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RESEARCH ARTICLE

Managing health and safety risks in restoration/renovation of historic buildings

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Abstract

Restoration and renovation of historic buildings aim to preserve and sustain those buildings with their original state. This fact is important to conserve historical values for a society as well as for sustainable city planning. Restoration projects have their own occupational health and safety risks and differ from ordinary construction projects. Additionally, implementation of safety measures according to the current regulations are very difficult due to geometrical structure, type of material used and preservation consideration for the structural and architectural elements of the historic buildings. Since the risks as well as mitigation and abatement techniques differ from conventional buildings, restoration projects require paying attention to establish safety and health plan and risk management system to implement safety and health measures. In this paper, different health and safety risks of the restoration projects are discussed. Different safety and health practices are dealt with ordinary structures, risk assessment is made according to specific risks, findings are revealed in some certain restoration projects in Turkey and a new approach for health and safety management in restoration projects is introduced.

1. Introduction

The restoration, renovation and conservation of historic buildings requires a comprehensive approach through a multidisciplinary project management approach that includes health and safety. Apart from the other construction projects, historic building restoration projects have unique problems and sometimes it is difficult to implement conventional project management techniques as well as health and safety practices. The restoration projects' ultimate aim is transfer of the cultural heritage to the future with minimum changes in their structures, characteristics, architectural/artistic design and aesthetic forms. Restoration and conservation of historic buildings are actually a sequence of actions, from understanding the historic place, planning for its conservation/restoration and intervening through projects or maintenance. Generally, historic buildings are defined as a structure, building, group of buildings, that have been formally recognized for its heritage value. Heritage value can be defined as the aesthetic, historic, scientific, cultural, social or spiritual importance or significance for past, present and future generations. The heritage value of an historic place is embodied in its character-defining

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materials, forms, location, spatial configurations, uses and cultural associations or meanings. Finally, character-defining element means the materials, forms, location, spatial configurations, uses and cultural associations or meanings that contribute to the heritage value of an historic place, which must be retained to preserve its heritage value [1].

Restoration is defined as a sub-class of construction works in the Turkish legislation as in the EU legislative framework [2]. Therefore, the health and safety regulation for construction works must be applied for restoration projects as well. Restoration projects contains many conventional construction activities (and related health and safety risks) along with the specific jobs with peculiar hazards and risks those cannot be observed in other construction projects. These issues firstly discussed by the authors in Turkey in a published study that put forward fundamental points for these projects [3]. This paper is going to extend and suggests more comprehensive view for restoration/renovation practices with field study. In Table 1. Distribution of fatal accidents according to the project type in the Turkish construction industry are shown [4]. Accident causes in Table 1 were classified according to International Classification of Diseases current version of ICD-10 (International Statistical Classification of Diseases and Health Related Problems). Unfortunately, occupational accidents in the restoration projects have not been recorded under "restoration or renovation projects" separately. However, it can be commented that majority of those accidents have been classified under "building" or "other" projects. It is nevertheless a starting point to focus on accidents or risks in the restoration projects by the examination of these projects.

Table1. Distribution of fatal construction accidents to project types (Gürcanlı, 2006)

Accident Cause /Project Type	Building	Highway	Railway	Channel	Bridge/ viaduct	Tunnel	Seaport/ Pier	Dam	Demo- lution	Energy trans.	Other	Total
Falls (W00-W19)	*880*	8	1	19	15	0	2	13	8	22	*60*	1028
Struck by thrown, projected or falling object (W20)	*152*	16	4	12	4	15	4	22	4	8	*20*	261
Cave-ins (while or after excavation), (W20)	*60*	4	0	68	1	1	3	0	1	0		138
Building/Structure Collapse (W20)	*105*	1	0	2	4	0	0	1	41	0	*13*	167
Exposure to electricity (W85-87)	*255*	1	0	5	0	0	4	6	1	9	*12*	293
Explosion (W36, 40)	*4*	24	0	8	0	5	0	3	0	1	*5*	50
Heavy equipment accidents (W24 and V09)	*33*	90	0	13	4	2	6	19	1	7	*31*	206
Crushed, jammed or pinched in or between objects (W23)	*1*	0	0	0	0	0	0	0	1	0	*0*	2
Transport accidents on site (W02-08)	*22*	74	21	13	2	1	3	14	1	5	*12*	168
Other Types W23, W24-29, W31, W68-74	*23*	9	0	7	6	0	2	7	0	6	*25*	85
Total	*1535*	227	26	147	36	24	24	85	58	58	*178*	2398

According to NACE Codes (Nomenclature Générale des Activités Économiques dans les Communautés Européennes) restoration projects should be classified under NACE Code 41.20.05, that is "reorganization or for renewal of the existing residential or non-residential buildings (major overhaul)". Additionally, NACE Code 43.99.07, scaffolding and work platforms setting up and dismantling works as well as NACE Code 43.99.12, steam cleaning, sand blasting and similar specialised construction activities for exteriors of the structures are the most common construction activities in restoration and renovation projects. Classification and definition of activities in restoration works will be a starting point to focus on health and safety risks and related prevention measures in the projects. This paper tries to put forward the specific health and safety risks as well as necessary prevention techniques for restoration projects and recommends a managerial approach and guide before the commencement of the on-site phase.

2. Health and safety risks specifically for restoration projects

Dealing with the renovation and restoration of historic building heritage often means facing several difficulties which not only concern ways of representing the ancient building and the design ideas, but also the phases of on-site interventions [5]. The designers must always take into account a range of possible and compatible solutions that avoid endangering the cultural significance of the building by taking into account restoration specific health and safety risks. Conventional methods often fall short to ensure health and safety of on-site staff. In many cases, the boundaries of the construction site indefinite, whether a sacred place or old building in which visitors enter or walk in the close vicinity of the restoration work. Therefore, before the commencement of a project, to define the boundaries of construction site should be the first task. Afterwards, not only for the workers but also for the public, hazard identification and risk assessment practices should be performed. To perform an efficient hazard analysis, health and safety risks specifically exist in restoration projects should be examined. There is not enough information in the literature about occupational health and safety risk factors in restoration and renovation projects. According to the findings obtained from on-site observations and interviews in the visited projects, these special hazards and risks are given in the following paragraphs.

Hazards due to damages of the historic building: Many historic buildings have structural damages or damages at the architectural parts because of age, deficient material, lack of competent workmanship, wrong design, natural conditions, natural disasters, wars, fires and so on. Therefore, intervention strategy is very important. In the preparation phase, these factors should be considered:

- Strength of slabs, columns, beams and other structural element for collapses,
- Damages in the architectural or artistic parts of the building for falling materials,
- Old and obsolete utilities such as water distribution, electricity, heat system for electrocutions, fires and/or damages due to water.
- Hazards due to performance of different jobs concurrently, such as structural strengthening and artistic works are being performed together (risk transfer of one job to the other).

Fall from height: Restoration of historic buildings requires very detailed and long hours of cleaning, steam cleaning, sand blasting, artistic painting, engraving and similar works at height. As in the conventional building projects, falls from height rank first in fatalities. However, there are different hazards and risks from the conventional projects those emanate from the difficulties to mantle scaffoldings in a usual manner/material, to install barriers, guardrails as well as to fix anchorage points for safety harnesses. In many cases, implementation of health and safety regulations for scaffoldings is difficult, for instance to fix anchorage points or proper footings. In most cases it is impossible to meet the requirement of minimum 30 cm distance between scaffolding and the building. Because historic buildings usually

have facade elements such as cantilever, exedra, console or more circular walls that require special attention. For this reason, the scaffolding distances cannot always be as in the standards. Mounting vertical or horizontal lifelines is also very difficult due to damage risks to the historic building or architectural details of it. In addition, it is risky to establish the lifelines on the unsound joint of the masonry building wall or another stable field without making sure that the load-bearing system of the historic building is strengthened.

Falling Materials: As mentioned above, structural weakness, old artistic and architectural parts of the building are the sources of falling material risks. Apart from these risks, falling of the many materials such as paintings, chandeliers, boards on the walls, roof or wall coverings create risks. Disposal of the materials which are taken from the upper parts of the building requires special carriage of the materials whether horizontally or vertically with special crane systems to prevent workers as well as public.

Dust: Dusts due to restoration activities such as sand blasting, micro sand blasting, engraving by the utilization of special equipment, pressurized air or nitrogen may be the most hazardous activity for the construction workers. Drilling, engraving or cleaning of natural stones such as mussel stone, basalt, marble not only a source of dust to create health risks for the workers but also for the public in historic buildings. Moreover, some materials cannot be identified easily without a material analysis and some certain materials used in past times may be regarded as hazardous for health now and they may still exist in the historic buildings.

Asbestos: Asbestos is a fireproofing and thermal insulation material that used to be a prominent element of building construction before it was banned in many countries. Because of its characteristics, asbestos was added to concrete, asphalt, vinyl materials in roof shingles, pipes, siding, wall board, floor tiles, joint compounds and adhesives. It poses a health risk to construction workers, repairmen, maintenance workers, restaurateurs, technical staff as well as public near the historic building when it is damaged, crumbles, or is in a state of disrepair. The risk is even greater if the building is demolished, renovated, or remodelled [6].

Lead and Tin: Both lead and tin are heavy metals those create bioaccumulation (concentration of toxic substances by an organism over an extended period of time) in the human body. For instance, lead in the body is distributed to the brain, liver, kidney and bones. It is stored in the teeth and bones, where it accumulates over time. Human exposure is usually assessed through the measurement of lead in blood. Lead in bone is released into blood during pregnancy and becomes a source of exposure to the developing foetus. There is no known level of lead exposure that is considered safe. However, lead or tin exposure is preventable [7]. Workers in the restoration and conservation projects expose to fumes of melting lead during construction activities such as covering, sealing or fixing joints. Notre Dame Cathedral fire is an unfortunate example of lead poisoning; where almost 300 tonnes of lead melted and lead particles dispersed in the form of fumes, and after two months of the fire it was recorded lead in a children's blood more than accepted levels [8].

Hazardous Chemicals: In restoration/renovation projects, chemical exposure has two sources; the hazardous chemicals in the building (façades, joints, artistic parts, paints, special chemicals applied on wooden surfaces and so on) and the chemicals that used during the project, especially while cleaning process of the surfaces. Chemicals used in restoration project may vary and those are different from chemicals used in standard construction projects (for instance absorbent jell AB57, ammonia, oxalic acid, hydrogen peroxide). The different ways a person can come into contact with hazardous chemicals are called exposure pathways. There are three basic exposure pathways: inhalation, ingestion, and skin contact. Every worker has the "right to know" what hazardous chemicals they are working with and what controls have been put in place to protect them from harm [9]. Therefore, Safety Data Sheets (SDS) must be prepared, analysed, health and safety measures

must be ensured and the employers must be informed about the risks of those substances.

Fire: As expected, most of the historic buildings do not meet the requirements of fire safety regulations. Wooden parts of those buildings, wood dust, chemicals and other flammable structural/architectural elements in the building increases the risk of fire and explosions. In many instances, construction activities such as welding, cutting are performed in the close vicinity of wooden parts, locations where wooden dust exists or flammable chemicals/materials. Additionally, in some jobs require welding tools (such as insulation works), those tools may create sparks and sparks may ignite flammable materials around them.

Biological risk factors: Decomposition in organic substances, dead animals as well as living animals, insects, plants (scorpion, rat, flea, lice, stinging nettle and so on) in the cracks of wooden parts or in deserted buildings are very serious biological risks for the workers and must be detected before the project commences.

3. Health and safety practices in restoration projects

Similar to conventional construction projects, restoration/renovation/conservation projects require planning of all activities from the pre-construction to post-construction phase. In the scope of the study, different restoration projects are visited and on-site jobs observed, hazard analysis performed, related risks due to restoration works are detected and a general flow chart for historic building restoration projects were established. Visited, observed as well as worked construction sites in authors professional life are given below:

- Bomonti Beer Factory Restoration Project,
- Ankara Opera Building Restoration/Renovation Project,
- Great Post Office Restoration Project (Sirkeci),
- Sadabad Mosque Restoration Project,
- Armenian Church and Monastery Restoration Project (Nicosia, Cyprus),
- Teutonia Building Structural Strengthening and Restoration Project (Beyoğlu, İstanbul)
- Sümela Monastery Restoration Project.

By the aid of on-site investigations and technical specification examinations, most common, most hazardous construction activities were determined. Accordingly, general health and safety activities in the preparation and construction phases are given below. The detailed steps are depicted in a comprehensive flow chart given in the Appendix.

3.1. Preparation phase health and safety activities

In the preparation phase, firstly project schedule should be examined and then related hazard analysis/risk assessment for each construction activity should be performed. Moreover, tools, materials, method of construction, risks on the premises (chemicals, materials, plants, animals, insects) should be detected/analysed. All this information will be used for Health and Safety Plan (HSP) that prepared by project manager and an assigned health and safety coordinator. It is worth mentioning that HSP should contain Emergency Response Plans (ERP) or ERP's should be prepared separately but annexed to HSP.

Preliminary risk analysis is an obligation to implement health and safety prevention. These risk analyses must also contain third party risks such as neighbours, public, tourists and so on. This step requires determination of "construction site" boundaries. Additionally, strength, fragility, brittleness tests for the materials in the structural as well as architectural/artistic parts of the building should be done by taking specimens. According to the results of the tests, most dangerous parts of the building (due to collapse, falling materials etc.) must be detected and workers must be informed [10].

Detection of asbestos, lead, tin and other chemicals in the historic building is very important. The locations where asbestos exist should be detected and labelled. Asbestos removal plan should be prepared and removal process must be performed according to Asbestos Removal Regulation under the supervision of asbestos removal experts.

Selection of appropriate access equipment to high working platforms, wide openings and/or atria is important. Characteristics of access equipment, working platforms (wooden or steel scaffolding, locations of the anchorage fixing points, types of safety harnesses if needed, joint elements and so on) should be determined according to the historic building's characteristics.

Work permits for the most hazardous activities (confined spaces, heating, welding, dust, fumes etc.) should be approved by governmental bodies as well as project health and safety coordinator. Activity Based Safe Method of Construction Manuals (ABSMC's) should be prepared according to the preliminary hazard analysis (PHA). PHA is a method for the identification of hazards at an early stage in the design process. Preliminary Hazard Analysis is performed to identify areas of the activities, which will have an effect on safety by evaluating the major hazards associated with the activity. It provides an initial assessment of the identified hazards. ABSMC's are the hinge point of health and safety in restoration projects. In the scope of this study, ABSMC's were prepared for different type of activities by the authors after the inspection and observation of restoration projects (Such as façade cleaning with steam and sand blasting, artistic painting, engraving). ABSMC of mosque dome restoration job is given as an example in Appendix 1.

As mentioned above, preparation phase is the most important part of restoration/renovation projects. In the flowchart given in Appendix 2, all necessary health and safety activities are given step by step. Implementation of all those steps are crucial for a safe construction as well as safety throughout post-construction phase, in other words owner occupancy, utilization of facilities by users/visitors, repair and maintenance activities and/or changes in the building. It is worth mentioning that submission of the project to the owner (whether private or public) requires elimination and/or minimisation of all risks only for the workers in the stage of construction but also risks those may appear during utilization and this is very crucial for facility management.

3.2. Construction phase

After the commencement of the project, firstly Health and Safety Plan and its annexes (ABSMC Forms) should be reviewed. Project and H&S Coordinator must distribute ABSMC Forms and ensure that those are read, discussed and reviewed by technical staff as well as workers. Construction phase should be performed in accordance with project schedule and H&S Plan. Information to governmental bodies, municipality and other institutions is very important especially for tourist attracting historic buildings and those of in downtowns. Site boundaries passageways, traffic routes must be indicated and necessary health and safety measures for public safety should be ensured (see Fig.1).

After the revision of preliminary risk analyses, project activity based risk analyses should be prepared and HSP should be revised. The revised form of HSP should contain a "responsibility matrix" and "task assignment" forms in which all assigned technical staff and workers can be monitored throughout the project. If new tasks appear or new hazards are detected, additional Activity Based Safe Method of Construction (ABSMC) Forms should be used. Construction phase of a restoration project differs from conventional construction work especially from the view of health and safety due to following reasons:

- Historic buildings have health and safety risks before the construction,
- Historic buildings have additional and specific health and safety risks during the construction,
- Historic buildings continue to serve their functions and may be used during restoration,
- Historic buildings my change their functions, transformed into a new one after restoration (from old fire station to museum),
- Finally, historic buildings do not meet current health, safety and fire (HSF) regulations due to lack of or insufficient HSF regulations when they built. An example for this issue can be seen in Fig. 2. that shows changed guardrail regulations.

Fig. 1. Tourist attracting monumental buildings with and without safety measures during construction phase in Belgrad, Ayvalık. (Photos: Öztürk, D.)

Fig. 2. The balustrade at the National Archives and Library in Ottawa underwent a sensitive rehabilitation to meet current requirements for spacing between balusters. (Provincial, 2014.)

Moreover, some projects require special permissions due to security reasons. For instance, because of its very close location to Green Line, visit of the restoration project in Nicosia (Fig.3) was so limited. However, technical specifications and construction contracts of these types of projects may be examined. Therefore, ABSMC forms should be regarded as dynamic forms which should be adapt new situations and specific risks and must be revised regularly by a competent person.

Fig. 3. Armenian Church and Monastry Restoration Works in Nicosia, Cyprus (Photos: Gurcanli, G.E.)

3.3. Case study

In the scope of this paper, restoration project of Sadabad Mosque is given as an example to show different aspects, difficulties and risks during the restoration project and how health and safety practices should be implemented. Sadabad Mosque built on the shores of Kağıthane stream in 1722 and damaged twice by fire and it was last rebuilt in 1862. The designers of this peculiar mosque were the architects Sarkis and Agop Balyan (See Fig 4.).

Fig. 4. Restoration activities for the dome of the Sadabad Mosque (Photos: Öztürk, D.)

The mosque influenced by baroque style, walls were built of masonry wall, interior dome and altar were adorned floral decorations and covered externally by lead sheets. Between 1997 and 1998 it was largely restored to its original state but in last years the mosque required new restoration works between the years of 2012 and 2014. An occupational safety specialist and an occupational physician are involved in the restoration project and follow the local legal requirements in Turkey. Although there are some basic plans and procedures related to OHS in the project, it has been observed that there are no hazard and risk assessment procedures specific to restoration works. The restoration site could be followed throughout the entire process and investigated some basic restoration items such as drainage, strengthening of the masonry walls, restore of the dome structure, renewal of lead coating, conservation of baroque motifs in inner dome and altar, cleaning of the facade stones.

For each construction activity, ABSMC Forms prepared and an example form for dome restoration works is given in Appendix 1. Afterwards to prepare on site practitioners in pre-construction phase, a flowchart prepared by adapting the similar flow published by Uzun et al [3] to this project.

4. Discussions

As mentioned before, restoration/renovation projects differ from conventional construction projects especially from the point of implementation of health and safety practices. Therefore, above mentioned ABSMC form as well as flow chart are very peculiar for restoration/renovation projects. The case study provides us some certain information and data to create a generic health and safety management tool due to its varied numbers of different construction activities. However, it is thought that the riskiest construction activities deserve attention for a comprehensive analysis. There were plenty of construction works but in the content of this paper but in spite of citing many of them, only dome roof restoration will be cited to put forward the importance of ABSMC. However, the suggested

flowchart is a generic one for practitioners on site. In the first phase, it is thought that the difficulties and/or differences between restoration/renovation projects with conventional building construction projects should be cited. Those are:

- Usage of lead in many parts and health risks due to lead exposure
- Difficulties and risks to mantle the scaffolding without damage decorations and floor,
- Difficulties and risks in mounting and dismounting wooden scaffold to meet the requirements,
- Difficulties to fix anchorage points for scaffolding as well as safety harness usage to prevent falls from height,
- Possible asbestos utilization in former restoration works,
- Difficulties to work on curvature dome roof, risk of falls and extreme temperatures,
- Special roof construction above the dome to prevent insulation materials from bad weather conditions (rain, snow, winds etc.)
- Necessity of the technical staff (restoration expert) to work at height with workers

All those peculiarities require different tools for designers, practitioners and restoration professionals. For instance, Godinho et al [11] suggests BIM as a tool and fundamental commencement for heritage management. Due to their peculiar geometric characteristic, integration of BIM with the geometric representation of historic buildings is a starting point. Additionally, 4D BIM may extends the model ability to include planning or simulation activities; 5D enables the consideration of costs of adding or changing constructive elements; 6D BIM is important to convey the heritage through ages from the point of sustainability (as the included information supports the analysis of the life-cycle of building components). Afterwards, utilization of 7D BIM will be effective in operations and facility management activities, especially for historic buildings aimed to be used different from original state (transformed factory building into a school or concert hall for instance). Finally, integration of 7D with 8D (Safety through design perspective) will serve as preventative maintenance scheduling or disaster and emergency planning [12]. These levels of information enrich the virtual para-metric base model and extend its applicability as a collaborative platform [13]. Moreover, it should be added 8D is about health and safety on the project site: embedded manuals, emergency plans as suggested in this paper. At this point, it should be introduced Heritage Building Information Modelling conceptual framework. According to López et al. [13], the goal of Heritage Building Information Modelling (H-BIM) is to model and document architectural elements, according to the diverse artistic, historical, and constructive typologies. In recent years, H-BIM has been applied with great advantage within the scope of management of heritage sites and buildings [14,15]. Accumulation of data by gathering into a central authority will provide workable database and the deployment of information to all the involved have been some of its main advantages. Due to all above mentioned literature, it is believed that this paper will provide a necessary information for the implementation of BIM, H-BIM and other tools to integrate health and safety issues with project management in historic building restoration/renovation projects.

5. Conclusions

Restoration projects are construction projects but have many difficulties and differences from others. Since implementation of conventional health and safety practices fall short to meet the requirements to provide safer work circumstances, restoration projects require paying attention to ensure health and safety of workers and technical staff. It should be noted that some of the risks discussed in this study may be limited to the observations in the restoration projects examined. There may be situations that require a deeper consideration of the risk factors unique to each restoration project. Authors believe that this study will increase the awareness to prevent our cultural heritage by ensuring healthier and safer working conditions with activity based safe method of construction and step by step approach prepared in advance and charm attraction for the practitioners how to

integrate BIM into historic restoration/renovation projects.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix 1. Activity based safe method of construction form for mosque dome

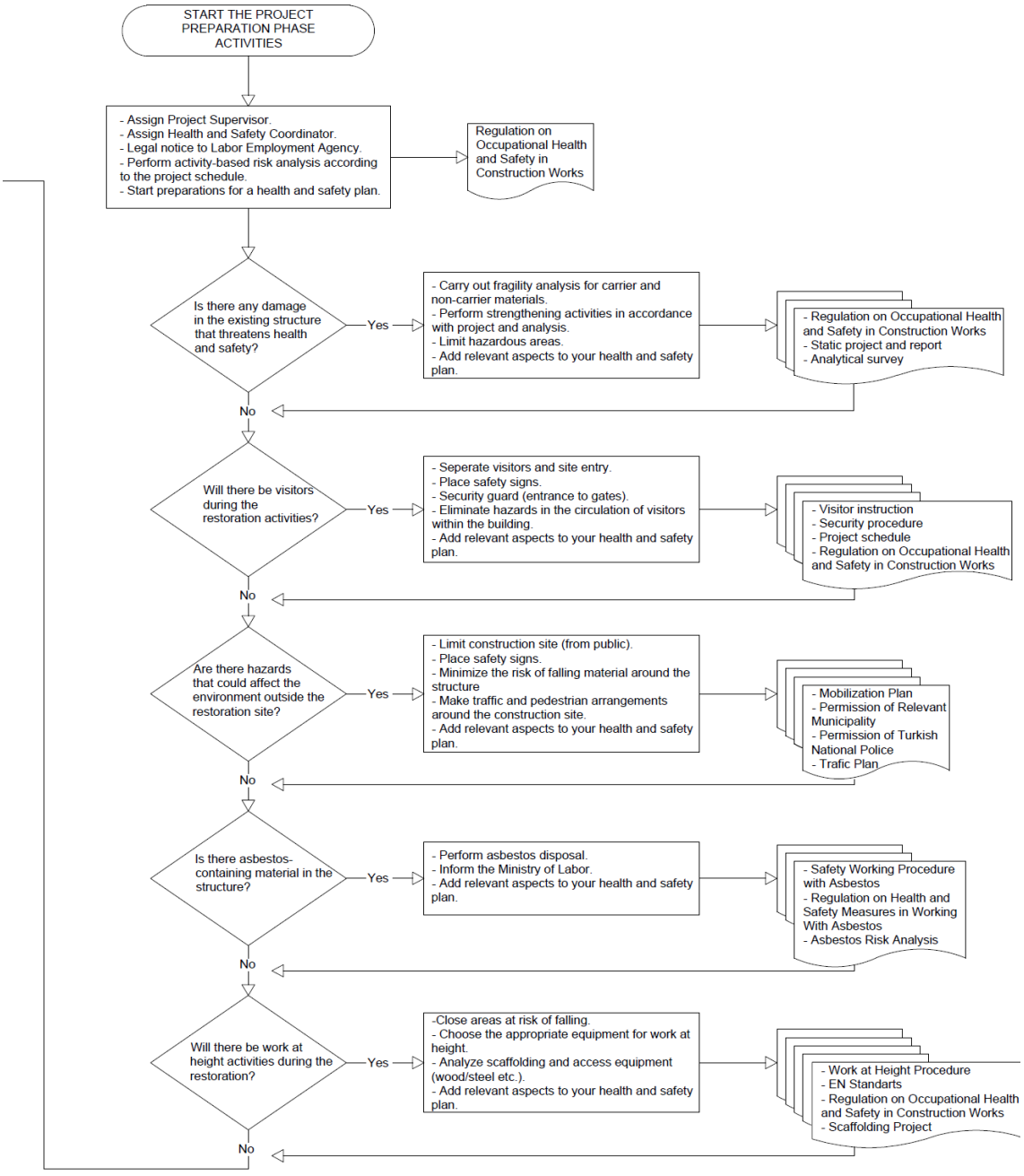
NOTE: Work must be performed in accordance with this ABSMC FORM
This ABSMC FORM must be kept and be available for inspection until the high risk construction work to which this ABSMC FORM relates is completed. If the SWMS is revised, all versions should be kept.

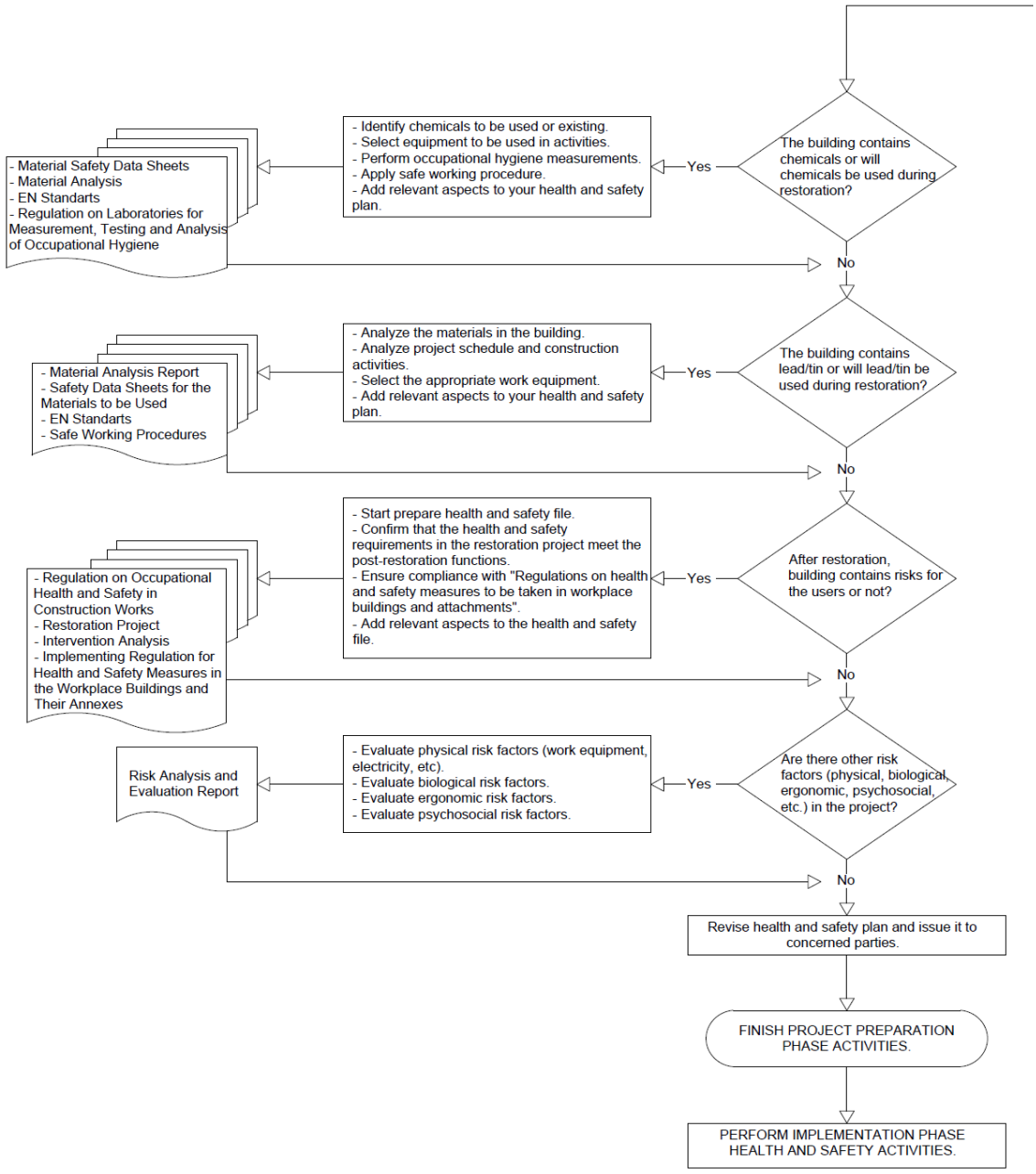
Workers, technical personnel and other staff involved in construction job: [Name, contact details]		**General Contractor Sub Contractor**	[Name, contact details]
Responsible Manager	[Name, contact details]	**Date ABSMC provided to Project and H&S Coord.**	
Work activity:	Restoration of mosque dome	**Workplace location:**	Top of the mosque dome and around it
High risk construction work:	☐ Risk of a person falling from height	☐ Likely to involve disturbing lead	☐ Likely to involve disturbing asbestos
	☐ Demolition of load-bearing structure	☐ Temporary load-bearing support for structural alterations or repairs	☐ Risk of falling materials
	☐ Temporary load-bearing support for scaffolds	☐ Use of heat and flammable substances	☐ Biological risks (insects; i.e. bedbugs)
	☐ Work in areas with artificial extremes of temperature	☐	☐

Person responsible for ensuring compliance with ABSMC:	[Name, contact details]	**Date ABSMC received:**	
What instructions are given to involved employees to ensure compliance with the ABSMC?			
Person responsible for reviewing ABSMC control measures:	[Name, contact details]	**Date ABSMC received by reviewer:**	
Review date:		**Reviewer's signature:**	

What are the tasks involved? *List the work tasks in a logical order.*	**What are the hazards and risks?** *Identify the hazards and risks that may cause harm to workers or the public.*	**What are the control measures?** *What will you do to make the activity as safe as possible?*
Transportation of wooden scaffold materials, temporary roof covers, working platforms and any other materials tools to the site	Falling materials Traffic accident on site	TO BE FILLED BY HEALTH AND SAFETY EXPERT WITH WORKERS AND TECHNICAL STAFF
Assembling the wooden scaffold	Falling materials, Fall from height	
Fixing the wipe wire hoist to carry materials vertically	Falling equipment/materials, fall from height, electrocution	
Assess working platform at height	Fall from height	
Assess with safety harness to working locations where scaffold do not reach	Fall from height	
Removal the crescent top on the dome and mantling temporary roof above dome.	Falling material/equipment, collision with material/equipment	
Removal of the lead roof cover	Lead exposure, falling material	
Removal roof cover materials under the lead sheets	Asbestos exposure, dust, insects, falling materials	
Analytical survey of the dome for its current architectural situation and structural strength to detect damages	Fall from height, falling materials, insects, dust, asbestos exposure	
Changing/repairing wooden elements damaged due to insects, decay or breakage	Fall from height, falling materials, insects, wood dust	
Laying wooden cover sheet, handmade mat, plastering with earth or Khorasan mortar	Chemical exposure, falling materials, wood dust	
Carrying lead sheets to the roof and laying by hammering	Lead exposure, falling material, Crushed, jammed or pinched in or between objects	
Fixing the crescent to its original place	Falling material/equipment, collision with material/equipment	
Dismounting the temporary roof	Fall from height, falling material/equipment,	
Name of Worker(s)		**Worker signature(s)**
Date ABSMC received by workers:		

Appendix 2. H&S Management Tasks in Pre-Cons. Phase for Restoration Projects (Adapted from Uzun et al. [3])




The building contains chemicals or will chemicals be used during restoration?
Yes
- Identify chemicals to be used or existing.
- Select equipment to be used in activities.
- Perform occupational hygiene measurements.
- Apply safe working procedure.
- Add relevant aspects to your health and safety plan.
- Material Safety Data Sheets
- Material Analysis
- EN Standarts
- Regulation on Laboratories for Measurement, Testing and Analysis of Occupational Hygiene
No
The building contains lead/tin or will lead/tin be used during restoration?
Yes
- Analyze the materials in the building.
- Analyze project schedule and construction activities.
- Select the appropriate work equipment.
- Add relevant aspects to your health and safety plan.
- Material Analysis Report
- Safety Data Sheets for the Materials to be Used
- EN Standarts
- Safe Working Procedures
No
After restoration, building contains risks for the users or not?
Yes
- Start prepare health and safety file.
- Confirm that the health and safety requirements in the restoration project meet the post-restoration functions.
- Ensure compliance with "Regulations on health and safety measures to be taken in workplace buildings and attachments".
- Add relevant aspects to the health and safety file.
- Regulation on Occupational Health and Safety in Construction Works
- Restoration Project
- Intervention Analysis
- Implementing Regulation for Health and Safety Measures in the Workplace Buildings and Their Annexes
No
Are there other risk factors (physical, biological, ergonomic, psychosocial, etc.) in the project?
Yes
- Evaluate physical risk factors (work equipment, electricity, etc).
- Evaluate biological risk factors.
- Evaluate ergonomic risk factors.
- Evaluate psychosocial risk factors.
Risk Analysis and Evaluation Report
No
Revise health and safety plan and issue it to concerned parties.
FINISH PROJECT PREPARATION PHASE ACTIVITIES.
PERFORM IMPLEMENTATION PHASE HEALTH AND SAFETY ACTIVITIES.