Restricted
Technical Report
RP/1981-1983/4/7.6/04

SOMALIA

International action contributing to activities of Member States for the preservation and presentation of cultural property

National Museum of Somalia, Mogadiscio:

Roof Restoration Project

by
Oguz Janos Lengyel

Serial No.: FMR/CLT/CH/82/160

United Nations Educational, Scientific and Cultural Organization

Paris, 1982

S O M A L I A

NATIONAL MUSEUM OF SOMALIA, MOGADISCIO : Roof Restoration Project

by Oguz Janos Lengyel

Report prepared for the Government of the Somalia Democratic Republic by the United Nations Educational, Scientific and Cultural Organization (Unesco)

U N E S C O

Technical Report
RP/1981-1983
FMR/CLT/CH/82/160(Lengyel)
1 October 1982

Printed in France

Table of Contents

Introduction

1. In response to a request from The Government of the Somali Democratic Republic, the Director-General of Unesco instructed Mr. Oguz Janos Lengyel to undertake a consultant mission to that country with the following terms of reference:

(a) To advise the Somali authorities at the Ministry of Culture and Higher Education and the National Museum on the steps to be taken for consolidating the roof of the National Museum, Mogadiscio;

(b) to advise the above-named authorities on the steps to be taken for the repair of the National Museum, especially with regard to the structural engineering needs.

2. The mission took place from 14 April to 6 May 1982.

3. The objectives of the restoration are:

(a) To re-establish the structural integrity of the museum building;

(b) to eliminate all present and future possibility of termite infestation;

(c) to eliminate all water leakage and humidity inside the building and within its walls;

(d) for the benefit of future generations, to preserve and restore the present esthetic aspects of the edifice, within and without.

4. The Consultant wishes to express his appreciation of the help extended to him by Mr. Aart Udo, Deputy Resident Representative of UNDP, which greatly facilitated his work. He wishes, also, to thank Mr. Abdullahi Ali Yusuf, Director of the Museum of Mogadiscio and Mr. Mohamed Abdiraman Mohamed, Acting Director of the Museum, for the support and co-operation they gave him in the preparation of the report and in the carrying out of his mission. Finally he wishes to pay a tribute to Mrs. Chris Albers, an active and enthusiastic member of the Museum Committee, who made a significant contribution towards the fulfilment of his task, both with artistic advice and the typing of the preliminary report.

A. The Structure

The walls

5. The Museum of Mogadiscio, which was built in 1872, is situated about 200 m. from the sea, next to the Uruba Hotel. The walls are made of limestone, their thickness on the ground floor being approximately 1.0 m.; on the upper floor it is 50 cm. on the outside facades and 30 cm. on the courtyard side.

The ground floor

6. The ceiling of the ground floor open corridor running around the inner courtyard is supported by roughly circular-shaped wooden beams placed tightly together and resting on steel I beams buried in the wall, one one side, and on reinforced concrete girders on the open side. Above the wooden beams there is a 20 cm. thick coral sand and lime agglomerate, solidly cemented by the lime, and topped by a colourful cement floor.

7. The ceilings of the adjoining rooms of the corridor are of similar structure, except that the tightly packed wooden beams are replaced by regular planks and wooden rafters. The steel I beams are always present as the principal support below the wooden structure. They are probably a later addition made to reinforce the ceiling.

8. The wooden ceiling in the open corridor is damaged by termites between 10% to 80% in its substance, depending on its location, so far as it is possible to judge viewed from below. The worst damage occurs in the section of the corridor nearest to the street. The wooden ceilings of the adjoining rooms and the library seem to be in better shape than the one on the corridor. Their replacement does not seem to be necessary at this time.

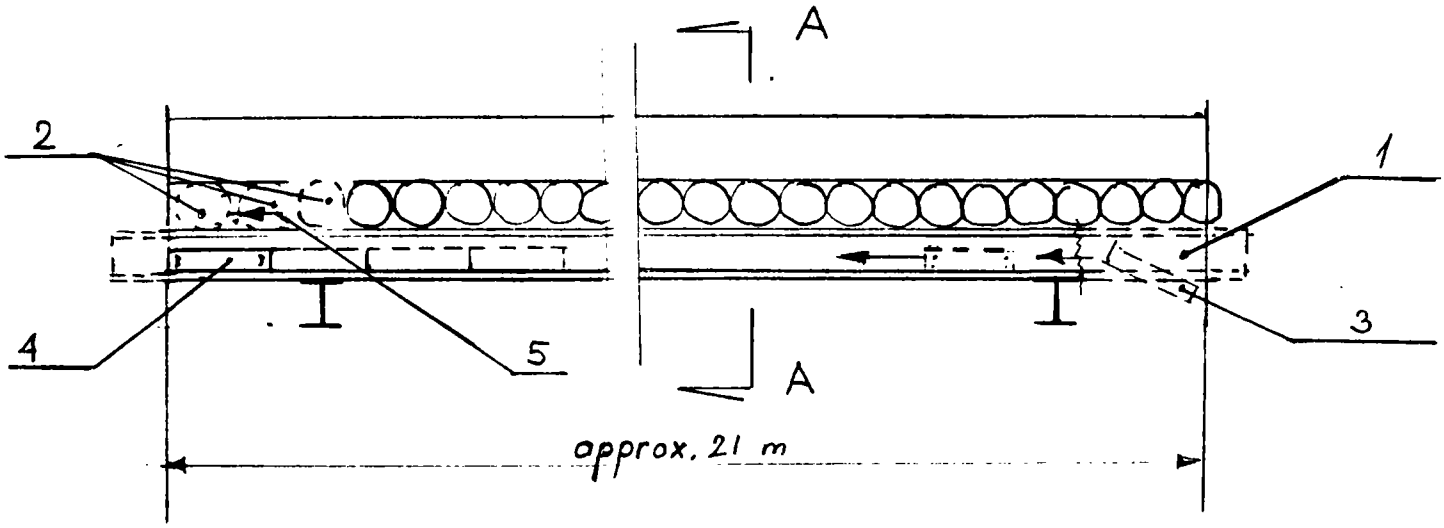
9. The replacement of the beams on the open-sided corridor could be done without breaking up the concrete and sand/lime floor above it.

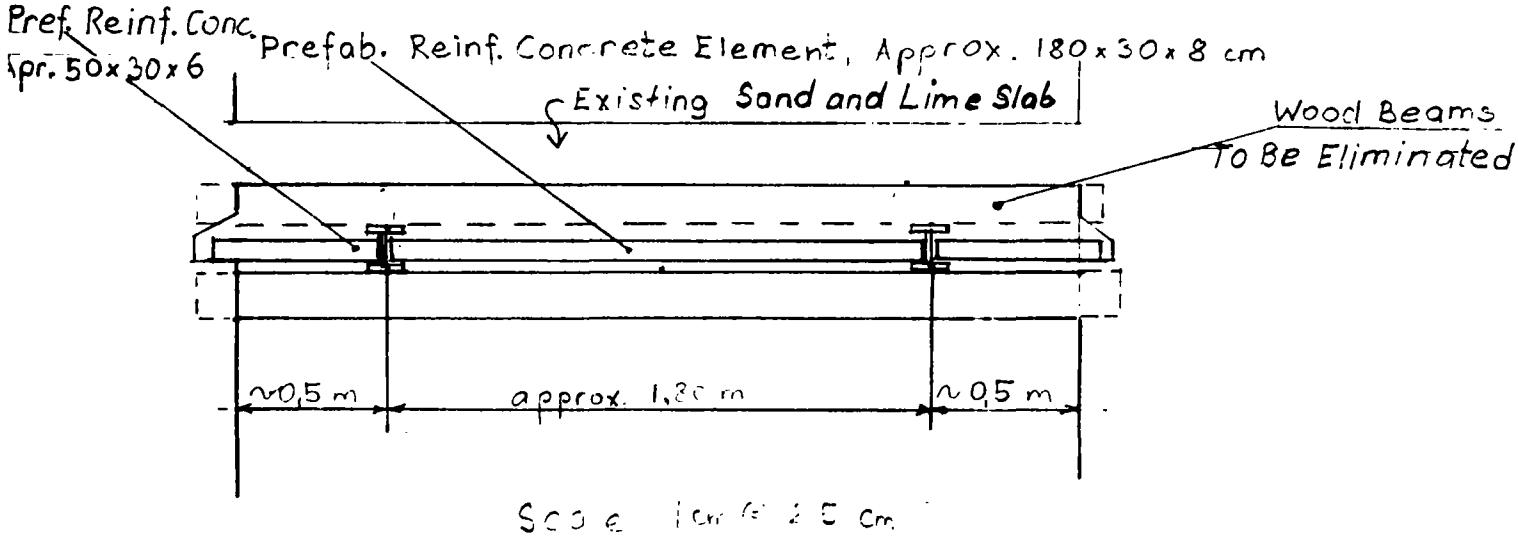
Alternative 1

10. It would entail the gradual extrication from below of the round wooden beams of the ceiling and replacing them with prefabricated reinforce concrete elements, about 300 x 30 x 12 cm., in size. This would be followed by the injection of liquid cement emulsion through holes left in the concrete to fill out any cavities remaining between the bottom of the existing floor and the new concrete elements. While this procedure seems to be somewhat complicated, it has the advantage of keeping the second floor intact.

Alternative 2

11. Recommended procedure for reinforcing and changing the ceiling on the ground floor open-sided corridor





Scale 1 cm = 2.5 cm

SECTION A-A

i) Cut out a length of 40 cm. of existing I beams at either end of the corridor.

ii) Eliminate 3 or 4 wooden beams at opposite end of corridor.

iii) Slide in through cutout in I beams prefabricated reinforced concrete element.

iv) Slide prefabricated reinforced concrete element all the way to the other end of the corridor on the lower flanges of I beams.

v) Fill up space between element and existing floor with lightweight concrete to ensure complete support.

vi) Install replica of wooden beam ceiling below new concrete elements to recreate original appearance.

vii) Repeat sequence 2, 3, 4, 5 until completion.

NOTE: Verify I beams load carrying capacity before adding this additional weight. Install new cross I beam, if calculation shows it is necessary to strengthen the structure.

Alternative 3

12. If it is impracticable to proceed on the lines suggested in Alternative 2 because of the reluctance of the contractors to use this method, a monolithic reinforced concrete floor should be cast from above to replace the actual wood-supported slab. After finishing the new reinforced concrete floor slab, in both alternatives, the actual appearance of the ceiling should be reestablished by attaching new, termite resistant circular shaped wood beams under the new floor.

The second floor and the roof

13. The second-floor ceiling is of similar construction with wooden beams of 8 x 18 cm. approximately, 25 cm. on centre, with wood planks above them. The main girders are of reinforced concrete, camouflaged with plaster and wooden beams. The roof above is the same coral sand and lime conglomerate as the second storey floor. Its thickness varies between 25 and 30 cms., the uppermost part consisting of several layers of cement added for waterproofing over the years. The roof has high and low points with slopes between coordinated with the drains around the facade walls to run off the rainwater into the downpipes.

14. The second floor ceiling is badly damaged in part by termites, and in part by the rain leaking through the roof. An estimated 30% of the planks and wooden beam construction is to be replaced. It is quite likely that there is additional damage both by termites and by rainwater, but it is invisible, being hidden by the walls, or situated on the inside of the beams and planks.

15. The roof is not waterproof. The coral sand and lime agglomerate must have been watertight in the first decades of its existence, but as it has been baked continuously by the sun, it developed cracks and was repaired again and again by layers of lime and layers of cement.

16. The only safe way of repairing the roof is by replacing it completely by a self-supporting reinforced concrete slab and waterproofing. The restoration should start with the concrete roof and proceed towards the interior in order to provide protection for the building, before carrying out the restoration of the interior.

17. The replacing of the existing roof should be done by sections, so as not to uncover more than a few meters at a time of the existing wooden structure below. A temporary wooden roof with bituminous felt waterproofing should be erected to protect the uncovered section from eventual rain. This structure should be portable and reused systematically over the entire roof.

18. The construction of the roof should start immediately due to the dangerously weakened rotten beams and planks in the roof. This has priority over all other work in the building.

19. The wooden beams and the planking have to be replaced partially or completely, depending in what condition they appear to be when the roof above them will be demolished. If they are to be reutilized, they should be chemically treated against termites. Any new wood in the restoration should be termite-resistant. The composition of the roof should be as on page 6.

20. The drains will have to be cleaned and repaired, or replaced if necessary. The same applies for the large L-shaped roof light and the two other smaller roof lights, in order to ensure that the roof is made entirely waterproof.

21. The wooden elements of the new ceilings will be attached to the new reinforced concrete roof and would be supported by it. Their role will be purely decorative and no longer structural. In order to be able to recreate the original appearance of the ceilings, a complete photographic survey should be made of both ceilings - first and second floor - clearly showing dimensions, distances between beams and the type and colour of decoration of the paintings on them.

22. Recommended roof construction procedure

i) Erect temporary protection over a section of the roof.

ii) Break up roof on a section of not more than 5 metres.

iii) Dispose rubble through shute on street side.

iv) Clear and examine surface of wooden planks after eliminating rubble.

v) If wooden elements are not in perfect condition, mark them below; from the inside of the building, but do not remove yet.

vi) Paint or spray twice all wood with anti-termite chemical solution from roof.

vii) Cover wood with protective waterproof sheeting.

viii) Place reinforcing steel and pour concrete and proceed to next section.

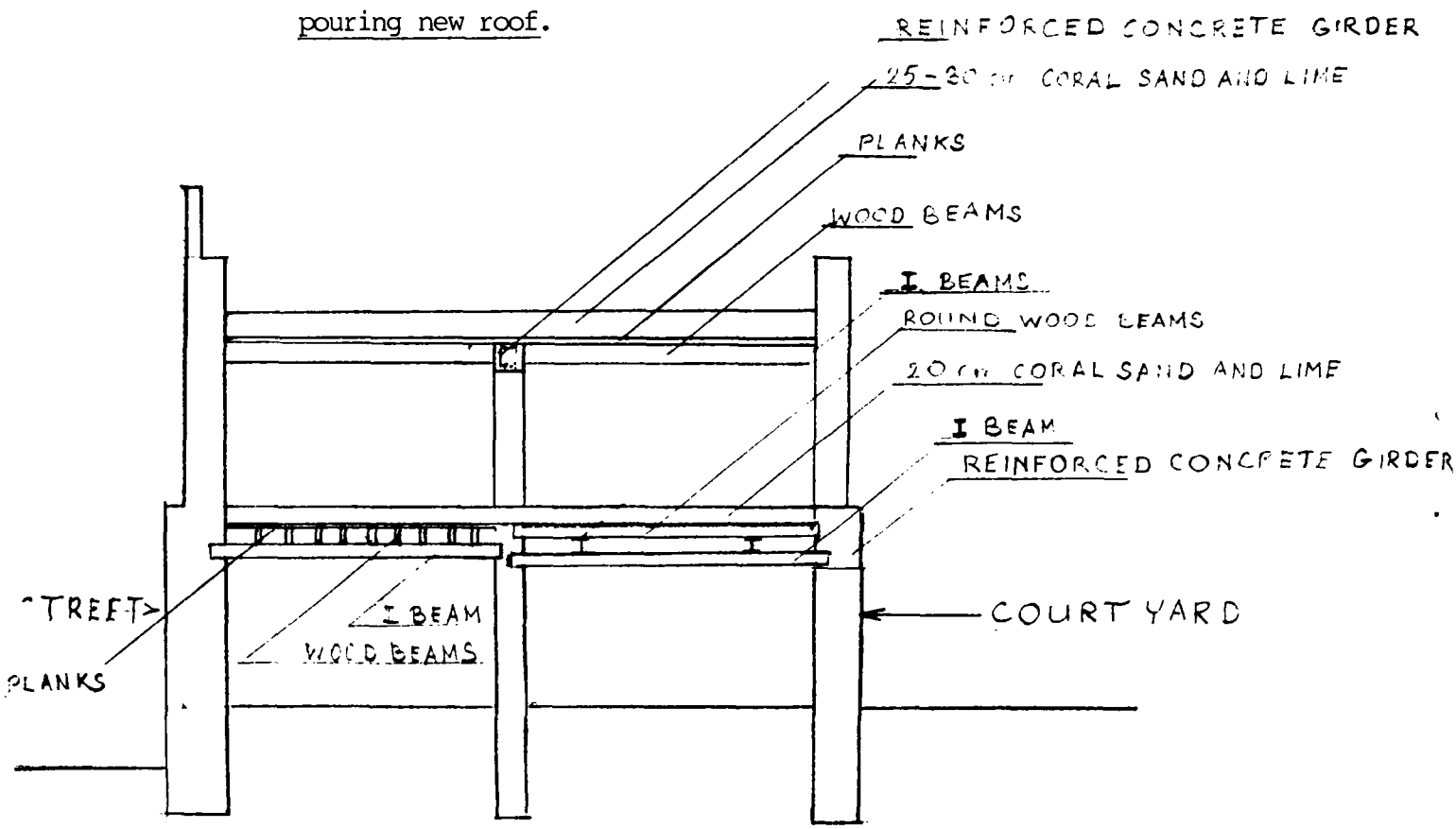
ix) After curing concrete, place 10 cm. thick pumice heat insolation; (when the whole roof is finished).

x) Place paper vapour barrier.

xi) Lay two-ply bituminous felt waterproofing.

xii) Only now remove damaged wooden elements from inside and replace them with new ones after anti-termite treatment.

Exception: When whole sections of the ceiling or an entire room are in an advanced state of decay, change wooden ceiling before pouring new roof.



TYPICAL

CROSS SECTION

NOT TO SCALE

B. Termite Control

23. The museum building is thoroughly infested with subterranean termites on both floors. Even the walls are full of termite tubes as can be observed mainly on the ground floor. The nests of origin, as established by Cole-King in his paper on the Mogadiscio Museum, are in the courtyard; most of the traces of termite tubes are on that side of the building. After a thorough and systematic extermination of them in the ground, protection of walls and foundations of the building should be executed. For this purpose, a specialized termite extermination contractor should be employed. The methods used should be as prescribed by O.P. Agrawal in his paper on "Termite Control in Museums". The essentials of his paper concerning this problem are as set out hereunder:

> "Prevention in Existing Buildings" ...
> Insecticidal solutions* are introduced into termite tubes and channels in walls and wood. The termite tubes, when noticed should not be scraped off prior to insecticidal treatment, otherwise live termites may spread in other areas of the museum. The tubes are thoroughly soaked with solutions and then removed. All traces of termite tubes should be removed so that any new termite infestation occurring later may be easily noticeable.
>
> It is not possible to provide mechanical barriers in the existing buildings. In them, the soil should be treated to establish a chemical barrier between the termites living in the soil and the building. As in the case of a new building, the treatment consists of treating the soil adjacent to or under the building, with an insecticide solution or emulsion. For this treatment, trenches are excavated up to a depth of 1/2 metre to expose the foundation wall. Holes about 15 cms. apart are then drilled at the bottom of the trench reaching another 1/2 metre. The soil is treated at the rate of 15 litres of solution per sq. metre of the surface exposed. The solution should be divided into two parts - one part poured in the holes and the other part mixed with the earth to be refilled in the trench.

---

* Among others "Aldrin" in the form of 0.3% as emulsion in water at 5 litres/sq. metre or "Dieldrin" 0.3% emulsion in water at 5 litres/sq. metre.

The soil below the points in the ground floor through which the termites are likely to enter the building should be chemically treated. The joint of the floor and the wall is particularly vulnerable.

For chemical treatment, holes of nearly 1 cm. diameter and about 50 cms. apart are drilled at the floor-wall joint, to reach the soil below. The chemical emulsion is pumped into the holes at the rate of 1 litre per hole. Afterwards, the holes are sealed. Treated in this manner, the soil below the joint acts as a barrier to the termite.

Similarly, the entry of termites through the masonry foundations and walls, may be arrested by drilling holes in the wall at plinth level and forcing the chemical solution inside. The holes may be drilled at a minimum distance of 50 cms. from each other. The chemical emulsion is forced in by a pump till the masonry is completely soaked. About one litre of emulsion per hole suffices.

The woodwork used in the building should also be inspected carefully. The wood used for building, if already damaged by termites, should be replaced with new wood pretreated with anti-termite solutions. For this purpose, the solution is applied by brush or the timber is dipped in it. For surface application, at least two coats should be given. The second coat is given only after the first is completely dried.

All woodwork in the buildings, such as doors, jambs, false ceilings, should be treated with protective solutions. For this purpose holes of about 1/2 cm. diameter are drilled in the wood at inconspicuous places and infused with chemicals. The holes may be drilled about 30 cms. apart from each other".

24. As an alternative solution timber to be used or reused should be treated by the "hot and cold method". This can be effected with minimum equipment, i.e. open tank with fire beneath. The timber is immersed in preservative, which is then heated to 180-220^{O}F and maintained thus for about one hour when it is allowed to cool; the timber is removed when it is cold. Absorption takes place during cooling. (DSIR, Forest Products Research Bulletin 24).

C. Local consultants and contractors

25. The following local consultants and contractors were contacted and asked for their reactions concerning the restoration work:

Somali National Consulting Agency (Director, Mr. Sharif)
Somali National Construction Agency (Director, Mr. Abdullahi Deria)
E. Pihl and Son Construction Co. (Manager in Somalia, Mr. Dahlgren-Jensen, Telephone 23099)
UN Co. United Company for Consulting SRL (Director, Giulio Cesare Zanoli, P.O. Box 1220, Telephone 32004)
Construction Company Africa (Contractor, Mr. Giandomenico, Telephone 26088)
BURALCO, Inc. (Contractor, Dipl. Ing. Burale, Telephone 32034).

26. The most serious interest was manifested by UN Co. Consultant, Mr. Zanoli, and his usual contractor Construction Company Africa. After a most thorough examination of the building lasting two days, they declared themselves to be ready to undertake the restoration work. An estimate of constructon costs was supplied by them. They seem to be well disposed and adapted to carry out this very delicate and complicated restoration work.

27. PIHL Construction Co. seems to be equally well equipped to do the restoration work. The local manager, Mr. Dahlgren-Jensen, after two examinations of the building, contacted his immediate superior in Denmark, who flew out to Mogadiscio on 2 May 1982 to inspect the museum building.

28. Mr. Burale's BURALCO is a relatively small company, and although he seems to be well disposed towards and interested in the work, there remains a certain doubt about his capacity to undertake this unusual construction/restoration work. The National Consulting Agency and the National Construction Agency manifested some interest; however, it was clear that the job would be outside their usual routine and that involvement in it would cause them undue problems.