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# PRESERVING AUSTRALIA'S TIMBER HERITAGE – SOME PRELIMINARY GUIDELINES FOR THE CONSERVATION OF SLAB HUTS

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***Abstract***

*The heritage wooden structures, so called 'slab huts', were the first vernacular buildings constructed in Australia by European settlers and pioneers venturing into the countryside of the vast continent. These unique historic structures are vulnerable and disappearing at accelerated pace, thus the development of an approach for their conservation is important. The approach must acknowledge the unique architectural character of the slab hut as well as identify the specific timbers used for their construction. This paper provides a summary of studies to date for developing a methodology for conservation of Australian slab huts. It discusses the current internationally accepted methods of conservation and structural strengthening of wooden heritage structures, as well as available methods of the vulnerability assessment of wooden buildings. Special focus is placed on the so called 'Resistance Drilling Method' (RDM), which is both considered efficient and accurate in assessing the condition status and vulnerability of wood tissue. The application of this method of assessment is shown via a case study – an analysis carried out in Poland on a wooden church in Miękisz Stary. In the conclusion the proposed method of analyzing the condition status and state of preservation of slab huts is described, together with the guidelines for proposed conservation approach.*

***Keywords****: Slab hut; Wooden building; Conservation; Assessment; Vernacular architecture*

## Introduction

The aim of this paper is initiate discussion and to propose a methodology for the conservation of early heritage wooden structures in Australia, the so-called 'slab huts'. These architectural structures were the first 'vernacular' buildings constructed in Australia, made by European settlers and pioneers venturing into the countryside. Early settlers required shelter and need to make a physical 'claim' or footprint onto land previously occupied by Indigenous people. Most of these structures were simple wooden rudimentary shelters made by 'non-skilled' makers, often primitive and naive in design, and fabricated from local 'native' Australian timbers (including the ubiquitous eucalyptus species and other hardwood timbers which are difficult to work and shape, unlike traditional European timbers). Many slab huts are listed as 'significant' in the Heritage Victoria database, however at present Australia lacks proper documentation and conservation methodology to preserve these vernacular timber structures.

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The development of a standard approach for the conservation of the slab hut is urgent. They have cultural, architectural and social significance as slab huts were the first built structures post settlement. They were constructed mainly during the period between 1780 – c.1930. These huts may have taken cues from and used similar materials to sheltering structures made by Indigenous people. The remaining extant slab huts are vulnerable and disappearing at accelerated pace, due to various hazards, namely deterioration and neglect, changing environmental conditions, catastrophe (bushfire) and the advancement of urban development. Any methodology for their conservation must be undertaken acknowledging the unique character of these Australian architectural structures and the specific of local timbers used in their construction.

The discussion acknowledges the current and accepted international methods of conservation and structural strengthening of wooden heritage structures. At the same time the methods of vulnerability assessment of wooden buildings are reviewed in detail. On basis of this information and discussion, a method of analyzing both the condition status and current state of preservation of slab huts and thence guidelines for conservation approach were proposed.

Particular attention is focused on the Resistance Drilling Method, (RDM) which is considered highly efficient and accurate in assessing the condition status of wood tissue in cross-sections of timber. This method is used in European countries, such as Poland, where it is used to identify components to be replaced or restored during conservation. The RDM method is illustrated using the example of analysis carried out by the author on a wooden church in Miękisz Stary, Poland. The usefulness of the RDM for assessing the condition status of timber is independent of the species of wood and as such is fully applicable to the Australian context and for the Australian timbers used for slab huts.

***Slab huts of Australia – brief characteristics***

The first form of housing erected by the European settlers in Australia was a simple hut constructed from wooden slabs. These huts were common all over Australia, but they were widely built on the eastern seaboard where forests were plentiful [1]. The existence of slab huts was determined primarily the non-availability of other building materials and the lack of skilled carpenters. These early structures continue to have particular charm coming from the expression of native materials in their mainly rural settings.

**Fig. 1.** "Bark and slab cottage at Barkly", author: John T Collins, Mar. 11, 1974, gelatin silver; 8.8 x 12.5cm. approx., J.T. Collins Collection, La Trobe Picture Collection, State Library of Victoria, Australia, accession no: H90.100/1136.

On frontier settlements, slab huts were constructed primarily as a simple shelter using wood which was readily to hand. Timber slabs were relatively easy to fabricate with simple

tools. Trees were felled, and then iron wedges were driven into the cut logs, rough timber slabs were the split off to usable lengths. Typically, the dimensions of the slabs were around 10cm thick and slightly less than 1.0m in length. However, some slabs measure as long as 1.5m [2].

Two styles of construction for slab huts are recorded. The first used long straight pieces of timber erected vertically, fitting into a chiseled groove in a base plate or sleeper, and held in position with horizontal wall-plates (Fig. 1). This form of construction guaranteed a firm solid structure. The second style of hut used slabs of shorter length, which were placed horizontally and fitted into slotted vertical supports spaced regularly around the external perimeter of the house (Fig. 2). This type of construction was a relatively easy method to build and was widespread [2].

Due to the simplicity of construction, slab huts could be dismantled and re-assembled quite easily. It needs to be stressed, however, that Australian slab huts vary from primitive log cabins of the North American frontier, as these were erected of whole or half logs intricately fitted together. This type of construction, namely 'log' construction, was quite rare for early Australia buildings. It demanded not only skilled workmanship but more importantly, the native eucalyptus trees did not provide regular, straight timber required for such a method of construction [2]. It is also likely that the more temperate climate in Australia did not require such close-fitting and tightly worked structures found in Europe and America which prevent ingress of cold.

**Fig. 2.** "Broadford. Slab hut Historical Society Main St.", author: John T Collins, Dec. 17, 1977, gelatin silver; 8.8 x 12.5cm. approx., J.T. Collins Collection, La Trobe Picture Collection, State Library of Victoria, Australia, accession no: H90.100/2619.

An interesting description from 1860`s about the slab hut erected in the first style can be found in the memoirs of Lucy Gray of "Glendower":

*"It consists of three rooms in a row all opening into the verandah, before and behind, which answers for halls and passage. Between the top of the walls and the roof there (is) about two feet open, which has the advantage of letting in plenty of air and the disadvantage of making it impossible to shut out cats etc, the partitions between the rooms being the same height as the walls leaves the whole length of roof open from end to end and that a person at one end has the benefit of conversation going on at the other. Wooden shutters shut out the light or let it in as you may dispose of them. Such things as glazed windows being unknown in these parts. The walls are made of thick slabs of wood placed up and down and kept in place by thick horizontal beams called 'wall plates' see sketch. All of a comfortable reddish brown but quite*

*rough simply adzed. The chimneys like the rest are wood and wide enough to leave standing room on the hearths when there is a large fire"* [3].

The main disadvantage of slab huts due to their construction method was that they were not weatherproof. Gaps between roughly shaped slabs were occasionally filled with mud. Sometimes old tents were used for lining interior walls and ceilings. Occasionally the interior was wall papered. In some cases, the interior walls were oiled to a dark sheen [2].

**Methods of conservation and structural strengthening of wooden structures**

Present international trends in the conservation of wooden architecture promote the use of both traditional techniques and technologies. In the literature, this methodology is described by the term "ecological approach" [4, 5]. However, where necessary, it is appropriate to accept the use of modern materials or solutions, if for some reason a traditional treatment method is not possible.

Based on Larsen`s proposals, there are two main methods of conservation of wooden architecture [6]:

Repair of the structure by disassembling into individual parts.

a) Replacement of degraded wooden elements or their parts with new elements repeating the original technique of fabrication using:

- traditional connection methods
- secondary joining methods (e.g. with epoxy resins, steel plates or belts, or any accepted modern methods)

b) Consolidation of degraded elements (e.g. filling the cavities with synthetic resins)

c) Reinforcement of damaged sections (e.g. use of metal plates, fiberglass rods or other accepted technology)

In situ structural repair (without disassembly into individual elements)

This method may include lifting the entire building or part thereof using pneumatic jacks. Access is gained via the lifted section and allowing removal or replacement of damaged elements or degraded parts.

The method of repairing individual elements is carried out using the same processes as above (1a-c).

Ideally, structural stabilization, replacement or reinforcement of damaged members without dismantling the building is considered the most justified. However, if for some reason this is not possible, it is acceptable to partially or completely disassemble the building into individual elements for conservation treatment, and then to reassemble or rebuild. Nevertheless, the choice of the method should be based on a 'case by case' analysis of the problems for each structure, and, if possible, in line with the construction and conservation traditions of a given region.

The practice of completely dismantling a wooden building for conservation and then reassembling is not common in every country with a rich wooden building tradition. Full dismantling treatment is found mainly in Asian countries, such as Japan, where it has been practiced since the 9th century [7]. However, this method is considered an 'outlier' and is largely not applicable to the conservation traditions of Europe. For example, in England, the custom of dismantling a building into individual parts during conservation has never been widespread. Full dismantling, according to Charles, is used only in cases where other solutions are insufficient [8]. The situation is similar in other European countries, such as Norway, where dismantling of buildings for the purpose of conservation has no established tradition. This may be due to the relatively good condition of wooden buildings resulting from the less humid climate of most of Europe compared with Japan, and particularly harsh climate of Scandinavia.

According to studies conducted by various authors, in general only the lowest (ground-level) part of the building deteriorates relatively quickly, and its replacement was performed by slightly lifting the building. If the degraded element is located in the higher parts of the wall, only partial lifting of the building above this element (e.g. by means of pneumatic jacks)

enables access for replacement. Nevertheless, in the tradition of European building the process of disassembling wooden structures into individual parts and then reassembling them is quite well known, as this method was used historically to move farm buildings to other places [9]. (According to tradition, farmers` daughters received one or more of their fathers`s farm buildings as dowry, so that they could establish their own farm. For this purpose, these buildings were dismantled into parts, and then moved to a new location and reassembled).

Referring to the previously mentioned Larsen, as well as Marstein, the methods of repairing wooden structures can be grouped into three basic approaches [4, 6]:

a) repair using the techniques and materials available at the time of repair,

b) introducing new elements to strengthen the original structure,

c) "reconstruction" of the original structure, replacement of damaged elements with new elements identical to the old, by replication of original.

The first approach is based on the use of materials and techniques available at the time of the repair. Ideally replacement elements are made of a material similar to the original (this extends to use of the same species of wood, with a similar structure and humidity content). Sometimes original materials can be replaced by new non-traditional materials, or by joining of new elements with the original elements but undertaken using a non-traditional way (e.g. using synthetic resins).

The second approach allows the use of brackets or stabilizing elements, introduced for structural strengthening or maintaining the form and shape of the building. These additional elements can be made of wood, but metal or synthetic materials are also permitted. It is also acceptable if the stabilizing elements shaped independently from the form of the original building, as long as the new items can be readily identified from the original.

The third approach is stricter, and consists of using traditional technologies and techniques, in keeping with the time when the wooden structure was erected. Emphasis is placed on the use of both traditional methods and l tools and to repeat the original machining processes. In this approach, the restorer or carpenter is trained in traditional craftsmanship and in awareness of the original construction techniques. In other words, when the degraded element originates from $17^{th}$ century, the replacement is sourced using traditional $17^{th}$ century methods and techniques and, if possible, by using tools typical of that period [10]. In addition, the same species of wood is used as the original with similar (possibly identical) physical and aesthetic properties. This method is practiced mainly in Japan, Russia and the Scandinavian countries.

## The vulnerability assessment of heritage wooden buildings

In order to determine an appropriate method of conservation of any individual Australian slab hut, a full assessment of its condition status must be undertaken and the degradation pathways identified. This will allow for the development a targeted conservation methodology with the most justified conservation approach. The possible methods for conducting condition status and vulnerability assessments of heritage wooden buildings can be divided into *in situ* and *ex situ* methods [11].

*In situ* methods allow systematic information gathering on general and current condition of the structural system, on defects and voids in specific elements, assessment of mechanical properties of materials, previous interventions etc. [12]. *In situ* methods, such as expert visual observation and documentation, are employed as the first step of any vulnerability assessment procedure [13]. *In situ* steps may involve preliminary survey and non-destructive tests (NDTs) or semi-destructive tests (SDTs).

*Ex situ* methods allow for advanced structural vulnerability assessments that may help illustrate the detailed behavior of the full-scale building as well as individual structural components [13]. *Ex-situ* experimental tests investigate the exact behavior of the simulated sub-structures or full-scale structure when subjected to different types of loads. These methods are helpful for developing the numerical models for evaluating the building in different risk

scenarios. The most common are seismic vulnerability assessment and wind and snow vulnerability assessment [11]. In Australia, seismic vulnerability risks are negligible.

### *In situ* methods for condition status and vulnerability assessment

Due to the characteristics, location, size and structure type of slab huts in Australia, this study mainly focuses on *in situ* methods for condition status and vulnerability assessment of historic wooden structures. It is expected that *in situ* analyses will be adequate to provide the data necessary to determine the methodology for conservation of these historic structures.

*In situ* assessment methods are used for evaluation of the current condition and mechanical properties of timber elements. These methods could be divided into two groups:

(i) a preliminary survey, and (ii) detailed survey [11, 13].

(i) A preliminary survey involves basic methods of the assessment of condition status of wooden buildings. It includes the visual inspection, preparation of necessary documentation with recorded data, essential analyses and geometric surveys [13]. The aim of the preliminary survey is to identify and gather all possible information about the historical aspects of the building and its status, any past intervention, restorations or eventual changes (in shape, size or loading conditions), exposures to different risks and identification of these risks, different kinds of damage and their causes, as well as any indications of biological damage (together with identification of biological species responsible for these damages) [12]. The analysis includes identification of wood species and description of any other materials used for construction [13].

(ii) A detailed survey identifies any defects and their advancement in cross-section of each individual element. Because the destructive tests in heritage buildings are discouraged, data collection must be based on non-destructive tests (NDT) or semi-destructive tests (SDT) [11]. This collected data will provide information regarding mechanical properties of timber elements for numerical simulations helpful for designing proper conservation methodology. In many cases, multiple and complimentary NDT or SDT tests are conducted simultaneously to provide comprehensive understanding of condition. The data obtained from different analyses are interrelated and permit comprehension about the soundness of the individual wooden elements [12].

Data compiled from the preliminary survey and the detailed survey together can feed into recording templates for the assessment of heritage timber buildings. These templates were elaborated in 2020 by the group 1-TG1, COST Action FP1101-WG [14], and then further discussed by professionals involved in protection of wooden heritage [15].

### Resistance Drilling

One of the most useful NDT methods for diagnosing the condition wood tissue in cross-sections of wooden elements is the Resistance Drill Method (RDM) [16]. This technique is used to identify and quantify decay, voids, and termite galleries in sections of wooden elements (like beams, columns, poles or piles). It is now the preferred drilling and coring technique for timber elements [17]. A needle-like drill penetrates the wood to record resistance as a function of depth density, biological defects or voids [18]. This analytical method is based on the measurement of cutting resistance during drilling and reveals variations in density in the timber caused by the biological or moisture/humidity deterioration. It also detects annual increases in yearly tree growth [19, 20]. Resistance drill equipment measures the resistance of wood members with around 1.5mm diameter drill bit with about 3.0mm head [21]. This method measures electrical power consumption of a needle rotation motor as function of wood density. This value is proportional to mechanical torque at the needle and primarily depends on wood density [21-23]. The RDM identifies areas in timber having low density, indicative of decay or deterioration. Areas of sound wood have various levels of resistance, depending on the density of the particular species [22]. The degree of resistance reduction indicates progress of the level of decay in the cross section and identifies areas of low, mild, and high levels of decay [22].

Where voids exist the drilling resistance decreases to minimum [17]. During drilling the data is collected electronically producing a chart or printout showing relative resistance over the drill path. The results identify a range of possible degradation issues, and an assessment of the strength of wood (i.e. the test shows if the analyzed wood has increased, medium or reduced strength parameters) [19]. The RDM is highly effective for identifying deterioration of historical wooden structures [24] and is recognized as the international standard. RDM has not been performed on timbers in Australian slab huts at the time of publication.

## Application of the Resistance Drilling Method on the example of orthodox church in Miękisz Stary

As it was mentioned above, the Resistance Drilling Method has high efficiency in assessment of the condition status and vulnerability of cross-sections of elements in an historical wooden structure. An example of the application of this method, prepared by the author [T. Tomaszek], is outlined in the case study in determining the conservation methodology for the Orthodox Church in Miękisz Stary (Fig. 3). This church is located in south-eastern Poland. It is a unique example of wooden Greek Catholic built heritage in this part of Europe. The church in Miękisz Stary has not been in use since the end of the World War II and it remains in an advanced state of ruin [25]. Thus, the data collected and the treatment undertaken represents the conservation issues typical for wooden structures in similar state.

**Fig. 3.** The Orthodox Church in Miękisz Stary (condition of July 2020)

In order to identify the condition status of wood tissue in cross-section of wooden structural elements of the walls of the Orthodox Church in Miękisz Stary the Resistance Drilling analysis was obtained *in situ* using the resistograph IML-RESI F400-S. The sample graphs shown below displays the results of these analyses conducted on the lower elements of the part of church called Sanctuary (south-east corner) (Figs. 4-8). The following color code was adopted for the graphs (Table 1).

The Resistance Drilling Method results confirmed (already noticed during the preliminary survey) an advanced degree of degradation of wood tissue in cross-sections of a substantial percentage of structural elements of the walls of the Orthodox Church in Miękisz Stary [25]. At the same time the results allowed for quantify the full scope of elements (or the parts thereof) for replacement (Fig. 9).

**Table 1.** Color code adopted for the graphs showing the results of obtained Resistance Drilling analysis conducted on the Orthodox Church in Miękisz Stary

| Color | Description | Characteristics, comments |
|---|---|---|
| | Input and output zone of drilling element | In this zone the measurement is disturbed due to the time needed for the proper arrangement of the drill and driller passage to the correct speed. The diagram is usually characterized by rising or falling curve. The long entrance zone suggests the highly degraded surface layer of wood. |
| | Knag | In the zone with the average amplitude of cutting resistance at a distance of more than 1.0cm and greater than 50% it is assumed that wood has the raised strength parameters. If the amplitude is smaller, it may be the result of encountering a knot when drilling. If section covers most of the graph it indicates a very good grade of wood. |
| | Healthy wood, with improved strength parameters | |
| | Healthy wood, with average strength parameters | In the zone with the average amplitude of cutting resistance at a distance of more than 1cm occurring in the range of 25 - 50% it is assumed that wood is healthy and retains the strength properties similar to medium quality construction grades of wood. |
| | Wood with low strength parameters (degradation) | In the zone with the average amplitude of cutting resistance at a distance of more than 1cm below 25% it is assumed that wood has reduced strength parameters. The reason for this may be due to damage caused by the biological degradation of the wood tissue, but might also be due to the use of very weak wood with low construction quality. |
| | Wood completely degraded | The flat character of the graph indicates a very low cutting resistance during drilling. If this value of the graph has continuation on a long stretch, then it is assumed that it shows an extensive area of the totally degraded wood tissue. The short stretches however can indicate encountering the split in the wood, which may not disqualify the cross-section (analyzed fragment) in terms of further use. |
| | Soaked wood (wood characterized by maximum absorption) | Very damp wood which reached a close-to-maximum absorption condition. It acts like (it has similar properties to) plasticine or wet soil (clay). It has high cutting resistance for the resistograph drill and the obtained graph appears to show the healthy wood. Not suitable for preservation. |
| | Split wood | Wood stratified within the annual rings. The reason for this phenomenon – which is seriously weakening strength of the material – is caused by the fungi usually quicker destruction of the early wood (softer and less resistant) than the late wood (harder and more resistant). |

## Guidelines for the methodology of conservation of Australian slab huts – initial proposals

Referring to previous findings and discussions above, some preliminary guidelines for the evaluation and conservation methodology for slab huts have been defined. Ideally, any proposal will focus as far as possible on *in situ* structural repair, avoiding disassembly into individual elements. However, due to the advancement of degradation of individual elements, the intervention on the greater extent may be required. In this case, a partial, fragmentary disassembly in order to replace elements locally may be acceptable. Ideally, it is postulated to avoid complete disassembly. This method of approach should be used only in the case of very advanced degradation of the whole structure, or when other methods turn out to be insufficient for the replacement of degraded elements.

*In situ* structural repair, without disassembly into individual elements or only partial disassembly is justified both due to the characteristic of slab huts and the applied structural solutions for their erection. Slab huts were mainly erected as temporary architectural structures, thus any historical repairs usually involved local replacement of degraded elements. Therefore, it seems justified to adopt such a similar "model" for conservation, avoiding full disassembly.

Partial dismantling may be necessary and may be the only possible conservation approach in the case of slab hut constructed of long straight pieces of timber placed vertically, fitted into a chiseled groove in a base plate and held in position with horizontal wall-plates. While in the case of the second type of construction of slab huts, namely construction made of

slabs with shorter length, placed horizontally and fitted into slotted vertical supports, generally it is expected that *in situ* structural repair, without partial disassembly will be sufficient in majority of cases. Where it is necessary to replace a degraded slotted vertical member, this should be done as far as possible by disassembling only the closest horizontal elements. Similarly, when replacing the degraded horizontal element, some partial disassembly may be required, but in general it should be performed only locally.

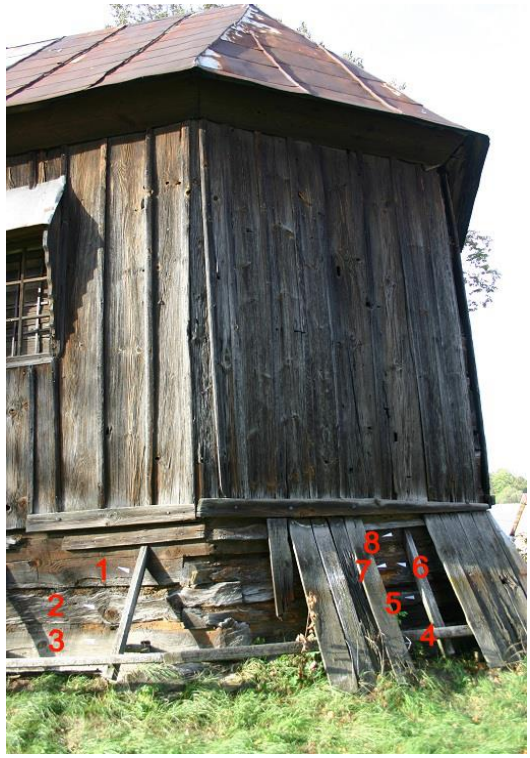


**Fig. 4.** The Orthodox Church in Miękisz Stary.
Sanctuary (south-east corner) – the spots
were Resistance Drilling analysis
were carried out shown by corresponding white arrows with numbers

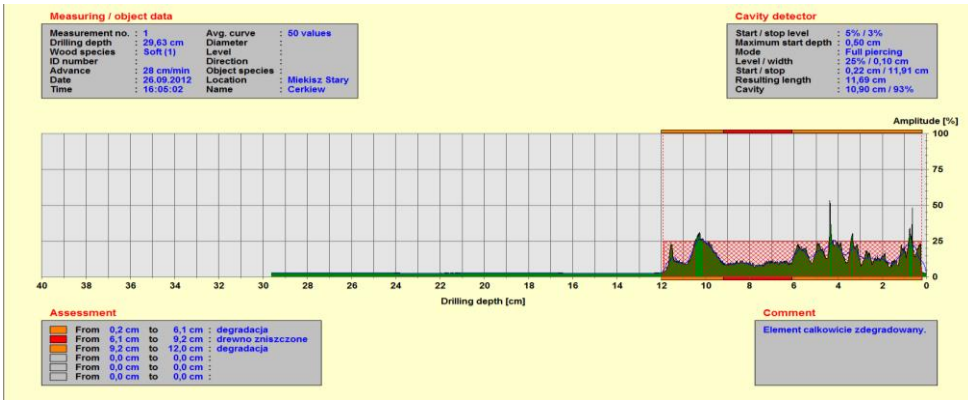


**Fig. 5.** Chart showing relative resistance over the drill path – Measurement 1
(see Fig. 4 for location of measurement spot); result: completely degraded element

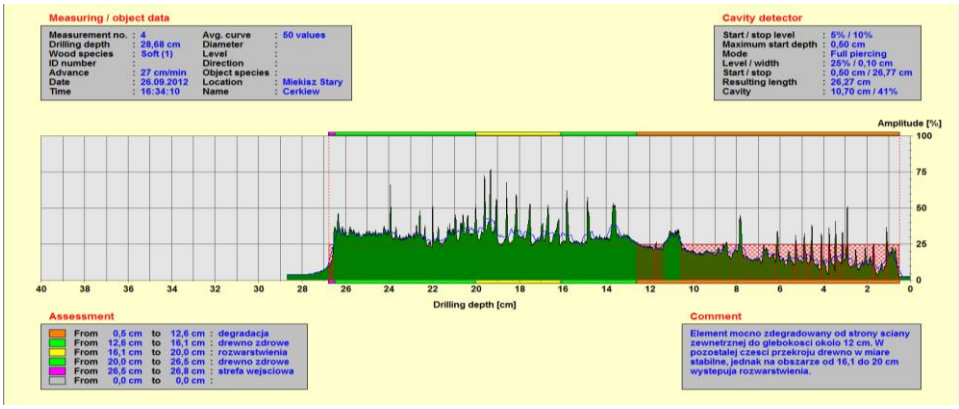


**Fig. 6.** Chart showing relative resistance over the drill path – Measurement 4 (see Fig. 4 for location of measurement spot); result: element is heavily degraded from the side of the outer wall to a depth of about 12cm. In the remaining part of the cross-section, the wood is relatively stable, but delaminations occur in the area from 16.1 to 20cm

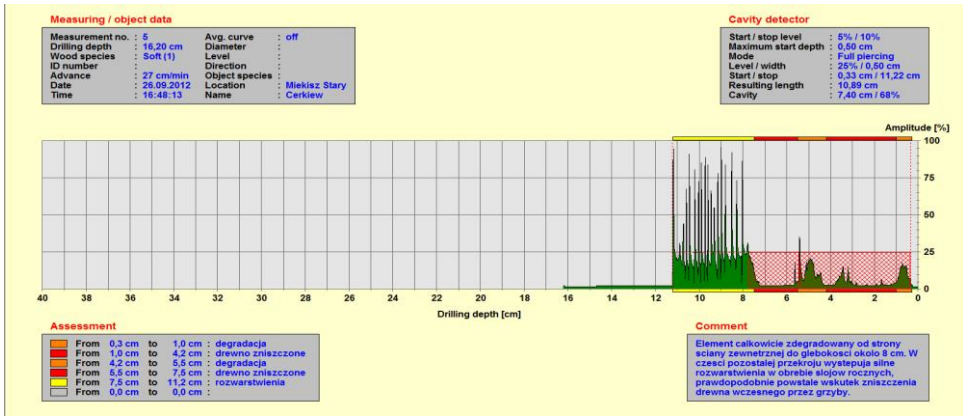


**Fig. 7.** Chart showing relative resistance over the drill path – Measurement 5 (see Fig. 4 for location of measurement spot); result: the element is completely degraded from the side of the outer wall to a depth of about 8cm., in the remainder part of the cross-section there are strong delamination within the annual rings, probably caused by the degradation of the early wood caused by fungi

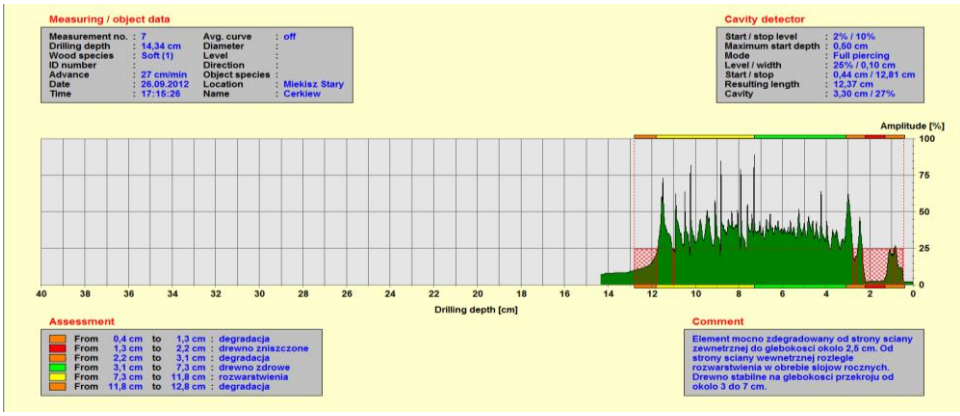


**Fig. 8.** Chart showing relative resistance over the drill path – Measurement 7 (see Fig. 4 for location of measurement spot); Result: The element is heavily degraded from the side of the outer wall to a depth of about 2.5cm. From the side of the inner wall, extensive delamination within the annual rings. The wood is stable at a depth of about 3 to 7cm

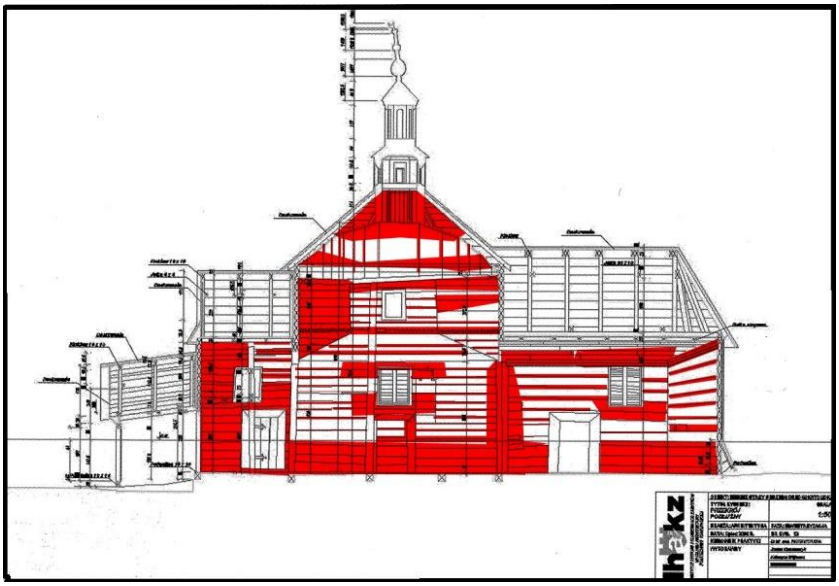

**Fig. 9.** The sample diagram showing the condition status of the Orthodox Church in Miękisz Stary– in red it is marked the quantity of elements (or their parts) substantially degraded and requiring replacement during planned conservation of the structure. Data obtained using compilation of Resistance Drilling Method.

If replacement of degraded wooden elements or their parts is necessary, it is proposed to exchange them with new elements as much as possible repeating the original technique of fabrication, and by using historical original connection methods. Because the slab huts were erected in most of the cases by non-skilled builders, it may be necessary to implement some improvements in technology (use of tools) to guarantee structural stability. However, introduction of any modern methods or reinforcement of damaged sections by using modern technologies should be minimized and fully documented. Similarly, introduction of new elements to strengthen the original structure should be avoided and used only when the building still needs structural stabilization after degraded elements have been replaced, or structural stability is required.

For any individual slab hut, it is necessary to perform at the first stage an appropriate assessment of its condition status. This assessment allows to define the number of members which need replacement. The assessment also identifies threats to structural stabilization for the particular building. Simultaneously, causes of degradation can be identified and means of treatment or eradication determined. For an appropriate assessment of the condition status and vulnerability of the whole structure as well as individual members, it is proposed to perform all available *in situ* methods. Therefore, a full preliminary survey should be conducted, followed by a detailed survey.

A detailed survey should incorporate Resistance Drill Method, which is a highly efficient NDT method for diagnosing the condition state of wood tissue in cross-sections of wooden elements. To date, this method has not been undertaken in Australia for assessment of heritage buildings.

The RDM will allow for the precise determination of the range of elements to be replaced. Thus, it will be the basis for adopting a decision to apply a specified conservation approach and method of proceeding, as well as for designating any parts of the structure where partial dismantling may be necessary.

The preliminary guidelines establish a general conservation methodology of Australian slab huts and thus form the basis for the development of specific conservation treatments. Their implementation should be preceded by additional analyses resulting from the individual conditions of each architectural structure to which the guidelines apply.

## Conclusions

The slab huts, which are the first vernacular buildings constructed in Australia by European settlers and pioneers are particularly vulnerable due to the material from which were erected – wood. They are disappearing at accelerated pace, which is caused by changing climatic conditions resulting in more frequent fires and unstable humidity amplitudes. Thus, majority of these early heritage architectural structures soon could be lost if no proper action to protect them is undertaken.

So far, no standardized actions have been taken to develop a methodology for their conservation and to analyze appropriate conservation methods. Slab huts have survived by 'benign neglect' due in part to remote location, and their being somewhat underappreciated part of cultural heritage. In recent years, efforts have been made to document existing slab huts (including the use of 3D and 4D laser scanning techniques) and to carry out basic measures to prevent their further degradation. A prime example of this can be the actions performed by Parks Victoria (which has governance and oversight of many huts on public land in Victoria) which has currently undertaken 3D and 4D imaging project of some slab huts. This is the quickest method to documenting the structures and that is how Park Victoria are progressing at present. There are approx. 100 huts (both slab built and other material) in public land alpine Victoria, and possibly up to 200 across Victoria, New South Wales and Australian Capital Territory. These three states form the majority of the 'high country' or alpine region where the huts are situated. However not much analytical work has been done recently regarding slab huts condition status and further research is urgent, particularly with increasing threat of large-scale bushfire [26]. The most recent study was carried out by Graeme Butler in 2005 [27], but it was devoted mostly to documentation and description of historic and formal characteristics but did not comment on conservation issues.

Current restoration works have been 'ad hoc' and conducted by Alpine hut enthusiasts with sympathy and empathy for heritage, but without formal protocols. Their work, as well as applied methods, do not conform to accepted internationally 'standards' for conservation [28]. Therefore, there is a danger that the performed treatments may lead to an effect different than the intended one, i.e. accelerated degradation of wood [27]. An unknown number of timber huts are located on private property, and their condition status is unknown. A conservational methodology for preservation of slab huts will assist private owners when taking care about their huts.

The proposed methodology outlined above is put forward for consideration. The use of 'Resistance Drilling Method will conform to accepted internationally methods for assessment and will be an innovative addition to heritage architecture analysis and methodologies in Australia. This method is considered highly efficient and accurate in assessing vulnerability of cross-section in wooden elements. Finally, by discussing the current internationally accepted methods of conservation and structural strengthening of wooden heritage structures, and with particular focus on the characteristics of Australian slab huts, the preliminary guidelines for conservation methodology were developed. The establishment of guidelines and the possible introduction of Resistance Drilling Method will be the necessary step in initiating the further studies and discussion, that guarantee that these early heritage wooden structures will be properly preserved for future generations.

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