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RISK ANALYSIS OF RESTORATION WORKS BY FINE KINNEY METHOD: AN EVALUATION OVER MASONRY CIVIL ARCHITECTURE EXAMPLES IN FATIH DISTRICT, ISTANBUL

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Abstract

Restoration interventions aims at conserving heritage structures. Different situations may occur during restoration works comparing to standard construction works. These differences may cause special risks for workers and the structure itself. Risk analysis is widely used in restoration field in the world as a work plan routine. Definite division between restoration and standard works hasn't been defined in Turkey. Aim of the study is revealing what kind of different risks restoration works carry, creating awareness and making recommendations for avoiding these risks. As method of this study, Fine Kinney Method was chosen. The risk factor was obtained by using probability, severity and frequency values. Listed masonry houses from Fatih district were chosen. The region is composed of civil architectural examples more densely comparing to whole Istanbul. The most important criteria is the fact that these houses are among the oldest masonry examples in Istanbul. They carry more risks with their current deterioration levels. The possible risks were listed and documented. The results were presented using Fine Kinney Method. Falling from height and partial collapse are found as main risks in restoration works. Risk levels and risk types of potential risks in restoration works show differences than the standard construction applications.

***Keywords**: Historical structure; Fine Kinney method; Masonry structures; Risk analysis; Restoration works*

Introduction

It is becoming more common to experience work accidents in all sectors as the production has increased and work life has developed over time. All developed countries have been trying to take needed precautions in order to maintain work and occupational safety increasingly for the last decades. These countries are producing related laws and regulations about work and occupational safety.

In order to obtain a healthy work environment, *"Work health and occupational safety law"* with the number of 6331 has been prepared and issued in 2012. As it is indicated in its first article, the aim of the law is to enable work health and occupational safety, to organize the rights and responsibilities of both workers and managers in order to rehabilitate the current situations [1].

In this sense, the first step should be detecting the possible threats and risks in order to obtain work and occupational safety. *X. Romao et al.* [2] described the risk factor as a concept

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interrelated with modern society's collective consciousness in their study. Enabling the increase in the level of consciousness and understanding in order to improve our talent of handling with the risk has become a general tendency over the globe. It is possible to define the concept of "risk" as a threatening incident or precaution and precautions to be taken against potential results of this incident.

Construction works are among one of the work environments in which the risk level is highest in all the world. A special need was emerged on this sector since serious injuries and accidents resulting with death have increasingly started to be a serious issue. The studies of various researchers and organisations have increased especially in the last decades related to the risks in this working field. *E. Gürcanlı* [3] indicated the top three types of work accidents in construction field as falling off, electric shock and falling materials.

The studies related historical construction sites' risk types and levels are rarer comparing to standard construction works. However, when it comes to historical structures the risks are not only for the workers but also for the structure itself. In order to prevent these risks, it would be beneficial to detect all these differences and sensitivities. Reyers and Mansfield indicate that it is difficult to predetermine the extent, duration and cost of conservation refurbishment projects. Restoration works are unique and non-duplicable [4]

Listing the risk factors which are common in restoration site works and are preventable as best as it will be a starting point for the later works considering creating consciousness regarding additional risk potentials of the historical structures and their original values.

Method

Definition of problem

Obtaining the work and occupational safety was secured with the laws and special precautions. It is very essential to define the possible risks in working fields since work accidents are increasing parallel to increasing volume of business sectors. There are also regulations regarding health and safety of construction works in our country. But there has not yet been created any special and comprehensive laws or regulations regarding historical construction practises. However, these practises are quite different characteristically comparing to standard construction works and they consist of risks and problems of their own.

The aim of the study

It is the main point of this study to show the differences between construction works and restoration practises regarding potential risks because these differences have not yet been defined clearly. It is essential to clear these in order to avoid any kind of light/ severe injuries or possible life losses. It is among the goals of this study to make these differences clear and to create consciousness regarding this issue.

The possible risks that may arise in restoration works are quite important both for work/ worker's health and for the structures themselves due to their heritage values. If the potential risks are not prevented, these may cause the injuries or life losses or irreversible damages on the authenticity of the structure may occur. For this reason, this study is aiming to be a source for the later researches and to draw attention to restoration works' potential risks.

The context and method of the study

Fine Kinney method was chosen in order to define the potential risks in this study. Fine Kinney method is based on three parameters. The first one depends on the chance of an incident that may occur in a time (Probability = P), the second value shows the frequency and duration that people are exposed (Exposure = E) and the last factor is the severity of the possible damage for the people, work field or environment if the hazard occurs (Severity = S). Risk value is dependent on the final multiplying of these three factors' corresponding values in their own tables.

In the context of the study, a case area was chosen and a risk analysis was applied on this area by using Fine Kinney method. This method was chosen because the potential risks are shown related to their real photos on tables with a chance of better understanding.

Fatih district in which historical constructions are densely located was chosen to apply the risk method. Examples of masonry civil architecture from XIX century are more commonly located in this region comparing to Istanbul in general.

Literature review

Risk evaluation consists of the studies to be done for detecting the threats which are existing or probable to exist. Risks are factors that could be defined as directly or indirectly harmful for the workers, workplace and its environment and risk evaluation is essential for taking precautions against these risks.

Also, it is a process used for deciding the level of risk caused by threats and deciding whether this risk is acceptable or not (Fig. 1) by taking into account of the efficiency of the current controls [5].

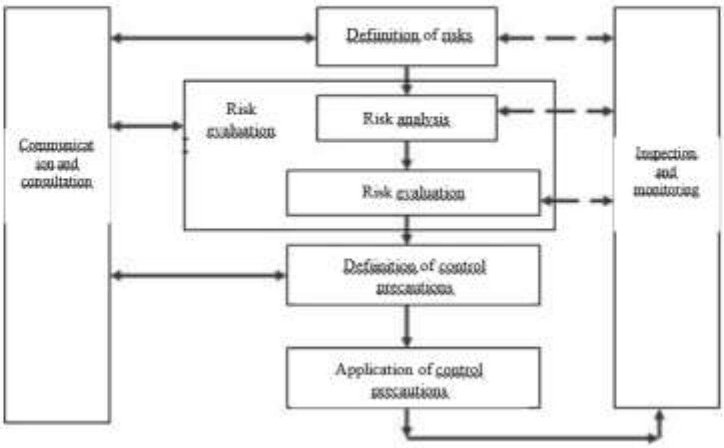


Fig. 1. The scheme of risk analysis process [6]

It is indicated that risk evaluation is the responsibility of all the offices and it is under the authority of the employers' guaranteed by the law of *"Work health and occupational safety law"* issued in 2012 with the number 6331. It is a subject of another regulation to define how the risk evaluation will be done [5]. The law describes the threat as the potential of harms that may cause from outside or that may already exist in the work place and affect the workers (stated under the 3rd article in section p) [7].

The steps of risk analysis are:

1-defining the dangers,

2-analysis of the risks arise by these dangers.

Risk analysis in architecture may be applied considering various reasons. Risk evaluations regarding site works, architectural structures, earthquake and etc. could be considered for different occasions. It is meaningful to evaluate the risk assessments for structural or non-structural elements or materials. These kinds of analysis are systems that secure the structures economically and constitute work health. They are used actively in our country for the recent years but has a longer background around the world.

Current risks in construction works

The threats and dangers should be defined before a risk analysis is applied for a branch of work or for a working area/ place. After that these threats should be levelled and evaluated.

According to the data of 2013, it is estimated that the total volume of work costs 3,5 billion dollars and 30% of total employment in business sector over the world is dominated by construction sector. Besides, according to the Social Security Institution (SGK), 344 workers lost their lives and 379 became permanently disabled in construction sites in one year according to the data obtained between 2000-2011 [3].

Table 1. The main accident types in construction works [8]

Type of accident	Death	%	Injuries	%
1. Falling off (workers)	1120	43,7	978	33,3
2. Electric Shock	303	11,8	86	2,9
3. Falling off (structural/non-structural material)	269	10,5	313	10,7
4. Accidents by machines	229	8,9	115	3,9
5. Partial/ total collapse of structure	174	6,8	90	3,1
6. Traffic accidents in construction site	171	6,7	41	1,4
7. Collapse of the excavation area	141	5,5	57	1,9
8. Other types of accidents	102	4,0	1170	39,9
9. Explosive material-based accidents	53	2,1	84	2,9
Total	**2562**		**2934**	

Construction sector is considered as one of the most dangerous and risky sectors among business field. Aslan indicates that more than 313 million work accidents occur annually (the study is titled as *"İnşaatlarda İş Sağlığı ve Güvenliği Kültürünün Tespiti"*). As for the work accidents resulted with life losses, the statistics of Turkish Social Security Institution shows that construction works rank in the first comparing to the other work fields in 2014. The percentage of construction works' accidents in total accidents is 16,3% and 36,086 accidents happened generally over the country [9]. The real data show that the risk level of the works in construction sector is quite high.

According to *"Work and occupational health in construction works"* regulation, the minimum security and health conditions in construction areas were defined. These conditions were prepared considering the threats and dangers that are most likely to happen in construction business. According to this regulation minimum conditions were considered and solutions were defined regarding falling off, security of the passages, falling materials, contact with electricity, emergency exits and doors, fire detections and precautions, air conditioning, temperature, lightening, doors and passages, traffic roads, loading places and ramps, first aid, areas where workers use and special risks [10].

Table 2. The types of accidents in different construction works [8]

Types of accident	Structure	Road	Railway	Channels	Bridge	Tunnel	Port	Demo-lition works	Other
Falling off from height	49.23	5.76	7.41	10.71	15.71	9.62	11.32	13.75	26.97
Electric shock	9.08	0.82	1.23	2.38	0.71	0.00	9.43	1.25	6.36
Falling material	9.23	6.79	22.22	9.52	9.29	42.31	18.87	6.25	8.79
Construction vehicles' accident	1.65	25.31	3.70	7.94	8.57	7.69	15.09	3.75	11.52
Traffic accidents	0.87	18.31	27.16	6.35	3.57	5.77	5.66	1.25	4.24
Partial collapse	4.57	0.41	0.00	0.79	3.57	0.00	0.00	66.25	5.76
Collapse of excavation area	2.34	1.85	1.23	32.14	6.43	1.92	7.55	1.25	0.91
Other types of accidents	18.57	24.07	27.16	17.46	41.43	17.31	26.42	5.00	30.61
Explosive material accidents	0.67	10.49	1.23	7.54	5.00	15.38	1.89	0.00	2.73
Material based accidents	3.78	6.17	8.64	5.16	5.71	0.00	3.77	1.25	2.12
Total	100	100	100	100	100	100	100	100	100

Zolkafli and others defined the risks experienced in construction works as controllable and uncontrollable. The controllable risks are insufficient planning, poorly designed work programme, mistakes on budget and time schedules, poor quality control, insufficient leadership, lack of management support, insufficient communication. There are weather conditions, budget and exchange waves, lack of experienced workers, technological changes, natural hazards, fires, strikes and wars can be caunted among uncontrollable risk factors [11].

Risks in historical structural/ restoration works

As *Deak et al.* explains conservation and restoration of heritage structures represent a topical issue and diagnosis of their pathology together with consolidation measures adaptation to establish a sound condition of a system is fundamental [12]. During the operational stage of restoration, risks arise differentiated from standard construction works. The first reason is that restoration works are applied on the areas where there is already an existing structure not like standard construction works. Since the existing structure has authentic value and this authenticity has to be preserved, the context and schedule of the work has to depend on different sensitivities. There are various studies and researches in world literature but the risk specially outlined in restoration field was not defined in a legal framework. *Florescu et al.* [13] focuses on preventive preservation in order to avoid decay and increase heritage structures' lifespan. Protect Heritage defined and listed the risks in their research with the title *"Cultural Property Risk Analysis Model"* and described these risks as agents which cause deterioration in general. Physical forces, fire, water, pests, contaminants, light and UV radiation, incorrect temperature, incorrect relative humidity, dissociation were defined as risk parameters. The study considered these agents as risk types. These risk types were classified as different processes like less than 1 event expected in next 100 years, a few incidents per century or per decade, a continual process or events repeated at least once per year [14].

It is not a comprehensive classification to accept restoration applications under construction works as we know these works have different characteristics considering the risks. This is why it is quite important to define the special risks special to restoration works. Heritage elements are undergone a serious of periods with major changes under imprint of time (age/patina, interventions to preserve-restore/falsify, deterioration and degradation effects) [15].

Fig. 2. The examples of masonry civil architectural structures in Fatih area: poor work cage (left) and people working without proper work precautions (right)

Zolkafli and others stated that there is uncertainty in restoration works considering budget, context and time schedule. The reason for this is due to the characteristics of historical works which are not standard and are special for each case. It may ease the work progress to make the classifications about the work defining if it is a rehabilitation, conservation or a renewal project or not [11].

Uzun et al. [16] tried to focus on the risks of conservation applications considering the work and occupational health in their research. The leading risks according to the research are the ones due to the deteriorations on the structure, falling from height, falling materials, dust, asbestos, lead and tin, chemical substances, fire and deteriorated organic contents and other biological reasons.

The risks due to the damage in the buildings, there are structural situations, workmanship, natural deterioration processes, natural hazards and wars [17]. Falling from height could be a special risk to be paid attention since there are monumental structures like aqueducts, bridges and city walls and these structures. The structures that need restoration are usually exposed to outer effects and deterioration because of the lack of maintenance and isolation. This is why risk factors like falling materials on roofs, canopies or damaged slabs could be observed apart from structural damages.

Orlenko et al. [18] underline that natural disasters- floods, hurricanes, earthquakes, landslides, fires, rains, rising groundwater and anthropogenic factors that are results of human activity are the main causes of destruction of architectural monuments in China in their work focusing on protective measures of monuments.

It is seriously dangerous to inhale the harmful chemicals such as asbestos or dust that are mixed through air during restoration interventions (the chemicals that are commonly used during cleaning procedures etc.) or to the original character of the historical structure itself. Chemical risk may occur in a situation such as fire of a structure like mosque or church since these kinds of monumental structures' roofs are usually covered with lead sheets which may dissolve in the air causing this risk. Fires also cause serious risk especially for the timber houses which are commonly used in our country as civil architectural examples. Timber material has another risk considering the long-term deterioration due to the insects, fungi or any kind of animals harming timber elements.

The main common problems of accidents in historical constructions are unsatisfactory condition of foundations, moistening of walls, ceilings and roof with a roof, hence the appearance of bio destroyers, cracks, chips and peeling [19]. Various different types of deteriorations and damages can be counted according to the different types of materials like cracks transferring through the facades, voids in the mortar due to the rain and temperature variations, loss of original elements and microbiological growth, loss in the colur and lustre on the glass pieces [20].

Fine Kinney Method

There are different kind of risk evaluation methods produced for different practices. These risk evaluations can be classified as quantitative and qualitative considering the general approach. The most common approaches are preliminary risk analysis-PRA, bow tie methodology, energy analysis, fine kinney method (mathematical risk evaluation method) and barrier diagram, job safety analysis, L type matrix method, cause- consequence analysis, preliminary hazard analysis [21]. Enhanced risk analysis tools provide improved information for pre-project decision and one of these kind of risk analysis method which is commonly used is Monte Carlo risk assessment [22].

It was first proposed by Kinney in 1971 and revised by Kinney and Wiruth again in 1976. The method relies on the calculation of three variables and a risk point is obtained. These three factors are probability (P), exposure (E) and severity (S); so: $R = P \times E \times S$ is obtained as a formula.

A risk value is obtained by multiplying the suitable value of probability given on Table 3 with frequency value in Table 4 and severity in Table 5. The result is compared with the values given on Table 6.

The regarding value of probability shown on Table 3, value of frequency shown on Table 4 and value of severity shown on Table 5 are multiplied and a risk value is obtained. The final value obtained gives the chance to define risk level (Table 6). The emergency level of risks is defined and the value of these risks help in deciding the precautions to take. For example, the risks that might be expected are calculated with the value 10 but if the risk is virtually impossible, the value is calculated as 0.1.

Table 3. Probability scale [23]

Probability (O)	Value
Might well be expected	10
Quite possible (%50-%50)	6
Unusual but possible	3
Only remotely possible	1
Conceivable but very unlikely	0.5
Practically impossible	0.2
Virtually impossible	0.1

The second variable in Fine-Kinney method is frequency. The values are shown on Table 4. How frequently the risk or a threat occurs is evaluated thanks to this table. For example, a tea pot in a kitchen in the workplace may cause a possible injury of someone because of boiling water or may cause a fire, this risk is calculated according to the daily usage of this tea pot. The usage resembles the highest score and risk. If it resembles a usage that is continuously, the value of frequency is 10.

The last variable to calculate risk level is Severity. The values of Severity are shown on Table 5. It helps to define the damage level if the potential risk occurs. The highest score reflects the situations where many fatalities may be observed. The minimum value reflects the situations where minor first aid may be needed.

Table 4. Frequency scale [23]

Frequency (F)	Value
Continuous	10
Frequent (daily)	6
Occasional (weekly)	3
Unusual (monthly)	2
Rare (a few per year)	1
Very rare (yearly)	0.5

Table 5. Severity scale scale [23]

Severity (S)	Value
Catastrophe (many fatalities)	100
Disaster (few fatalities)	40
Very serious (fatality)	15
Serious (serious injury)	7
Important (disability)	3
Noticeable (minor first aid accident)	1

Table 6. Risk scale scale [23]

Risk (R)	Value
Risk > 400	Very high risk; consider discontinuing operation
$200 \leq R \leq 400$	High risk; immediate correction required
$70 \leq R < 200$	Substantial risk; correction required
$20 \leq R < 70$	Possible risk; attention indicated
$R < 20$	Risk; perhaps acceptable

In this study, the possible risks that are likely to occur in historical structures' work sites were analysed by using Fine Kinney methods. The method was chosen since it enables an easier and a comprehensive evaluation considering the possible risks. Besides, the method is easy to interpret and to understand considering the results with the help of tables and figures.

Case study

Fatih area in Istanbul was chosen as case study for the research. The civil masonry examples are the highest in number around this region. Masonry structural system has been used for a long time in Ottoman architecture in civil examples. In this sense, it is quite important to conserve these unique examples due to their value as cultural heritages. Olgun defines the masonry structures as *"the solid structures made of the same material from foundation to the walls"* [24]. Most of these examples which reflect traditional and neighbourhood life of their period in Istanbul date back to the end of XIX century and the beginning of XX century. The conservation of this unique heritage was secured by the laws and regulations. But if the proper attention should not be paid during restoration applications, a reversible damage could be a case both for the structure itself and the workers. It is the leading goal of this research to draw attention to this issue since there is lack of researches considering the work health in restoration applications and the importance of these examples with their architectural values.

Fig. 3. Alman Mavileri Maps: Istanbul Historical Peninsula and Fatih area [25] https://sehirplanlama.ibb.istanbul/beyoglu-arsivi-haritalar/

Starting to construct the structures with masonry style at the end of XIX century and in the beginning of XX century is due to frequent fires of that period which caused serious damage on timber buildings. The masonry structures which mostly served as dwellings were typologically constructed with stone from foundation till the entrance level and old brick from this level up. The slabs were mostly made of timber. The slabs of the basements were sometimes made of iron jack arches.

Fig. 4. Fatih-Kumkapı area: deteriorated masonry row houses (listed civil architectural examples)

Fig. 5. Fatih-Kumkapı area: deteriorated masonry row houses (listed civil architectural examples)

There is severe deterioration due to the lack of maintenance and restoration works in the civil architectural examples around the region. These deteriorations carry dangers and risks with their current situations and with the future restoration processes. There should be special precautions with a full awareness against these risks and bigger difficulties comparing to standard construction works may arise because of the deteriorated materials and existing damages. Some of these are the difficulties in accessing the location of the working area since these kind of heritage structures are placed in old fabrics and the streets are very narrow in these kinds of neighbourhoods. There is a limitation since construction works are done in empty plots while there are already existing structures in restoration works' sites. Besides, historical structures' work scale mostly is smaller than standard construction works. This may cause some contractor companies to neglect some work and occupational health issues like construction of proper work cages.

Since the areas of already existing structures are mostly isolated for a long time, there are weak materials, broken or rotten slabs, structural elements that have the possibility to collapse such as stairs, roofs, canopies and even structural elements like walls. Falling off deteriorated material like stone and brick are the most possible risks to occur.

Results and discussion

The photographic analysis was applied on the case study area to be used in Fine Kinney method. The analysis chart is shown on Table 7. In this table, potential risks that were defined in the site and the descriptions were shown with photos. The level of these potential risks was evaluated and the ones who are potentially affected by these were defined. According to the Fine Kinney method probability, frequency and severity values were calculated for each case and listed on this table. Risk value was obtained by these variables. As a final note, the proposals for rehabilitation of these potential risks were offered and Table 8 was created.

The highest risk is about construction of work cage on the bearing walls which are already deteriorated and weak. They have a potential risk of collapse. This situation which may cause a lot of people to get seriously injured requires an emergency solution. There are two types of risks due to the weak and deteriorated floor, roof and slabs. One of these is falling off due to stepping on weak material and falling from height. The other threat is the possibility of material to fall itself and cause someone to get injured.

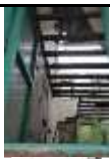
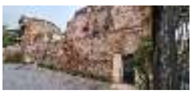
Another risk is due to the deterioration of the structure itself and deterioration of materials. Stone and brick materials' deterioration are high and there is a risk of breaking or crumbling of this material by wind. There is a high risk of possible injuries because of this situation. When the risk table was examined, it is obvious that there is high level of risk. Similar to this, structural materials lost their integrity and they are damaged. These elements have a potential risk of collapsing.

Other current risks are less dangerous if proper precautions are taken. Broken windows and similar materials and the unnecessary materials on the ground level may cause workers to fall and get injured. The pieces of mortar may crumble and break in big portions because of the exposure to outer conditions and deteriorations. These may cause possible injuries.

The least risk is observed due to the water pipes and similar material that are not original and not connected with the structure properly. These kinds of materials show a risk of falling causing possible injuries. These require emergent precautions but usually have easy solutions to take.

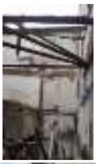
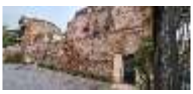
The top three risks in construction works according to the research of *E. Gürcanli and U. Müngen in 2013* [8] are falling off, electric shock and falling materials. Falling off is among important risks in historical structures. The study regarding civil architectural work sites around Fatih area showed that the highest risk is falling off from height due to the weak structural walls (risk level: 2400). This result supports the literature research. The results of the method were shown on Table 7. Standard construction works show that "partial collapse of structure" is a risk in the fifth level among all potential risks [8]. Since there is existing deterioration and lack of maintenance in historical structures' intervention, this situation bears a higher risk comparing to construction works. When the current risks are observed on Table 7 resembling the case study area, the collapse of floor slabs, deteriorated roof elements and rotten timber slabs and instable corbel constitute high level of risk. These situations can both cause people to fall from height resulting with serious injuries or life losses or can cause materials to fall leading people to get injured. The risk of partially collapse or falling materials in applications of historical constructions comparing to standard construction works is higher on the case study area. Historical constructions are different than construction works since there is already a structure existing in these kinds of works. As it is possible to see on Table 7, broken windows, rubbish that was collected on the ground, the mortar and brick/stone material that are potentially likely to collapse or fall cause risks. It is not likely to see these kinds of risks in standard construction works. The areas of already existing structures are mostly isolated for a long time, there are weak materials, broken or rotten slabs, structural elements that have the possibility to collapse such as stairs, roofs, canopies and even structural elements like walls. Falling off deteriorated material like stone and brick are the most possible risks to occur.

Table 7. Risk analysis of masonry row houses site works around Fatih area (Fine Kinney method)

NO.	PICTURE	DESCRIPTION OF THE RISK	RISK OF THREAT	EFFECTED PEOPLE	PROBA-BILITY	FRE-QUENCY	SEVERITY	RISK LEVEL
01		Timber slab (Falling off risk)	Risk serious injury/ life losses due to deteriorated timber material or slab, the risk of falling off	All workers	6	10	15	900
02		Material deterioration (Falling off risk)	Falling off weak elements due to deterioration causing risk of injuries	All workers	6	10	15	900
03		Rubbish material on the ground	Slipping, falling or cutting by the rubbish material left on the ground level	All workers	10	10	1	100
04		Weak material on the ground level (falling off risk)	Falling off risk due to the deteriorated material on the ground	All workers	6	10	15	900
05		Weak structural wall (Material collapse/ falling off risk)	Instabilised structural wall- injuries due to collapsed stone/brick material	All workers	6	10	7	420
06		Deteriorated/ broken material (glass, window etc.) risk of injury	Risk of injury due to the broken glass	All workers	6	10	3	180
07		Risk of building of construction cage due to weak structural walls	Rrisk of collapsing of construction cage, falling off from height	All workers	6	10	40	2400
08		Collapse/falling off non original material	Risk of injury due to the falling material	All workers/people	6	10	1	60
09		Falling/peeling off mortar or thick paint	Risk of light injuries due to the crumbling structural materials	All workers	6	10	3	180
10		Not stabilised timber corbel (risk of falling off)	Risk of serious injury or life losses due to the weak corbel	All workers	6	10	7	480

The data of Table 7 was used to create Table 8 which consists of rehabilitation proposals. Basic proposals were offered with the aim of removing of situations that create risks. Pinning of the loose materials that have the risk of falling, securing the walls with a net or similar material to avoid any structural elements to break and fall, cleaning the unrelated and rubbish material from the working site are examples of rehabilitation proposals. These proposals are basic but effective.

Table 8. Rehabilitation proposals of the risks defined on **Table 7**

NO.	PICTURE	REHABILITATION PROPOSALS	NUMBER	PICTURE	REHABILITATION PROPOSALS
01		The weak elements with a risk to fall/crumble or collapse should be taken out	06		Broken materials like windows should be cleaned and sent from work site
02		The weak elements with a risk to fall/crumble or collapse should be taken out	07		Steel work cage should be established with extra precautions to avoid collapse of the weak bearing walls
03		The rubbish, vegetation and such materials should be cleaned or carried away from work site	08		Unnecessary and not authentic elements should be eliminated from the structure
04		The elements that are not going to be used or weak should be taken out	09		A net should be applied on the wall against the possible crumbles from mortar and small pieces of stone/brick elements
05		A net should be applied on the wall against the possible falling material like stone/ brick	10		The timber corbel should be strengthened against the risk of falling

Conclusions

In this study, a risk evaluation was applied on the work site of civil architectural case study area in Fatih district using Fine Kinney method. The main aim is to draw attention to how the risks of historical construction work sites differ from the standard construction works. The data obtained were documented with photos taken on the site work. According to the analysis, differences regarding the potential risks between the work areas of historical structures and standard constructions were defined.

A summarized list of risks from the highest to the least one are as follows:

- the difficulty of construction the work cage due to the weak structural elements and related to this, the risk of falling from height occurs. (risk level: 2400);
- the risk due to the weak and severely deteriorated material causing possible injuries or life losses on the condition of stepping on (risk level: 900);

- stone/ brick walls that are structurally weak create risk of materials to fall or break (risk level: 420);
- risk of falling or breaking of old material like broken window, risk of crumbling/ falling of deteriorated mortar (risk level: 180);
- risk of stepping on and getting injured due to the rubbish on the ground (vegetation or unnecessary material) (risk level: 100);
- risk of getting injured by unpinned materials such as water pipes (deteriorated and not authentic material added as later additions) (risk level: 60).

Working on an already existing building in restoration field can cause extra risks comparing to standard construction works. This is usually the main reason why restoration works have more risks. The research showed that there may occur serious risks for workers if proper precautions are not taken. Because the components of historical structures are usually exposed to deteriorations for a long time. For example, working on construction cage in a standard construction site usually is dangerous due to the height of the building. But it is the risk of the structure itself because of the weak structural components in restoration applications. Similar to this, it constitutes a higher risk for the deteriorated materials to fall, break or crumble causing possible injuries or life losses comparing to standard construction works. These kind of situations require special precautions on restoration work sites.

This study shows that risk factors and levels differ between restoration applications and standard construction works. Differences will occur when an existing structure is undergone a restoration work and even the level of deterioration, the scale and type of the structure (whether it is a monumental or a civil architectural building) would have the impact on level and types of the potential risks. So all structures have to be evaluated on its own conditions and suitable risk method should be chosen. Before a restoration work started, the most suitable risk evaluation method should be detected and applied in order to define the potential risks.

Proper precautions are advised to be taken before the work has even started in order to establish work and occupational health conditions in a best environment.

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