

PHILIPPINES

IMPACT OF THE 15 OCTOBER 2013 BOHOL EARTHQUAKE ON THE BOHOL CHURCHES



Daus church

Prepared by **Ma. Joycelyn Bolhayon-Mananghaya, M. Arch, uap**
Trustee, ICOMOS Philippines

Paper that came out of the Assessment Mission to Bohol 18-26 October 2013

INTRODUCTION

Earthquakes are unforeseen natural disasters that gravely affect lives and property. In general, they have resulted to landslides, fires, soil liquefaction, tsunami and floods and have impacted human lives such that loss and injury debilitate movement to those affected. Shakes and ground rupture during earthquakes cause severe damage to buildings and infrastructure, while tremors and aftershocks prolong anxiety and fears, as in some instances they continuously destroy property and cause psychosocial dysfunction to people. In most cases, normalcy takes time and development is hampered.

The October 15, 2013 earthquake that hit Bohol and other parts of the Visayas has had the same effects to the Boholanos and to its cultural heritage. The earthquake was unexpectedly sweeping, devastating residences, public buildings and religious structures both modern and of cultural heritage significance.

The epicenter of the 7.2 magnitude earthquake was in Catigbian town at an area between the towns of Sagbayan and Balilihan. Many structures within and in surrounding towns have experienced wreckage. Structures in towns as far as Anda that is located at the southeastern part of the island experienced damage while those as far up north in Talibon equally felt drastic effects. The disaster deeply distressed and overturned the high esteem and pride of heritage that was so prevalently felt from the Boholanos and Filipinos at large who have know and loved Bohol and their rich cultural heritage.

It is in this light that, upon hearing of the disaster, the National Commission for Culture and the Arts immediately defined measures to assist the island in the areas within its mandate: cultural heritage. A meeting was held to discuss the extent of damage, and specific actions were identified. This included fielding of a mission to verify and assess the state of cultural heritage that the NCCA, in its years since inception, have painstakingly supported and nurtured. This report forms part of the outcomes of the assessment mission. It is hoped that the information herein generated will be helpful in defining steps to assist in the rehabilitation of cultural heritage damaged by the 15 October 2013 earthquake.

THE NCCA'S RESPONSE TO THE DISASTER

The NCCA, cognizant and proud of the wealth of heritage in Bohol, has for decades fully supported the conservation, promotion, management and development of cultural heritage in the province. Many programmes and projects completed and on-going in Bohol have been founded with the NCCA always steadfast to work on its mandate and in close collaboration with its associated cultural agencies, the province and the church authorities. This commitment forms part of its dedication to uphold national pride and identity that in Bohol are extensively manifested in various forms in its rich patrimony.

Thus, immediately following the earthquake, the NCCA together with the other national cultural agencies and the representative of the church convened an emergency meeting. This was to discuss the outcomes of the damage wrought on cultural heritage and to identify initial steps to be undertaken in order that its safeguarding may happen.

The mission to undertake a technical assessment of the Bohol Churches came about as a result of that emergency meeting held on 15 October 2013 at the National Historical Commission of the Philippines. Archt. Ma. Joycelyn B. Mananghaya, Secretary/Exe-Con member of the National Committee on Monuments and Sites, NCCA and Trustee, ICOMOS Philippines was invited to undertake the technical

assessment on behalf of the NCCA, with the purpose of defining possible directions of work on the conservation and rehabilitation of the churches of Bohol that have been damaged by the recent earthquake.

The Executive Director, NCCA, Hon. Emelita V. Almosara explained that the rehabilitation work for the Bohol churches should go beyond a national context and should consider an international perspective. ICOMOS Philippines has been identified to assist in this endeavor. It was serendipitous as the initial steps carried out by ICOMOS Philippines immediately following the tragic incident was to reach out to its broad international network informing them of the devastation that the earthquake has caused on the heritage of Bohol. Many have signified support and are awaiting news on the final directions that government will take, as well as to know the needs of the site which may assist in defining the possible involvement of the international sector in the rehabilitation work. Being a member of the National Committee on Monuments and Sites (NCMS) and a trustee of ICOMOS Philippines, collaborative efforts came to fruition.

SIGNIFICANCE OF BOHOL'S CULTURAL HERITAGE

Bohol's cultural heritage treasures stem from centuries of prosperous cultural development that covers a broad range of period starting way before the Spaniards came to the Philippines, reaching its zenith during the Spanish and American era, moreover carrying on to periods in between and after and continuously existing to the present. This covers a wide spectrum of tangible representations such as the pre-historic caves that are graced with pictographs (found in the Anda Peninsula), religious heritage in the form of churches, cemeteries, mortuaries and other forms of religious heritage manifestations, domestic heritage such as the vernacular houses that line major thoroughfares as well as those found in centrally located and remote areas, watch towers, public and institutional buildings including those within the realm of intangible cultural heritage.

The significance of Bohol's cultural heritage is not merely rooted in the variety of its tangible expressions but more so in how it withstood time and has shaped the cultural development of the Boholanos. Associated with the Spanish period churches are the cantatas of Bohol that formed an essential part of the rich liturgical ceremonies of its churches and at present are closely linked to the famous Bohol children's choir.

Within the milieu of the Bohol's tangible heritage are the attributes that point to the unique qualities of its heritage structures. Particularly special in Bohol's heritage architecture are the churches built during the Spanish period, that for centuries have withstood time and events. These churches are of coralline limestone masonry walls (*mamposteria*). Its coursework, cantons, pilasters are all of hewn limestone while its interior wall fabric is of rubble masonry - pieces of limestone consolidated by a lime based-binder. Its buttresses are of two kinds: the inclined type found at the lateral walls of the churches which are intentionally placed to absorb the lateral forces of the roof, and the vertical type found at front façades. Roof framing systems of these churches are of hardwood that are presently covered over with galvanized iron, a modern material which in contemporary times has replaced former old tin and/or

cogon roofs. Floor and other structural members (beams, posts and other frames) are of hardwood as well.

A significant built technology found in these churches is the 'tabique pampango', a construction method that is similar to the wattle and daub system found in other countries. Tabique pampango is a partition wall having interior wall frames of wood (thin wood branches), bamboo, reeds or sawali (weaved rattan) that function as joists or as a strengthening material of the interior wall fabric. These are pasted together with lime based mortar and plaster and they appear like any other mamposteria wall except when through time, the adhering plaster has defaced the rendering material thus exposing the inner core of the wall.

Another significant part of these churches were the additions made during the Spanish and American period in the form of porte cochere and other wall elements. These are made of concrete with twisted re-bars and they seemingly appear to have been homogenously constructed with the rest of the mamposteria components of the church. However, in truth, they act as singular independent sections that have their own strength and properties so unlike that of the mamposteria walls alongside it.

The interior of these churches presents elaborate features that associate them specifically to the Bohol cultural landscape. There are the ornately painted ceiling in tin by known Cebuano artists, Ray Francia and Canuto Avita. These colorfully done ceiling paintings are early 20th century and depict the life of Christ and the saints. There are also the intricately carved altars (retablos) of varying styles ranging from the baroque (Loboc, Dauis, others), neo-gothic (Loon and Maribojoc), neo-classic and the eclectic. Of equal significance are the American period churches in the neo-gothic and other revivalist styles that show how in that period reinforced concrete ruled as the method of construction easing over the former popularly utilized mamposteria.



Features of Bohol churches: Ornately painted ceiling of Panglao church (L); Elaborately carved Baroque retablo of Baclayon church (M); Tabique Pampango walls (R)

The vernacular houses of Bohol are at par in importance. These are almost of the same layout but of lesser proportions as the bahay na bato found in the northern parts of the country. They exhibit significant features that associate them to the Boholano lifestyle and artistry.

Many of the aforementioned cultural heritage of Bohol succumbed to damage as a result of the 15 October 2013 earthquake. Spanish period churches, vernacular houses and institutional buildings were affected. The degree of destruction was wide range, where some of these totally collapsed to the ground while others withstood seismic movements albeit with some degree of damage.

METHODOLOGY AND GENERAL OBSERVATIONS

The eight (8) day visit to the 19 Bohol churches located in different municipalities rendered information helpful in forming future actions that the NCCA and other government agencies could follow in order to address the rehabilitation of Bohol's religious heritage following the 15 October 2013 earthquake.

Technical Assessment was undertaken through the following: 1. Actual ocular survey and in-situ evaluation of what may have happened, which eventually led to the collapse and/or failure of structural members. Theory on what may have occurred during the disaster is evidenced by the remains at the site which was briefly examined during the visits; 2. The undertaking of thorough photo documentation which serves as first hand evidence of the damage found in these structures. The photo documentation records the state of the structure and its various elements following the earthquake. It serves as a reference for future off-site assessment; 3. The conduct of off-site assessment through the examination of photos. 4. The identification and definition of categories of damage, classified according to the material remains of the structures and their gravity of destruction.

During assessment which was done in-situ and off-situ, books and written materials about the cultural heritage of Bohol as well as old photographs were consulted to ensure clarity of information especially on the names of the churches, its various features and the parts that have been destroyed that contained certain important elements denoting its cultural significance. Similarly, so as to ensure correctness of use of architectural terminologies, architectural reference materials were also referred to during the evaluation process.

The actual visits to the sites that primarily focused on the assessment of the effects of the October 15, 2013 earthquake on Bohol's religious monuments have revealed damage that maybe categorized in different levels or degrees. Damage classification has been based on the level of gravity of destruction. Two (2) general types of damage were seen: major and minor. A rubrix has been designed to clearly understand and identify the categories of damage to the churches as well as to group them together basing it on the degree of damage by which they fall into.

RUBRIX FOR THE CATEGORIES OF DAMAGE:

Degree of Damage was classified into the following:

MAJOR DAMAGE - Level 1 (Gravest damage)- Loon, Maribojoc ; **Level 2** (Major parts are still standing but in critical condition and have incurred severe damage which are restorable; Major parts have collapsed but can still be reconstructed; All these need immediate attention;) - Loboc ; **Level 3** (Major parts are still standing and with major and minor damage and repairable; Major parts have incurred severe damage, some are in critical condition. All these are restorable/repairable and require immediate attention;) - Dauis, Loay, Cortes, Tubigon,

Inabanga, Clarin, Baclayon; and **Level 4** (Major parts are still standing but with major damage and repairable, most parts are standing and intact, or with minor damage. All parts that have major damage require immediate attention;) - Anda, Jagna, Talibon, Dimiao

MINOR DAMAGE - Level 5 (Most parts are intact, some with very minor damage which are repairable, restorable) - Panglao, Alburquerque, Lila; and **Level 6** (Still very much intact, damage if present, are not discernible) - Duero, Mabini

TYPES AND DEGREES OF DAMAGE OF THE BOHOL CHURCHES THAT WERE AFFECTED BY THE 15 OCTOBER 2013 EARTHQUAKE Date of Assessment: 18-25 October 2013

PARTS OF CHURCH	MAJOR DAMAGE				MINOR DAMAGE	
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
	Maribojoc, Loon	Loboc	Daus, Loay, Cortes, Tubigon, Inabanga, Clarin, Baclayon	Anda, Jagna, Talibon, Dimiao	Panglao, Alburquerque, Lila	Duero, Mabini
Significance	Highest significance = National Cultural Treasure; Spanish Period	Highest significance = National Cultural Treasure (NCT); Spanish Period; Church and its adjoining structures (the convent and the school) have huge proportions meriting its being declared as the first NCT;	Some are of Highest significance = National Cultural Treasure (Daus, Loay, Baclayon); Have other declarations or are yet to be declared; Spanish Period with some of the churches having reinforced concrete additions from the Spanish American period	Some are of Highest significance = National Cultural Treasure (Dimiao); Have other declarations or are yet to be declared; Spanish Period with some of the churches having reinforced concrete additions from the Spanish and the American period	Panglao is a marked structure by the NHI (now NHCP); Other churches have no declaration but might merit equal recognition; Major parts of these churches are Spanish Period with some reinforced concrete additions from the Spanish and American period	No declaration at present; might merit declaration especially in the case of Duero which is substantially made of wood; Time of establishment of churches may have been in the Spanish Period with some additions from the American period
Walls (front façade, lateral walls, transept walls, altar wall, rear wall, walls of sacristy and other attached structures)	Total collapse	Majority of the significant parts and elements of the church have collapsed and/or have disappeared; The church can still be restored to its original form and parts, and those parts that have collapsed	Some significant parts and elements of the churches have collapsed and/or have disappeared; These are still restorable and/or reconstructable; Some walls remain standing but have incurred major	Some of the major parts are still standing with major damage which are repairable; Most parts are standing and intact, and/or with minor damage and repairable;	Most wall parts are intact, some have been observed with minor damage which are repairable/restorable;	Walls are still very much intact; If there is damage it is not discernible;

		<p>can still be reconstructed following original technology and materials;</p> <p>Some walls remain standing but have incurred major damage to its members as evidenced by the presence of large vertical and diagonal cracks, splits and fissures that have caused the dislodgement of some stonework and/or parts of rubble fabric thereby sustaining partial /full disintegration of from its base;</p> <p>Traditional methods can be used for restoration while structural damage can be addressed using either/or both traditional and modern technology;</p>	<p>damage to its members as evidenced by the presence of cracks, splits and fissures; Some stonework and/or parts of the rubble fabric have been dislodged and/or have sustained partial /full disintegration of from its base;</p> <p>These churches are still restorable and/or repairable;</p> <p>Traditional methods can be used for restoration while structural damage can be addressed using either/or both traditional and modern technology;</p>	<p>Traditional methods can be used for restoration while structural damage can be addressed using either/or both traditional and modern technology;</p>		
Roof	Total collapse	Partial collapse, major damage found	Roof members of some of the churches have incurred partial to major collapse, and in some areas major damage is found	Still standing and appears to be intact but may have incurred damage which was not discernible during survey and assessment	Still standing and appears to be intact but may have incurred damage which was not discernible during survey and assessment	Still standing and appears to be intact but may have incurred damage which was not discernible during survey and assessment
Floor parts (choir loft, floor slab)	Total collapse	Total collapse of front façade leading to a minor collapse of choir loft floor; major damage found;	Some churches have been found to have incurred partial collapse of choir loft, major damage found on floor slab	Churches have been found to have incurred partial collapse of choir loft, major damage found on floor	Still standing and if there is damage, it is not discernible;	Still standing and if there is damage, it is not discernible;

		Floor framing system of gallery holding the pipe organ still intact but may have sustained some significant degree of failure; Pipe Organ still standing but may have to be checked to verify state;		slab		
Other structural parts	Total collapse	Partial collapse in some areas but with major damage found;	Partial collapse, major/minor damage found	Still standing and if there is damage, it is not discernible;	Still standing and if there is damage, it is not discernible;	Still standing and if there is damage, it is not discernible;
PROBABLE OVERVIEW OF RESTORATION COST	Cost for intervention depends on the kind and approach to be undertaken	Cost for restoration is major, substantially greater than Level 3	Cost for restoration is major, but is less than Level 2.	Cost for restoration is less than Level 3	Cost for restoration/repair is less than Level 4	Cost for any intervention work will depend on findings of the DES if damage has been discovered;

The above rubric qualified the degree by which the churches have incurred damage. Level 1 is found to be the gravest level wherein Loon and Maribojoc fit into this category. Maribojoc and Loon churches have been totally destroyed. Full collapse of its members is apparent leaving the whole edifice and its parts slumped to the ground with remains of crushed rubble, huge pieces of stone work, some recoverable fragments of ornamentation, torn and buckled roof parts and dislodged wooden members all becoming evidence of the existence of these once proudly standing monuments.

Under major damage is Level 2 which is the church (Loboc) that has sustained substantially severe damage in most of its members. Loboc has some of its parts still standing but have equally suffered grave failure as evidenced by the presence of major cracks (vertical and diagonal) and/or the serious splitting of structural members, which when not immediately addressed, may ultimately lead to its eventual collapse and harm and/or injury to its users. Major parts of Loboc’s structural fabric are still standing although they have been found to have incurred major damage. There is still a chance for these parts to be repaired, restored and those that have collapsed may still be reconstructed.

Level 3 are churches that have major parts still standing but have been found to have minor damage and are repairable. In these churches, it is at the canton of walls and at the joints of these corner pillars that connect the front façade to the lateral walls that vertical cracks and the splitting of members have occurred. This is mainly due to the fact that most of the front façade of these churches did not have buttresses that acted upon the outward forces of the lateral walls as tensioned by the roof members, which remain stable during normal conditions and worsened during seismic movements. It is also notable that the weakest parts of arches of openings (windows and doorways) such as the voussoirs

nearest to the keystone, and including the keystone, are those where failure occur. Such failure is apparent in the church of Dauis where practically all its arch openings succumbed to vertical and diagonal cracks that emanated from the uppermost part of the wall, following a downward direction that reached the underside of the said arch openings. In most apertures in Dauis, stone parts have been totally dislodged, leaving the apex of the arch opened. It has also been observed that churches having vertical pillasters acting as buttresses instead of the inclined retaining wall type buttress, have sustained much graver damage. In some instances, walls of churches having inclined buttresses that absorbed the outward splaying of the roof remained standing, although in many cases, some of these buttresses have also incurred major damage such as the dislodgement of its stonework from base, the dismemberment of the interior rubble fabric as well as in grave cases, the total collapse of the said structural element. Despite occurrence of these failures in the churches, they are still restorable/repairable.



Dauis Church

Level 4 churches have major parts still standing but found with major damage at cantons which are the corner pillars of the building, and/or at intersecting coursework of adjoining walls. Damage to the Talibon church, for instance are the bulging of quoins at the upper most parts of its canton which are repairable, with the rest of the corner elements still standing and very much intact, and/or found to have minor damage. In Level 4 churches, all the other parts that have major damage require immediate attention.

Due to the still on-going tremors which lasted weeks after the earthquake in Bohol, it has been noted that some churches visited on 18 October 2013, which were re-visited after 4 days, have sustained much worse damage. This is the case of Loay, Dauis and Dimiao. It is highly probable that other churches of the same condition with parts that may have been initially found with lesser damage or still intact, may have become worse in condition following the tremors that occurred after initial inspection.



CONCLUSIONS ON THE STATE OF DAMAGE

Remains found at the sites showed indications that failure occurred in specific areas within the structures. The cause of this is manifold and can be attributed to many factors such as the intrinsic quality of the structure itself : the type of material used during construction, the state of material and how it behaved over centuries of use or mis-use, the technology used; extrinsic factors such as previous seismic movements as well as the present earthquake that has led to the collapse and dismemberment of buildings and/or its parts; interventions to the buildings themselves which in one way or the other have enriched the building's significance but may have played an important role in their damage.

As a general overview, it is clear that parts that have collapsed and those that have remained standing are those that 'independently' acted on its own when the shakes and movements occurred, whilst, not considering that the other building parts alongside it are to be affected when it did its own self-determining reaction. This observation is shown in many areas where previous non-homogenous interventions were made. In particular, collapse (full or partial) was seen in the churches of Dauis, Loboc, Loay, Cortes, Baclayon where parts or full areas of the front façade walls gave way frontward. These are the churches with Spanish and/or American period additional interventions in the form of the portico facades.

The churches where central parts of lateral walls partially or fully collapsed in an inward direction and where buttresses failed to hold together the structure (Loboc, Inabanga, Clarin) showed that said walls similarly independently acted on its own sans being tied together to the rest of the structure or its adjoining members. In the case of Clarin, the front façade and its sanctuary wall remained standing

while both its lateral walls fell inward, an indication of the lack of a fastening material at the corners that could have prevented total collapse.



Loboc church (L); Loay church (R)

Churches where lateral walls remained standing are those supported by inclined buttresses which not only acted to absorb the lateral sway of the roof, being its inherent function, but also prevented buckling of these lateral walls.

There were clear splitting and failure of connection between wall members especially at transept walls and between the front façade and/or the sanctuary wall corners that adjoin nave lateral walls. This observation is prevalent amongst Level 2, 3 and 4 churches.



Clarin church



Inabanga church

In many churches, failure occurred at arch openings with vertical/diagonal cracks emanating from the apex of the wall following downward directions and cutting into spandrels (Dauis, Loboc, Jagna, Baclayon, Cortes, Loay, others). In Dauis, this was most apparent as almost all apertures manifested the same problem. This means that the weakest points in the walls consequently gave way due to the movements. The arch action (compressive action of all its parts) eventually failed when the spandrel and arch abutments also fell short in putting together the compressive stresses that held them together. Arch openings should have in full the keystone, voussoir stones and the impost. These should be solid enough to carry its own the load. The coursework beside the arch which is the abutment helps prevent thrust thereby assisting in strengthening compressive qualities of the arch. If all these are subjected to multi-directional movements, they become weak and eventually result to the disintegration of parts. Most churches likewise manifested damage at the cantons with the bulging and eventual dislodgement of hewn stones that held the wall together. There were also cracks between the corner pillars and adjacent walls. Very much apparent in all churches was the state of the interior rubble masonry fabric which was found pulverizing and disintegrating. It was only the coursework that held these together so that when movements occurred and the coursework were eventually dislodged, the interior fabric similarly gave way.

*Cortes church**Dimiao church*



Ground cracks Loboc church (L); Maribojoc church(R)

In the case of the Loon and Maribojoc churches, ground ruptures found to have laterally cut across the longitudinal part of these churches at central and strategic locations may have led to the total collapse of the edifices. Owing to the karst topography of Bohol, the existence of caverns crevices within the karst substrate and theories of the presence of crevices under these churches remain as a plausible reason for the total collapse. This theory can only be substantiated by geophysical investigation.



Loon and Maribojoc churches in state of rubble

RECOMMENDATIONS

The aforementioned criteria used for determining the gravity of damage could become the basis for defining recommendations and succeeding actions that government may take for the conservation, risk reduction and/or damage control of the churches affected by the 15 October 2013 earthquake in Bohol.

General Recommendations:

1. Organize a workshop/international conference aimed at drawing information about similar experiences and practices employed by other countries and organizations who have encountered the same disasters such as the one in Bohol; From the workshop and conference can be inferred the necessary information needed in defining Guidelines for Conservation and for Disaster Risk Reduction and Post Disaster Management work. The Guidelines will become the framework for actions in the rehabilitation of the churches damaged by the 15 October 2013 earthquake;
2. Follow a collaborative, participative and inclusive approach where the voice and opinion of stakeholders are considered, as well as systems that will ensure longer life to the churches;
3. Prioritize shoring, risk reduction and damage control measures for the churches that have already incurred destruction (minor and major) from the earthquake; Consider that delays in putting the shoring may lead to the eventual collapse of structural members that are in a serious, precarious state;
4. At the clearing and retrieval operations, ensure that remains and evidences of significant tangible attributes of the churches are safe kept and well documented; Other forms of remains should be secured for future use during actual restoration work and as a reference for future studies;
5. As recommended, ensure the undertaking of complete and thorough Detailed Engineering Studies (DES) that cover complete architectural and engineering studies and structural retrofitting and/or re-strengthening methods that, when necessary, may go beyond the traditional; Consider, with extra care and prudence, the use of modern innovative methods for the restoration and structural strengthening of damaged parts of the edifices;
6. Depending on the availability of resources, prioritize intervention work according to the degree and gravity of damage; Damage found in churches under Levels 2, 3, and 4 have to be addressed the soonest possible time;

For Level 1

1. Propose solutions that are beyond standard restoration and reconstruction practices; consider innovative approaches that are appropriate to the present and future needs of the place and the people as well as those considering the thrust of the owners of heritage and government in as much as the conservation of heritage is concerned;
2. Work within a consultative, participative and inclusive framework (for issue resolution, for information generation and for interpretation)

For Levels 2, 3, 4

1. Prioritize funding for restoration, reconstruction, repairs;
2. Immediately undertake shoring and support for all areas that could fall off, collapse or be dislodged;
3. Prioritize the preparation of a complete Detailed Engineering Studies (DES) which will assist in determining cause of failure and damage as well as in defining appropriate solutions to conservation concerns;
4. Consider, with extra care and prudence, reliable retrofitting methods that, if necessary, is based on non-traditional practices; Consider, with extra care and prudence, instituting innovative modern approaches;
5. Institute restoration, reconstruction and repairs the soonest possible time (following completion of a complete

thorough DES); 6. Work within a collaborative framework where all national cultural agencies and other relevant national agencies as well the owners of heritage address conservation concerns within a spirit of cooperation so as to attain the desired direction and vision;

For Level 5

1. Undertake complete DES; 2. Institute repairs the soonest possible time, which include whatever damage discovered in the DES; 3. When necessary, work within a collaborative framework where the owners of the heritage, the concerned national cultural agencies and other relevant organizations address issues within a spirit of cooperation so as to attain the agreed direction and vision;

For Level 6

1. Undertake complete DES; 2. Institute repairs of damage discovered prior to or following completion of a complete DES.