Çukurova Üniversitesi Mühendislik Fakültesi Dergisi, 37(2), ss. 329-340, Haziran 2022
Cukurova University Journal of the Faculty of Engineering, 37(2), pp. 329-340, June 2022

Risk Assessment of Construction Works in City Square Using Fine Kinney Method

Selman ASLAN[*1] ORCID *0000-0002-6766-7315*

[1]*Muş Alparslan University, Department of Transportation Services, Muş*

Geliş tarihi: 15.02.2022 Kabul tarihi: 30.06.2022

Atıf şekli/ How to cite: ASLAN, S., (2022). Risk Assessment of Construction Works in City Square Using Fine Kinney Method. Çukurova Üniversitesi, Mühendislik Fakültesi Dergisi, 37(2), 329-340.

Abstract

Our country, as in other developing countries, tries to minimize work accidents by taking adequate and appropriate measures. It is necessary to adopt and implement occupational health and safety in all work areas, regardless of small or large size. In this context, risk assessments regarding occupational health and safety are vital. Various work accidents may occur in areas such as city squares where human density is high. This study includes the result of an exemplary study by emphasizing the importance of risk assessment in construction works that carried out in areas where people and vehicles are dense, such as busy streets, squares, or boulevards in cities. The results were obtained using Fine Kinney Risk Assessment Method. It was shown that the construction-related risks are vital and have a significant impact on the people not only construction workers but also who have to pass through the construction site.

Keywords: Construction sector, Fine Kinney risk assessment method, Occupational health and safety

Kent Meydanlarında Yapılan İnşaat Çalışmalarının Fine Kineey Yöntemiyle Risk Değerlendirmesi

Öz

Ülkemiz de diğer gelişmekte olan ülkelerde olduğu gibi iş kazaları yeterli ve uygun önlemler alınarak en aza indirilmeye çalışılmaktadır. İş güvenliğini küçük büyük demeden bütün çalışma alanlarında benimsemek ve uygulamak gerekmektedir. Bu kapsamda iş güvenliği ile ilgili yapılacak risk değerlendirmeleri de önem arz etmektedir. İnsan yoğunluğunun fazla olduğu kent meydanları gibi alanlarda çeşitli iş kazaları meydana gelebilmektedir. Bu çalışma, kentlerdeki işlek sokak, meydan veya bulvar gibi insan ve araç bakımından yoğun olan bölgelerde yapılan inşaat işlerinde risk değerlendirmesi yapılmasının önemine değinerek örnek bir çalışmanın sonucunu içermektedir. Sonuçlar Fine Kinney Risk Değerlendirme Yöntemi kullanılarak elde edilmiştir. İnşaatla ilgili risklerin hayati önem taşıdığı ve sadece inşaat işçilerini değil, inşaat sahasından geçmek zorunda olan insanları da önemli ölçüde etkilediği görülmüştür.

Anahtar Kelimeler: İnşaat sektörü, Fine Kinney risk değerlendirme yöntemi, İş sağlığı ve güvenliği

[*]Corresponding author (Sorumlu yazar): Selman ASLAN, *se.aslan@alparslan.edu.tr*

1. INTRODUCTION

With the rapidly increasing construction, one of the most important problems of the construction in the city squares is that the construction activities affect life negatively [1]. Depending on the innovations, the change in the production process and the increase in the work volume may cause negative consequences such as work accidents and occupational diseases [2]. Activities in the construction sector are provided by different working teams. It can be in the form of other materials or different manufacturing for each activity. Therefore, the whole process needs to be well coordinated. In this respect, there may be problems in the healthy execution of the activities in the construction that are not well organized, and work accidents are inevitable. In a poorly managed construction site, the working environment is usually not regular due to the fact that each team focuses on their own work and the use of different equipment and materials, and the confusion of this environment causes work accidents [3]. When such construction sites are in places where there is a high density of people, such as the city square, it is even more difficult to provide the construction site organization. An important problem in such construction sites in the city is whether or not appropriate work security is taken. It is important to consider adequate occupational health and safety, especially in construction sites that have activities during working hours and are located in city squares. The occupational health and safety to be taken here will not be enough to cover only the workers at the construction sites, it should also be considered for the citizen passing by the construction site for any reason. During some construction activities taking place in the city squares, the construction site environment is not closed adequately and appropriately. Therefore, various work accidents occur. For example, 43810 of the 286068 work accidents that occurred in 2016 were the fall of people due to slipping or stumbling [4]. This type of work accident can also happen in such construction sites.

There are various regulations on a city or national basis regarding how the construction sites in the city squares should be. For example, one of them is the city construction site regulation and some of the measures to be taken in terms of occupational health and safety in this regulation are as follows [5]:

- The perimeter of the construction site security area will be surrounded by prefabricated elements or aluminium sheet metal with a height of 2,00 m and the ground connections of this enclosure will be made in a way that does not create a security weakness.
- To ensure vehicle safety in both long-term and short-term-mobilized construction sites, places, and points that pose a safety risk will be determined in the active work area of the construction site, and high-strength barriers by the standards will be placed at these places as protective-separators.
- In the construction site security area, like a pit, rubble pile, etc.; in the presence of situations that pose a safety threat to people (especially the disabled, children, and the elderly); long-term construction sites will be surrounded by containment elements (sheet metal, prefabricated elements, concrete barriers, etc.) fixed to the ground in a way to ensure safe pedestrian access for 24 hours. During the daytime, the dangerous areas will be protected by at least two construction site security personnel in a way to ensure passage order and control, depending on the pedestrian density and the degree of security threat.

As mentioned above, it is necessary to take additional measures about occupational health and safety in places with a high density of people such as city squares. It is important how much the above-mentioned substances are applied in such areas. By applying these substances, work accidents can be minimized at construction sites. Otherwise, these accidents are inevitable. These various regulations can be grouped as city-based, national-based, or international. The critical point is whether to comply with these regulations. If these precautions are taken while the construction sites are being created, the occurrence of work accidents will be reduced. In developed countries, such regulations are strictly enforced and success is achieved in terms of occupational health and

safety. For example, in the Construction and Repair Regulations published by the Chicago Department of Transportation in Chicago, USA, has published a comprehensive guide for conducting construction and restoration works on public roads [6]. Within the scope of this article, a risk assessment was made in terms of occupational health and safety at a construction site located in one of the busiest squares of Adana. It is the project of covering the construction site underpass. The risks observed within the scope of the risk assessment were recorded at certain times and the Fine Kinney Risk Assessment method was applied.

2. MATERIAL AND METHOD

The risk assessment determines the risks that may arise from the hazards and gives an idea at what level the risk is in terms of probability of occurrence, frequency of occurrence, and severity. As a result of the risk assessment, the employer and other stakeholders related to occupational health and safety take the necessary precautions. While risk management is the process of using logical and systematic methods applied to share information and consult about risks. On the other hand, risk identification is the process of identifying risk elements, preparing a report, and defining each risk element [7]. According to the 6331 Occupational Health and Safety Law, risk assessment refers to the studies that must be carried out to determine the existing or external hazards in the workplace, the factors that cause these hazards to turn into risks, and the analysis and grading of the risks that can arise from the hazards, and to decide on control measures [8]. There are three primary purposes of risk assessment in terms of occupational health and safety [9];

- Protecting employees,
- Ensuring production safety,
- Ensuring business security.

As mentioned above, occupational health and safety is important not only for employee health but also for business and production safety. With a well-made risk assessment, while a safer environment is prepared for employees in terms of occupational health and safety, it will also be beneficial for the business. While taking measures in terms of occupational health and safety, it is not sufficient to take measures to protect employees only. It is necessary to take precautions for everyone around the construction site or who has contact with the construction site in some way. Therefore, the risk assessment is comprehensive for everyone affected by the construction site. This study focused more on the risk assessment of people indirectly affected by the construction site. Work accidents will be less with the measures to be taken as a result of the risk assessment to be made in this context.

There are various risk assessment methods regarding occupational health and safety, both qualitative and quantitative. Preliminary Hazard Analysis, Fine Kinney Method Failure Mode and Effects Analysis, Fault Tree Analysis, Event Tree Analysis, L Type Matrix, X Type Matrix, Root Cause Analysis are some of them. In this study, the Fine Kinney Risk Assessment method is applied. The Fine Kinney Risk Assessment method was developed by Fine in 1971 under the name of "Mathematical Assessment for Hazard Control" [10]. The method was first used as the Kinney method in 1976 by G.F. Kinney and A.D. It was presented in a technical document by Wiruth [11]. In the first document prepared by Fine, the evaluation criteria of the method and how the mathematical model will be applied are given in detail [10]. On the other hand, Kinney transformed the application of the method from a mathematical approach to a graphical form [11]. The method is known as the Fine-Kinney method in the literature. The basic idea behind the Fine-Kinney method [11]:

- Many of the dangers in our lives are not completely preventable and it is not possible to eliminate all risks against dangers.
- With careful thought and effort, most of the risks in daily life can be reduced to an acceptable level.
- Limited resources of time and effort should be used to reduce risk and provide maximum benefit, rather than completely eliminating risks.

From this basic idea, there will always be risks in life. We aim is to reduce the risks to a level that will affect our lives less, instead of eliminating the risks. The Fine-Kinney method is widely used for professional risk assessment. The approach in this method is based on the sensitivity of the potential hazards in the work area to the employee and the result that will occur on the employee if the threat occurs [7]. The Fine-Kinney Method is widely used in the construction and cement industry, and it is stated to be one of the simple methods applicable to small and medium-sized businesses [12]. There are three variables in mathematically determining the Risk Value in the Fine-Kinney method. The risk value is obtained by multiplying these three variables. These;

- Possibility
- Frequency (Frequency of exposure to danger)
- Severity
- Risk Value = Probability x Frequency x Severity

Necessary actions are also taken according to the risk value obtained. Necessary measures should be taken immediately according to the resulting risk value. The scales of Probability, Frequency, and Severity variables are shown in the tables below (Table 1, Table 2, Table 3). The frequency value is the exposure time of the worker to the situation. The value of severity is the damage that the employee will suffer in the face of this event. The frequency value will be effective in the score to be taken for probability.

Table 1. Probability scale [11]

Probability value	**Probability of hazard occurrence**
0.1	Almost impossible
0.2	Practically impossible
0.5	Bare chance
1	Very unlikely
3	Rare but possible
6	Most likely
10	Very strong possibility

Table 2. Frequency scale [11]

Frequency value	**Description**	**Hazard occurrence frequency**
0.5	very rare	Once a year or less
1	quite rare	Once or several times a year
2	Rare	Once or several times a month
3	Sometimes	Once or several times a week
6	Often	once or several times a day
10	Continuous	Continuous or multiple times per hour

Table 3. Severity scale [11]

Severity value	**Description**	**Harm of hazard**
1	Should be considered	Mild, harmless or unimportant
3	Important	Low job loss, minor damage, first aid
7	Serious	Significant damage, external treatment, loss of working days
15	Very serious	Disability, loss of limb, environmental impact
40	Too bad	Death, total disability, severe environmental impact
100	Disaster	Multiple deaths, major environmental disaster

The risk value is obtained by multiplying the probability, frequency, and severity values. As seen in Table 4, decisions are made according to 5 different risk value ranges. It is also shown with different coloring for each range. For example, if the risk value is over 400, this is a very high risk and the relevant work should be stopped and the risk should be reduced to an acceptable level.

Table 4. Risk value [11]

Risk value	Decision	Action
R>400	Very high risk (Stop)	Work should not be started until the identified risk has been reduced to an acceptable level.
200<R≤400	High risk	It should be decided to continue the activity by taking urgent measures for these risks.
70<R≤200	Significant risk (Moderate)	Actions should be initiated immediately to reduce the identified risks.
20<R≤70	Possible risk (Low)	Existing controls should be maintained and it should be audited that these controls are maintained.
R≤20	Acceptable risk (Insignificant)	Additional control processes may not be needed to eliminate identified risks.

The advantages and limitations of the Fine-Kinney method are shown in Table 5 below. The most important advantage is that it is simple to use. The most important shortcoming of the Fine-Kinney method is that it does not consider occupational diseases. However, the result of some events is in the form of an occupational disease [13]. If the Fine-Kinney process is performed by a single person, it may be insufficient because it presents only one person's unique perspective. Therefore, a multidisciplinary team is needed [14].

Table 5. Advantages and limitations of the Fine-Kinney method [14]

Advantages	Limitations
Numerical	Random data
Simple to use	Costly
Risk ranking	No guarantees in risk identification
Effectiveness of the measures	It is a subjective method
Allows evaluation	No council can be made for different risk scores
Risk acceptability assessment	Hazard confusion: probability, frequency and severity not clearly defined.
If necessary, measures are taken.	False sense of security
Education, information, reflection	Lack of precision: how to interpret score differences?
	Applicable only for certain risks.

Fine-Kinney method has been used by many studies. Some of these studies are briefly mentioned below. In this study, there will be a different area where the Fine-Kinney method is applied.

- A New Approximation for Risk Assessment Using the AHP and Fine Kinney Methodologies [15]

In this study, a risk assessment study was conducted in a large manufacturing company where hazards were determined based on experience, and the statistical records of the last 10 years were categorized and each category was prioritized using the AHP method. The hazards identified in the field were evaluated with the Fine-Kinney method.

- Comparative Analysis of Methods for Risk Assessment - “Kinney” And “Auva” [16]

KINNEY and AUVA methods were used to assess risk in workplace safety, environmental safety and fire protection, and a comparative analysis was made to indicate possible advantages or disadvantages of the selected methods.

- Indicators in Risk Management [7]

It gives an example of the Risk Indicators Method, which gives more objective results for risk assessment. The authors recommend the Risk Indicators Method based on the Fine-Kinney method.

- A New Approach to Fine Kinney Method and an Implementation Study [12]

In this study, new approaches were introduced to the classical Fine-Kinney method (Linear interpolation and square interpolation). New risk scores were obtained by increasing the sensitivity of the probability and frequency scales in the classical Fine-Kinney.

- Kinney-type Methods": Useful or Harmful Tools in the Risk Assessment and Management Process [14]

The neglected points in the Fine-Kinney method and the possible threats that may be encountered in the application of the method are mentioned. The main objective of this article is whether such methods can meet the current requirements for risk quantification in terms of risk ranking and assessment of anticipated prevention actions.

- Occupational Health and Safety in Industrial Enterprises Producing Workshop Type [17]

In this study, analysis of hazards, risk assessment, determination of regulatory activities and surveillance steps are mentioned. During the implementation phase, four different risk assessment methods (Fine Kinney Risk Assessment Method, FMEA Risk Assessment Method, 5x5 L Type Matrix Risk Assessment Method and 3T Risk Assessment Method) were compared.

- 3T and Fine-Kinney Risk Analysis Methods in Occupational Health and Safety and Its Application in a Metal Industry Business [13]

In this study, an application study was conducted on both correct scoring and comparing the methods by considering the 3T risk analysis method and the Fine-Kinney method.

- Risk Analysis Application in the Metal Industry [18]

In this study, Fine Kinney Risk Assessment was applied for the steel mill and rolling mill divisions of an iron and steel business (376 risks). The information and observations received from the employees were taken into account in the risk assessment.

- Risk Management in Occupational Health and Safety with Fine-Kinney Method: The Example of a Marble Factory [19]

In this study, hazards and risks were determined in the marble business. The identified risks were analyzed using the Fine-Kinney method and the measures to be taken to prevent these risks from occurring are listed. After the measures were taken, the working conditions in the enterprise were tried to be improved.

- Risk Assessment within the Scope of Occupational Health and Safety Management System: "An Application in the Health Sector" [20]

In this study, a risk assessment was performed using the Fine Kinney Method in the medical pathology laboratory of a private hospital. The risks identified in the laboratory, the measures were taken against these risks and the precautions to be taken are given in detail in the risk assessment report.

3. RESULTS

Hazards were determined by making observations in the area where the construction site works were carried out at different times. The probability, frequency, and severity values of the risks related to these hazards were determined by consulting expert opinions. Then, the risk scores included in the Fine Kinney Risk Assessment were obtained. Pictures of the study area are given in Appendix 1. As a result of the observations obtained, 47 risks were determined to conduct the Fine Kinney Risk Assessment. Table 6 provides information on 47 risks. Out of 47 risks observed as a result of the Fine Kinney Risk Assessment, 9 are very high risk (stop), 6 are high risk, 15 are significant risk (moderate), 14 are possible risk (low), and 3 are acceptable risk (non-significant) was determined.

Each risk value range is also shown with a different color.

One of the very high risks is not closing the gaps in the construction site or not closing them properly. Due to these reasons, work accidents due to falling may occur. Exposure to this risk occurs at more than one point of the construction site. This risk is more likely to occur, especially at night, due to the lack of sufficient lighting. Due to the lack of suitable, adequate signs and safe roads for people who want to pass through the construction site, people try to pass from any part of the construction site. In this case, work accidents due to falling will occur. Entering the construction site by unauthorized persons is also determined as a very high risk. In such construction sites, which are dense in terms of human intensity, it is very important to close the construction site appropriately and adequately. In the construction sites that are closed appropriately, people will not have to pass everywhere according to their heads. Incomplete use of warning and danger signs has also been identified as a very high risk. People may be exposed to various work accidents without these signs about occupational health and safety. The high risks mentioned above are the risks that come to the fore in such construction sites. Those who are exposed to these risks are both construction site workers and people who have to pass there somehow. In this context, these risks gain importance.

Traffic accidents may occur and vehicles may be damaged in some way due to working on the vehicle road without taking the necessary traffic precautions. If the construction site is not closed properly, it may cause damage to the surrounding workplaces and the environment. The scattered stacking of the material on the construction site causes all kinds of accidents on the construction site. The inability to distinguish between employees and third parties, the absence of an employee responsible for the safety of the construction site (security guard or watchman), and the lack of communication due to the complexity of the construction site can also be the cause of work accidents. Psychosocial factors may occur due to the exposure of third parties who work near the construction site or who have to pass through the construction site.

The last 3 risks, which are also shown in green in the Fine Kinney Risk Assessment Table (insufficient ergonomic conditions of the operator's cabin, theft of material, periodic maintenance of Construction Machinery) are the lowest risks in terms of risk values. These are interpreted as acceptable or insignificant risks. No action is required for these risks.

Table 6. Fine Kinney Risk Assessment (sorted by risk value)

No	Hazards	Risk	P	F	S	R.V
1	Lack of first aid supplies	Failure to do first aid	6	10	40	2400
2	Improper enclosure of the generator	Fire	1	10	100	1000
3	Employees not receiving training on OHS	Accidents due to lack of information	3	6	40	720
4	Leaving the generator cover open	Fire	3	2	100	600
5	Not closing the gaps in the construction site	Fall-related accidents	6	6	15	540
6	Improper sealing of gaps within the construction site	Fall-related accidents	6	6	15	540
7	Material or object falling into the underpass	Traffic accident	0.5	10	100	500
8	Unauthorized persons entering the construction site	tripping, falling object	3	10	15	450
9	Incomplete use of warning and danger signs	All kinds of accidents due to ignorance of the hazards	6	10	7	420

10	Inappropriate behavior of the operator (talking on the phone on the job, etc.)	Any accident due to operator distraction	3	3	40	360
11	Working in poor lighting conditions (placement of precast beams overnight)	Falling, penetrating sharps, overturning of construction machinery, hitting people and/or objects	3	3	40	360
12	Working on the vehicle road without taking traffic precautions	Traffic accident	0.5	6	100	300
13	Employees not wearing helmets	Fall-related injuries	3	6	15	270
14	Use of warning and danger signs in the wrong place	Any accident caused by misdirection	3	10	7	210
15	Failure to properly secure warning and danger signs	All kinds of accidents as a result of the plates falling over	3	10	7	210
16	Failure to place marking plates for pedestrian and vehicle traffic	Traffic accidents, crashing into people and vehicles	0.5	10	40	200
17	Disorganized stacking of material at the construction site	Waste of material, loss of time, slowdown of work	6	10	3	180
18	Inability to distinguish between employees and third parties	Distinction between authorized and unauthorized, turmoil	6	10	3	180
19	Employees not working in a suitable construction site environment	Slowing down of work, loss of time, material damage	6	10	3	180
20	Employees not wearing work shoes	Penetrating, cutting object, crushing	3	3	15	135
21	Employees not wearing work gloves	Penetrating, cutting object and friction injuries	3	3	15	135
22	Due to the openness of the construction site, workers and third parties are affected by dust.	Health deterioration due to dust in the eyes and inhalation of dust	3	6	7	126
23	3rd parties tripping over dilatation joints and building materials	Fall-related accidents	3	6	7	126
24	Failure to provide appropriate and understandable communication with the pointer	Any kind of accident due to the lack of direction of the operator	0.5	6	40	120
25	Not using PPE during transportation of precast beams	Falling from high	1	3	40	120
26	Lack of communication due to the complexity of the construction site	Loss of time, decrease in efficiency	6	6	3	108
27	Failure to remove the rubble at the construction site on time	Narrowing of the working area, slowing down of work, visual pollution	6	6	3	108
28	Working on the pedestrian road without taking the necessary traffic precautions	Traffic accident	1	6	15	90
29	Setting up the site office in the wrong place	Accidents due to reduced control over the construction site	3	10	3	90
30	Lack of an employee responsible for the safety of the construction site	Material theft, unauthorized persons entering the construction site	3	10	3	90

31	Employees not wearing work clothes	Cleaning	3	3	7	63
32	Failure to carry loads suitable for the capacity of the mobile crane	Any accident due to material drop	0.2	3	100	60
33	Incorrect handling and placement of precast beams	Waste of construction element, loss of time, material damage	0.2	3	100	60
34	Unbalanced loading	Overturning the vehicle, tipping the load	0.5	3	40	60
35	Emergency assembly location not specified	Chaos	3	0.5	40	60
36	Psychosocial factors of third parties due to noise	Noise-induced attention loss and stress etc.	3	6	3	54
37	Not closing the underpass to traffic during the transportation of precast beams	Traffic accident	0.1	3	100	30
38	Not closing the underpass to traffic during night work	Traffic accident	0.1	3	100	30
39	Damage to third party vehicles	Scratches of vehicles, damage to tires	3	3	3	27
40	Damage to third parties' workplaces and the environment	Dust, mud, stone splashes	3	3	3	27
41	Use of construction machinery by unauthorized and unqualified persons	All kinds of accidents due to lack of professional competence	0.2	3	40	24
42	Failure of the reversing lamp and siren	Bumping into people and/or objects	0.5	3	15	22.5
43	Vehicle headlights not working	Traffic accident	0.5	3	15	22.5
44	Manual lifting and transport	Getting musculoskeletal diseases	0.5	6	7	21
45	Inadequacy in ergonomic conditions of the operator's cabin	Any accident due to operator distraction	0.2	3	15	9
46	Theft of material	Business slowdown, material damage	3	0.5	3	4.5
47	Periodic maintenance of Construction Machinery	Accidents caused by technical problems (Fire, Overturning)	0.2	3	7	4.2

P: Possibility, F: Frequency, S: Severity, R.V: Risk Value

4. CONCLUSION

As in the whole world and also in our country, studies on occupational health and safety are increasing. As a result, work accidents decrease and improvements in occupational health and safety occur. However, the point reached is not yet at the desired level. In some sector-based or activity-based areas, adequate work security is not taken. Adopting occupational health and safety should be in every field and at all times. Thus, a culture of safety will be formed at the social level. As seen in this study, adequate and appropriate measures are not considered in places where people are dense such as city squares. Work accidents also occur at construction sites in such places. With the risk assessment to be made in this context, it is envisaged to identify the hazards, to identify and rank the risks, and to minimize the accidents that may occur as a result.

In this study, a risk assessment is carried out at the construction site located in a city square with a high density of people. It is more appropriate to carry out a Fine Kinney Risk Assessment in such construction sites, both because there are people who are indirectly affected and because there is a high density of people. Because, in such construction sites, it is important to take into account the frequency value while calculating the

risk value. Risks were determined by observing the construction site on different days. Within the scope of Fine Kinney Risk Assessment, 47 risks were obtained. Some of the 47 risks revealed by risk assessment are similar to the risks that arise in different types of construction sites. However, within the scope of this study, it is aimed to highlight the risks that are affected by people who do not belong to the construction site but have to move to the construction site. In this context, the affected people may not have received occupational health and safety training within the scope of the construction site, may not have occupational health and safety awareness, or may not have any knowledge of occupational health and safety. These people may not know how to behave in dangerous situations in terms of occupational health and safety. For this reason, the occupational health and safety to be taken in such construction sites should be handled more carefully and in a broader framework, considering such people as well. It will also be important that the inspections are carried out very strictly by both the relevant official institutions and the employer's occupational health and safety unit. In this context, it will be important to consider the following measures within the scope of occupational health and safety:

- The construction site area should be surrounded by barriers, security or guard should be appointed to protect the construction site and prevent unauthorized people from entering the construction site, areas should be created for pedestrians to walk safely outside the construction site.
- Traffic should be directed with traffic signboards, barriers should be placed between the construction site and other active roads.
- Warning and danger signs should be placed completely and constantly checked for both employees and anyone who may have to pass through the roads specified on the construction site.
- Before starting work, all hazards and risks should be explained to the employees in their training on occupational health and safety, it should be specifically stated that people outside the construction site may also be affected in such construction sites, the employees should be constantly observed, and the employees should be informed about any changes in the construction site.
- Which materials will be stacked where should be specified in the construction site layout plan, materials should be stacked in a way that does not cause waste, and rubble should be removed from the construction site without accumulating.
- Gaps within the construction site should be properly closed, necessary lighting should be provided.
- The construction site office should be planned in a way that dominates the entire construction site area.
- Continuous effective supervision should be provided

There are also different methods of risk assessment. In future studies, comparisons between methods can be made by applying different risk assessment methods for such construction sites. In addition, for such construction sites, the relevant official institutions may prepare a guide within the scope of the above-mentioned measures and express that employers should implement them. Since observations are not made at the construction site every day, different risks that may arise are not included in this study. Risks related to occupational disease risk, biological and chemical hazards are not included in the risk assessment.

5. REFERENCES

1. Beşiktepe, D., 2007. İnşaat Sektöründe Şantiye Gürültüsünün Değerlendirilmesi: Bir Konut Şantiyesi Örneği. Yüksek Lisans Tezi, İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul, 113.

2. Akcay, C., Aslan, S., Sayin, B., Manisalı, E., 2018. Estimating OHS Costs of Building Construction Projects Based on Mathematical Methods. Safety Science, 109, 361-367.

3. Çalışma ve Sosyal Güvenlik Bakanlığı, 2018. Kanal Kazısı Çalışmalarında İş Sağlığı ve Güvenliği Rehberi. İş Sağlığı ve Güvenliği Genel Müdürlüğü İş Sağlığı ve Güvenliği Araştırma ve Geliştirme Enstitüsü Başkanlığı. https://www.csgb.gov.tr/medias/12262/kanalkazicalismaisgreh.pdf. Erişim Tarihi: 14.03.2022, Ankara.

4. Kalkınma Bakanlığı, 2018. İş Sağlığı Güvenliği Çalışma Grubu Raporu. https://www.sbb.gov.tr/wp-content/uploads/2020/04/IsSagligiGuvenligiCalismaGrubuRaporu.pdf. Erişim Tarihi: 14.03.2022, Ankara.

5. Malatya Belediyesi, 2011. Urban Construction Site Regulation. https://www.malatya.bel.tr/yonetmelikler/. Erişim Tarihi: 14.03.2022, Malatya.

6. Chicago Department of Transportation, 2019. Chicago Public Way Construction Regulations. https://www.chicago.gov/content/dam/city/depts/cdot/Construction%20Guidelines/2019/2019_CDOT_Rules_and_Regs_101819.pdf. Erişim Tarihi: 14.03.2022, Chicago.

7. Berezutskyi, V., Berezutskaya, N., 2015. Indicators in Risk Management. Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego, Rozdzıał 9, 108-116.

8. İş Sağlığı ve Güvenliği Kanunu, 2012. T.C. Resmi Gazete, Kanun Numarası: 6331, Sayı: 28339, Tarih: 30.06.2012. Erişim Adresi: https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6331&MevzuatTur=1&MevzuatTertip=5 Erişim Tarihi: 14.03.2022, Ankara.

9. Mum M., 2015. İstanbul'da Yaya Üst Geçitlerinin Güvenliği ve Kaza Risk Analizi. Yüksek Lisans Tezi, Bahçeşehir Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul, 115.

10. Fine, W.T., 1971. Mathematical Evaluations for Controlling Hazards. Naval Ordance Lab White Oak. Maryland, 34.

11. Kinney, G.F., Wiruth, A.D., 1976. Practical Risk Analysis for Safety Management. Naval Weapons Center China Lake CA, USA, 25.

12. Oturakçı, M., Dağsuyu, C., Kokangül, A., 2015. A New Approach to Fine Kinney Method and an Implementation Study. Alphanumeric Journal, 3(2), 83-92.

13. Köşek Özler, M., 2016. İş Sağlığı ve Güvenliğinde 3T ve Fine-Kinney Risk Analizi Yöntemleri ve Metal Sektöründeki Bir İşletmede Uygulanması. Yüksek Lisans Tezi, Kırıkkale Üniversitesi, Fen Bilimleri Enstitüsü, Kırıkkale, 125.

14. Babut, G.B., Moraru, R., Cioca, L., 2011. Kinney-Type Methods: Useful or Harmful Tools in the Risk Assessment and Management Process. In International Conference on Manufacturing Science and Education, Romania, 1-5.

15. Kokangül, A., Polat, U., Dağsuyu, C., 2017. A New Approximation for Risk Assessment Using the AHP and Fine Kinney Methodologies. Safety Science, 91, 24-32.

16. Stankovic, M., Stankovic, V., 2013. Comparative Analysis of Methods for Risk Assessment-Kinney and Auva. Safety Engineering, 3(3), 129-136. Doi: 10.7562/SE2013.3.03.04.

17. Çakmak, E., 2014. Atölye Tipi Üretim Yapan Sanayi İşletmelerinde İş Sağlığı ve Güvenliği. Çalışma ve Sosyal Güvenlik Eğitim Uzmanlığı Tezi, Çalışma ve Sosyal Güvenlik Bakanlığı, Ankara, 265.

18. Özgür, M., 2013. Metal Sektöründe Risk Analizi Uygulaması. Çalışma ve Sosyal Güvenlik Bakanlığı İş Teftiş Kurulu Başkanlığı, İş Müfettişi Yardımcılığı Etüdü, Çalışma ve Sosyal Güvenlik Bakanlığı, Ankara, 116.

19. Özçelik, A., 2013. İş Sağlığı ve Güvenliğinde Fine-Kinney Yöntemiyle Risk Yönetimi: Mermer İşletmesi Örneği. Yüksek Lisans Tezi, Eskişehir Osmangazi Üniversitesi, Fen Bilimleri Enstitüsü, Eskişehir, 98.

20. Kılcı, S., 2015. İş Sağlığı ve Güvenliği Yönetim Sistemi Kapsamında Risk Değerlendirmesi: "Sağlık Sektöründe Bir Uygulama". Yüksek Lisans Tezi, Gediz Üniversitesi, Fen Bilimleri Enstitüsü, İzmir, 54.

Appendix 1. Images from the Construction Site