities

The project has not had the benefit of a senior expert whose prime activity and expertise is timber construction, except for Harald Erichsen for four months in 1980. This has naturally been reflected in project activities.

An important part of influencing Government decisions is high level discussions with senior Government officials in the various ministries concerned with construction. This necessitates a senior expert qualified not only academically but also professionally, either an engineer or architect.

A successful construction-oriented project must involve a considerable amount of practical demonstration which will involve working with and training local tradesmen. This can only be done by a tradesman, and neither an expert nor an associate expert, almost by definition is this, however competent he may be at home handyman level.

It is recommended that a suitable tradesman expert should be included in a revived project staff. Costs could be reduced by recruitment through UN Volunteers.

C. Short-term Programme

1) Data Base

The data base is a valuable long-term tool for planning, preparation of regional codes and assessment of impact of project proposals. This should be continued.

2) Inter-Agency Co-operation

Experts at field level are usually pleased to assist one another, but limitations of individual project scope and administrative difficulties often preclude this.

It is recommended that a list of UN projects which have a possible timber component should be prepared, and these projects should be investigated to see whether they could benefit from expert timber advice.

Examples:

- ILO Rural Roads (Culverts, bridges) already cited,
- FAO livestock marketing (field treatment of stockyard posts)
- HABITAT (Engineered construction of traditional roof types).

Depending on the number and nature of replies, an assessment of the value of a field demonstrator could be made, together with the cost of specialized supplies.

3) Assistance to WUAR, Addis Ababa

- Evaluation of small clear specimen tests;
- Assistance with in-grade testing programme;
- Seminar for timber industry forestry sector;
- Production of roof trusses;
- Assistance to consultancy on selection /implemenation of roof truss project.

If travel funds are available: Mission to Madagascar and Tanzania for follow-up work on initiatives taken for formation of forestry/timber associations.

D. Long-term Activities

Apart from problems of supply and quality of timber which are discussed elsewhere, long-term inhibiting factors are:

1) Low social acceptability. This affects the attitute of inhabitants and also the attitudes of high level officials in Government banking and insurance. This leads to

2) Rejection of timber housing or infrastructure schemes by Government officials.

3) Refusal of mortgages by banks and others.

4) High insurance premiums or refusal of insurance on timber buildings.

5) Official classification of timber buildings as "temporary".

Overcoming these attitudes can only be a long-term process of education and persuasion.

Some preparatory work could be done be ascertaining which banks and insurance companies come into categories 3) and 4), finding their affiliated firms in timber-using countries (Australia, Canada, New Zealand, USA) and then asking the African firms why they are holding back their own country's development when they have internal evidence of timber's suitability. This work would all be by correspondence.

For Government commitment it is felt that high level seminars would probably be more efficient in changing policy. Such seminars would be at a high political level and would require careful handling and, if concentrated on housing, would necessarily be diluted from a timber point of view, by other materials. However, the suggestions could be put to the top level say OAU, but would have to come from a similar level, the Director-General of an Agency.

An example of this is the "Conference on the Use of Timber in Construction in Africa" organized in conjunction with "BATIBOIS", Bordeaux, France, 30 September - 1 October 1986, which had ligh level sponsorship and was attended by some 30 senior West African officials including several Ministers.

Fellowships for study tours should be confined to Technical-Director level of major timber production or using firms to be sent to attend National Housing Conferences or similar in timber construction countries. Selection of candidates might be a problem in some countries where those who could benefit most are in private companies and therefore strictly not eligible for direct UN aid.

Contact should be made with the embassies of the previously mentioned countries to ascertain the nature and dates of suitable conferences with a view to funding of fellowships.

E. Training

The need for training all areas of African industry has been emphasized time and again. In the primary wood industries alone a training requirement of a total of 65,000 workers at all levels between 1983 and 2000 has been identified.

FIAG has established good links with universities and Forest Departments in East and Southern Africa.

It is recommended that an expert in timber construction and design should be attached to a revived FIAG with a primary responsibility of preparing syllabi and all the necessary training material and subsequently conducting training seminars at these universities aimed principally at engineers and architects. These seminars would consist of one-week courses at the Faculty of Engineering or Architecture. Preferably the courses should be residential, if this can be arranged at a university hostel.

From previous timber engineering courses held by UNIDO in Melbourne and Auckland and the furniture and joinery courses in Helsinki, a considerable body of training material exists. The major problem is probably to condense

and edit this material rather than prepare it. Teaching aids such as colour slides, transparencies and charts are not available from UNIDO in a coherent form. National projects are now instructed to prepare suitable slide series. The compilation, titling and working into the existing teaching material will be a considerable effort but well worth it in terms of technology transfer.

Some trade training facilities exist at technical colleges and the Italian-financed centre being established for SADCC countries.

A woodworking instructor expert should

1) inspect these facilities to decide on training possibilities in the various institutions, with the equipment available;

2) prepare training syllabi and teaching aids for each institution; and

3) monitor the training given by national instructors to ensure that it is appropriate and up to date, and realistic in terms of tools and materials available locally.

F. Costing

A major lack of knowledge exists in the field of construction costs. At an early stage in any discussion on construction whether of houses or institutional buildings, the question of costs arises.

Past UNIDO projects in various parts of the world have assembled an impressive range of designs of timber structures and in most of these detailed schedules of quantitites have been prepared.

In any building, certain items are common regardless of the major construction material. These include roof covering, doors, windows. In cost comparisons between materials, these can be eliminated. For selected buildings deemed suitable for Africa, particularly schools, concise quantitities should be prepared on a basis of 100 square metres of building, thus:

Timber - cubic metres
Nails - kg
Tradesmen - man hours
Labourers - man hours.

While an overall figure is the one generally discussed at policy-making level, it must be compiled from more detailed breakdowns of components, e.g.:

Roof structure - m^2
Ceiling structure - m^2
Internal partition - lineal m
Exterior wall, plain - lineal m
Exterior wall, with window - lineal m
Timber floor - m^2
Elevated foundation - m^2 of floor supported.

In turn each item above needs to be broken down into smaller units, e.g.:

Timber - length, size, unit price
Hardware - type, local or imported, price
Nails - kg, price
Other materials - specify
Paint
Labour - proportion of supervisory overhead
tradesmen - hours, wage
labourers - hours, wage
Transport - within city
through country

A consistent methodology of proforma cost sheets needs to be prepared in a regional project which can then be completed in detail on a case-by-case basis whenever timber construction is to be considered as an option.

These costs can then be compared with traditional material costs and used as a planning tool to either:

a) Demonstrate economic benefits of timber construction, or
b) accept that certain specific aspects of timber construction in the local circumstances can never compete with other materials, and therefore forests should be used for other purposes than construction materials.

Without this knowledge, no informed decision can be made one way or the other.

UNITED NATIONS

ANNEX I

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

Forest Industries Advisory Group for Africa

JOB DESCRIPTION

DU/RAF/82/006/11-51/J13101

Post title Consultant in Timber Construction

Duration One month

Date required As soon as possible

Duty station Addis Ababa, Ethiopia

Purpose of project

1. To assist member states to develop their capabilities for identifying, defining and solving problems related to the development of forest industries.

2. To assist member states in promoting the development of forest industries in such a way that they interact with and stimulate other sectors and contribute to the development and growth of the national economy.

Duties:

The consultant will work within the terms of reference of the project to develop a realistic programme for promoting and advising on improved and more widespread use of timber in construction. He will recommend to the Headquarters of UNIDO and FAO both a short-term work plan within current resources to end September 1987 and a longer-term programme for the next phase lasting to 1991.

In particular he will:

1. Define timber construction problems in the region.

2. Classify the problems on the basis of possible immediate and long term solutions.

3. Draw up a work programme for problems which require immediate solutions, bearing in mind the competence of staff and resources available.

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

4. Prepare work programme for problems which require long term planning and search for solutions.

5. Examine the staffing of the project with emphasis on secondary industries and timber construction, point out deficiencies and recommend necessary remedial measures in order to effectively deliver the expected outputs arising from recommendations in (6) and (7).

6. Write up appropriate terms of reference for experts working in secondary industries and timber construction.

7. Recommend a suitable coordinating role that could be reasonably played by FIAG and UNIDO in assisting governments in solving the problems identified and how international and bilateral agencies might best further these programmes.

8. For these duties, the consultant should consider how best UNIDO could provide key inputs at critical points to national efforts through short-term consultancies or specific "satellite projects" to the FIAG project exectued by FAO, ECA and UNIDO. "Timber Construction Awareness Seminars" for professionals involved in building, high-level advice to Ministries of Construction, housing, Public Works, etc., and standards bodies are examples of such activities that would complement the regular work programme of FIAG staff. Also assist in drafting standards or submissions for revisions of relevant legislation could be considered.

9. Any other recommendations and/or suggestions relevant to the general timber utilization problems which fall within the competence of the expert.

Qualifications: A specialist in timber construction with practical working knowledge in developing countries. He should be familiar with building codes relevant to the poor economies of the developing regions. A knowledge of the properties of plantantion timbers and of grading rules is an asset.

Language requirements: English, knowledge of French an asset.

Background and Justification:

The Forest Industries Advisory Group for Africa (FIAG) is a regional project which is financed by UNDP and executed by FAO with UNIDO and ECA as cooperating agents. The present phase of the project ends in December 1986 but FAO has submitted proposals to UNDP for the project to continue through the UNDP Fourth Cycle, 1987-1991. All along UNIDO has been an active partner of the Forest Industries Advisory Group for Africa and they have expressed their willingness to continue the collaboration and, where possible, to improve their input to the project. This generosity to the project is highly welcome because it will strengthen the project and improve the quality of output delivered.

Both UNIDO and the project have realized the need to develop and promote utilization of timber in construction, particularly in the Eastern and Southern sub-regions of the continent which are endowed with rich tropical high forests. Governments in these sub-regions have invested large sums of money in industrial softwood plantations now estimated at about two million hectares with an annual establishment rate of about 120 000 ha.

Development and promotion of plantation timber for use in construction call for an understanding of the problems involved and a search for solutions through established methodology. The proposed one-month consultancy is expected to enlighten the project staff on the problems and the means of solving such problems.