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PLANNING AND DESIGNING OF LOW COST RURAL HOUSES USING "WATTLE AND DAUB"

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ABSTRACT

The purpose of this paper is to understand the structural characteristics of the wattle and daub walls. Firstly, preliminary investigations were carried out to record the construction procedure and the architectural characteristics of the walls, such as materials and geometries of the walls. Secondly, material experiments were then conducted based upon the data obtained from the preliminary investigation. Wattle and wipe can mostly cut down the normal cost of development to almost half in the event that it is received broadly over the world. Alongside the cost lessening, this sort of structure serves different favorable circumstances some of which are acoustic, subzero, hygroscopic and simple accessibility of materials. In our investigation we found that the wattle and wipe structures survived a colossal seismic vibration and recuperated. This demonstrates Wattle and smear structures which are struck by seismic tremor and harmed can be effectively restored when contrasted with a typical solid structure. Wattle and wipe structures are dependable, financial and most practical structures which makes it a flawless building technique.

Keywords : Wattle , Daub , Bamboo ,Dung, Limestone, Soil, Fibers, Aggregates.

1. INTRODUCTION

Wattle and daub is a composite building material used for making walls, in which a woven lattice of wooden strips called wattle is daubed with a sticky material usually made of some combination of wet soil, clay, sand, animal dung and straw. Wattle and daub has been used for at least 6,000 years and is still an important construction material in many parts of the world. Many historic buildings include wattle and daub construction and the technique is becoming popular again as a-low-impact sustainable building technique. During the severe earthquake occurred in 1907,Taiwan the survey discovered that the wattle and daub wall in Taiwan has good performance under the seismic loading. Therefore, the wattle and daub walls can not only used as parties but also improve the seismic performance of the buildings.As the main materials of the wattle and daub walls are usually available and recyclable, it may be more and more important to all human beings, from the ecological view. To improve the utilization of the walls, the contribution of the wall to racking resistance of traditional wattle and daub infill has been done in Japan, Indonesia and Costa Rica. In the areas mentioned, the wattle and daub walls can be frequently found, and these walls usually have great contribution on resisting the seismic load. To understand the structural characteristics of this type of walls, this paper preliminarily investigates the construction process and the architectural characteristics of the walls, such as building materials, dimensions, and the method for constructing.

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2. DESIGN AND CONSTRUCTION

WATTLE

Before the daub is applied, it is necessary to provide the correct detailing to its frame in order to accept the staves of the wattle panel. The bottom salwood would be either part of a cill beam, mid rail or nogging and, before construction; a long continuous groove along the centre-line of its upper face should be gouged. The top of the panel may similarly have been formed by a mid-rail or wall plate, onto which the an auger is used to prepare holes spaced approximately 250-450mm apart, ensuring that one was placed 0-50mm in from each end. Less commonly, the stave holes were made into rectangular mortices, rough v-groove mortices or a continuous v-slot gouged on the soffit (underside) to match the lower rail. Sometimes, the end staves were run into the same mortice as the adjacent structural salwood. Additional grooves along the inside face of the posts or studs to accept laths.

DAUB MIX

The term to daub derives from the Old French term dauber meaning to plaster, paint or whitewash: the roles of plasterer and whitewasher were closely related. Daub was principally earth. Not any earth was suitable, since it had to be generally free from organic topsoil, contain some clay as a binder, yet also contain sandy aggregate so not be too clayey, as otherwise the daub would shrink excessively.The desire to strengthen the daub with fibre seemed to be sufficiently important for materials to be bought in. Jute was usually chopped to enable workable amounts to be extracted from the mass. The daub was mixed manually with hands or by foot. Manure was commonly added to make the earth workable in preference to water that would result in excessive shrinkage.

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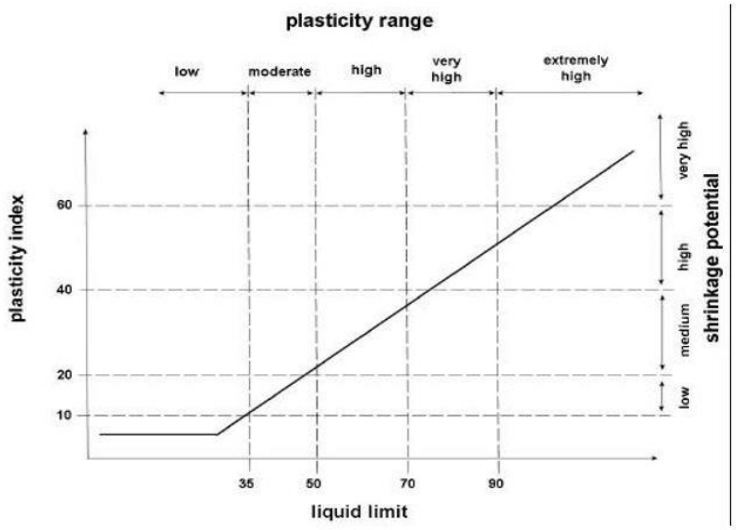

Fig: Shrinkage potential of clay

3. TESTS AND RESULTS

FIELD TESTING OF SOILS

Test	Term	Approximate Strength (kNm^{-2})
Easily moulded or crushed in the fingers	un-compact	0
Can be moulded or crushed by strong pressure in the fingers	compact	0
Finger easily pushed in up to 25mm	very soft	<20
Finger pushed in up to 10mm	soft	2 to 40
Thumb makes impression easily	firm	40 to 75
Can be indented slightly by thumb	stiff	75 to 150
Can be indented by thumb nail	very stiff	150 to 300
Can be scratched by thumb nail	Hard (or very weak mudstone)	>300

SPECIFIC GRAVITY TEST FOR LIMESTONE

Specific gravity is a dimensionless unit that defines the ratio between the density of a rock and the density of water at, typically, 4 Celsius. The test results of specific gravity for limestone came to be 2.7, which should be between 2.3 to 2.7.

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WATER ABSORPTION TEST FOR WATTLE

A procedure is presented to determine the water absorption distribution of wood composite panels. The procedure is based on the direct measurement of the vertical density distribution before water soak, the vertical density distribution after the water-soaked specimens have been reconditioned to pre-soak weights, and the construction of the vertical density distribution for the specimens immediately after water soak.

The test results were

1. **Dimensions:** Vertical (42 x 1.5cm)
2. **Treatment**: Sun drying
3. **Test**: Water absorption of bamboo = (90 - 65 = 25g) i.e. (38.4%)
   Water absorption of salwood frame = (200 – 170 = 30g) i.e. (17.6%)

COMPRESSIVE STRENGTH OF WOOD

Wood has unique, independent properties in the three mutually perpendicular axes: longitudinal, radial, and tangential. The longitudinal axis is parallel to the grain, the tangential axis is perpendicular to the grain but tangent to the annual rings and the radial axis is normal to the annual rings (and perpendicular to the grain direction).

The compressive strength of lumber parallel to the grain is much higher than that perpendicular to the grain. Columns, posts and members of a truss are subjected to axial loads parallel to the grain of the wood. When a column rests on a beam, the load from the column creates compressive (bearing) stress on the beam that is perpendicular to the grain of the wood.
The test results were

1. **Dimensions**: 45 x 45 x 4cm
2. **Treatment** : Acid-copper-chrome composition
3. **Tests**: compressive strength = 69.635 mpa

GENERAL APPLICATIONS:

- Resorts
- One storied structure
- Can be used as a partition wall in multi-storeyed structure.

Applicable in areas prone to earthquake as studies have proved that it can withstand vibrations up to a magnitude of 6 Richter scale.

CONCLUSIONS AND RECOMMENDATIONS

This study has been successful in so far as creating a platform that conveys all aspects of the wattle and daub craft, yet much continuing research is warranted, especially in the identification, categorization and geographic mapping of regional variation. This may be accomplished through an increased interest in the subject that, in turn, may hopefully be stimulated by this work. The structure designed was frigid meaning the interiors would be cool in summers when compared to a concrete structure.

The use of materials which are completely natural, easily available and eco-friendly reduces the overall cost of the structure making it economical and thus the lower income society can afford such houses. The assembly and construction time is also reduced. These can also be adopted for construction of farm houses and resorts. The structure designed is also partially acoustic and it is made so by the use of jute fibre. These structures withstand low as well as moderate seismic vibrations and the same has been proved earlier.

This study demonstrates the current inadequacy of professional knowledge within the conservation industry and highlights the lack of interest in one of the most historically widespread building techniques. If nothing else, it has been shown that many a conservation professional concerned with timber framed construction is missing out on an essentially unexplored subject in which further research is likely to be very rewarding.

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