

CASE STUDY

The Application of Passive Defense in Construction Management and Risk Management of Civil Projects: A Case Study of Ramsar City

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Received: July 27, 2025;

Accepted: November 3, 2025;

Published: November 10, 2025.

Citation: Sadeghi, F., & Hooshmand Aiini, A. (2025). The Application of Passive Defense in Construction Management and Risk Management of Civil Projects: A Case Study of Ramsar City. *Sustainable Construction and Risks*, 1(1), 16-23.
<https://doi.org/10.25082/SCR.2025.01.002>

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Abstract: One of the topics that have received special attention today in the design and implementation of railways, airports, power plants, dams, military barracks, offices, etc., is the issue of passive defense. It aims to proactively safeguard facilities and is of critical importance in practice. With the advancement of reconnaissance technologies, passive defense capabilities have also developed correspondingly: they have moved beyond static and immobile states and shown kinetic-thermal-acoustic reactions against enemy identifiers. The purpose of this research is to study passive defense in managing the risks of construction projects. The study population consisted of 12 companies and 68 experts in the field of civil engineering in Ramsar City. The research sample, selected using Cochran's formula, included 58 of these experts. The research method was correlational, and the relationships between variables were analyzed using multiple linear regression. The results of this study showed that the components of passive defense—including camouflage, concealment, deception, cover, location, dispersion, division and relocation, fortifications, safe structures, and information announcement—have a positive and significant relationship with the dependent variable: risk management of civil engineering projects.

Keywords: passive defense, construction management, risk management, civil engineering projects

1 Introduction

In civil engineering projects, given the critical role of project managers—particularly in risk management—and the necessity of safety during both execution and operation phases, the city of Ramsar presents unique challenges and opportunities. Ramsar's significance arises not only from the need to preserve its environment and valuable agricultural lands but also from the need to protect historical monuments such as the Marco Castle, Ramsar Hotel, and Ramsar Palace (Ghoochani et al., 2019).

Passive defense refers to a set of measures, actions, and plans implemented using tools and environmental conditions, which, as far as possible, do not rely on human intervention and are self-sufficient. Such measures, on one hand, enhance the defensive capabilities of infrastructure during crises and, on the other hand, reduce the impacts and damages of disasters, facilitating reconstruction at minimal cost. In practice, passive defense plans are developed and executed during periods of peace and stability, allowing comprehensive consideration of all factors, which ultimately reduces costs while enhancing operational efficiency (Khalili & Yasemi, 2015).

Given Ramsar's geographical location—situated along the main transportation corridor connecting Tehran and Mazandaran provinces to Gilan, in the Caspian coastal zone and the slopes of the Alborz mountains—even brief traffic disruptions could inflict irreparable national damage. This underscores the critical importance of conducting research in this context.

In the twenty-first century, as humanity faces diverse natural and human-induced hazards, project managers employ various strategies to ensure the safety of civil engineering projects during construction and operational phases. One of the most effective techniques is risk management, which, according to the PMBOK Guide, involves risk management planning, risk identification, qualitative and quantitative risk assessment, risk response planning, and risk monitoring and control (Mohammadshafiei, 2015). Uncertainty is inherent in all projects. When uncertainty interacts with project objectives, it transforms into risk. Risk is defined as an uncertainty that, if it occurs, affects one or more project objectives, which may be either positive

or negative. Thus, risk encompasses both opportunities (uncertainties with positive effects on objectives) and threats (uncertainties with negative effects) (Mohammadzadeh & Mohabbati, 2008).

A structured process for managing both opportunities and threats provides clear benefits for projects and is referred to as risk management, which is an integral part of the broader project management process. Given that Iran ranks among the ten most hazard-prone countries in the world, proper risk management is essential for ensuring the safety of structures and the surrounding environment. From an etymological perspective, the term *Paddefa* (passive defense) consists of two components: *Pad* (or *Paad*), a prefix meaning anti, opposite, or preventive, and *Afand*, meaning offense or attack. Accordingly, passive defense refers to measures designed to counter threats proactively (Fathi Biranvand, 2017).

Active defense is typically employed during crises such as war, floods, earthquakes, or civil unrest, using weapons, combat equipment, and military techniques. In contrast, passive defense emphasizes pre-crisis management and includes any non-armed measures that reduce the vulnerability of human resources, buildings, infrastructure, equipment, documents, and national lifelines to natural hazards (e.g., droughts, floods, earthquakes, landslides, storms) or human-induced hazards (e.g., war, internal unrest, sanctions) (Mohammadzadeh et al., 2012). Most theorists emphasize the preventive nature of passive defense in countering human-induced attacks.

Passive defense measures aim to enhance the resilience of building and urban infrastructure, even without human intervention, mitigate crisis impacts, and enable rapid reconstruction at reduced costs. Essentially, these measures are designed to counter threats before they occur. Key strategies include: site selection, reinforcement, dispersion, relocation, barriers, access control, camouflage, concealment, deception, mobility, coverage, alert systems, capacity building, power regeneration, localization, innovation, creativity, theorization, independence, confidence, courage, national unity, sustainable development, and deterrence. These strategies are particularly effective against aerial, missile, or ground hostile attacks (Lotfian et al., 2020).

One practical application of risk management in civil projects is the implementation of passive defense principles. When applied to residential, commercial, educational, healthcare, sports, and green spaces, these measures enhance safety, comfort, security, compatibility, and overall satisfaction at national, regional, city, and neighborhood levels (Moghelezadeh et al., 2016).

Ramsar, being a tourist city, offers an ideal context for integrating passive defense principles into civil engineering projects. By implementing proper risk management as part of the overall project management process, it is possible to identify and leverage effective factors and opportunities while recognizing, controlling, or converting threats into new opportunities. Therefore, this study investigates the role of passive defense in risk management of civil engineering projects in Ramsar. Based on the research objectives, the study considers nine components for the passive defense variable.

Given the intense competition among stakeholders in the construction industry—each striving to achieve maximum stakeholder satisfaction and the highest performance outcomes at the lowest possible cost—it is essential to employ modern risk management techniques in the implementation of civil engineering projects.

Today, passive defense is recognized as one of the most effective approaches for reducing environmental vulnerabilities. By applying the principles and methodologies of passive defense together with risk management prior to any decision-making, it is possible to minimize potential damages, preserve natural resources, and reduce unnecessary financial investments.

In the city of Ramsar, considering its unique natural and economic conditions, the application of these principles is particularly vital. Proper implementation can contribute significantly to the protection of natural resources, enhancement of economic efficiency, reduction of potential losses, and overall improvement of safety and security in urban construction and infrastructure development.

2 Project risk management in civil engineering projects

The success of civil engineering projects is commonly evaluated through the achievement of specific objectives within the defined constraints of time, cost, and quality. However, the realization of these goals is often challenged by numerous uncertainties and risks inherent in the construction environment. Effective risk management has therefore become a critical

determinant of project success, as it enables project managers to anticipate potential threats, assess their impacts, and implement appropriate mitigation strategies. Despite its importance, many organizations still initiate projects with limited clarity regarding their true objectives and priorities, which significantly increases the likelihood of delays, cost overruns, and performance shortfalls. The project risk management process, as outlined in the PMBOK Guide, involves a systematic sequence of activities including risk identification, qualitative and quantitative analysis, response planning, and continuous monitoring and control. Each of these processes requires the integration of analytical tools, planning techniques, control systems, and managerial expertise, which in turn necessitates sufficient investment and organizational commitment. To successfully implement risk management, a solid foundation comprising technical infrastructure, information systems, decision-support tools, and standardized operational procedures must be established within the organization.

Furthermore, a comprehensive understanding of the role and potential of risk management should be embedded into all levels of project decision-making. The project life cycle provides a natural framework for this integration, allowing decision-makers to anticipate and manage uncertainties as they evolve throughout different stages of project execution. Early recognition of potential risks, combined with adaptive management strategies, enhances the project's resilience and ensures optimal resource utilization.

Ultimately, effective project risk management is not merely a reactive approach to uncertainty but a proactive strategic tool that promotes sustainability, improves decision-making quality, and enhances the overall performance of construction projects. By embedding structured risk management into every phase of the project life cycle, organizations can achieve higher levels of efficiency, safety, and stakeholder satisfaction while minimizing potential losses.

3 Research methodology

The present study employs a descriptive-analytical research design and relies on library and documentary studies. Initially, the principles, objectives, and considerations of passive defense are explained, followed by an analysis of the passive defense approach in urban construction in the city of Ramsar. Furthermore, the study identifies risks associated with construction project management and examines the role of passive defense in urban construction management, aiming to mitigate the identified risks arising from natural and human-induced disasters.

The statistical population of this study consists of all experts from active civil engineering companies in Ramsar County who were engaged in the construction of commercial, residential, administrative, military, and educational units during 2020–2021. Based on preliminary assessments, a total of 12 qualified civil engineering and contracting companies certified by the Mazandaran Province Engineering Organization and 68 experts holding relevant scientific and technical credentials from these companies were identified. To determine the sample size necessary for addressing the research questions, the Cochran formula was employed using a random sampling method, resulting in a final sample of 58 experts from the civil engineering companies in Ramsar.

For data collection, two questionnaires were used: one for the project risk management variable (developed by [Khaksar et al. \(2008\)](#)) with 21 items answered by the experts, and the other for the passive defense variable (developed by [Mousavi Nesab & Keshvari \(2019\)](#)) with 16 items divided into 9 components. The validity and reliability of the project risk management questionnaire were previously confirmed by [Khaksar et al. \(2008\)](#) using Cronbach's alpha, yielding a coefficient of 0.947, which is considered highly acceptable. The passive defense questionnaire's validity and reliability were also confirmed in Iran by [Mousavi Nesab and Keshvari \(2019\)](#), with a Cronbach's alpha of 0.89, indicating satisfactory reliability. Data analysis was conducted using both descriptive and inferential statistics. Descriptive statistics included frequencies, percentages, mean, and standard deviation, while inferential statistics employed Pearson correlation analysis. To examine the relationship between passive defense components and project risk management, multiple linear regression analysis was applied. All statistical analyses were performed using SPSS version 27.

3.1 Population and sampling methods

3.1.1 Population

The statistical population of the present study consists of all experts from civil engineering companies active in Ramsar County during 2020–2021. These experts were involved in the

construction of commercial, residential, administrative, military, and educational units within the county. Based on preliminary assessments, the population was determined to include 12 qualified civil engineering and contracting companies certified by the Mazandaran Province Engineering Organization, and 68 experts holding relevant scientific and technical credentials from these companies.

3.1.2 Sampling methods

There are various sampling methods and formulas to determine the appropriate sample size, each requiring prior knowledge of the population characteristics. To estimate the sample statistically, information regarding the distribution of the studied traits within the population is necessary—specifically, the proportion of the population exhibiting certain attributes versus those who do not. Additionally, the population standard deviation must be considered when calculating the sample size.

In this study, the Cochran formula was employed to estimate the sample size with a 95% confidence level (corresponding to a 5% significance level), as suggested in Morgan's table. The Cochran formula is commonly used in research involving qualitative variables to determine the minimum required sample size. The formula calculates the sample size based on the desired confidence level, estimated proportion of the attribute in the population, and acceptable margin of error. The Cochran formula is as follows:

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N} \left[\frac{z^2 pq}{d^2} - 1 \right]}$$

In the formula:

N = Population size;

p = Proportion of the population possessing the characteristic of interest (set to 0.5 if unknown, for conservative estimation);

q = Proportion of the population lacking the characteristic of interest;

z = Critical value for the desired confidence level (z = 1.96 for 95% confidence level)

d = Margin of error (set to 0.05 for maximum accuracy).

To determine the sample size necessary to answer the research questions, this study employed Cochran's formula in conjunction with random sampling techniques. Using this approach, the final sample consisted of 58 experts from civil engineering companies in Ramsar County.

3.2 Data analysis methods

In this study, data were analyzed using both descriptive and inferential statistical methods. Descriptive statistics included frequencies, percentages, mean, and standard deviation to summarize the characteristics of the participants and their responses.

For inferential statistics, Pearson correlation analysis was employed to examine relationships among variables. Additionally, multiple linear regression analysis was conducted to determine the association between the components of passive defense and project risk management in civil engineering projects. All statistical analyses were performed using SPSS version 27, ensuring accuracy and reliability of the results.

4 Research findings

The findings of this study are presented in two parts: descriptive statistics and inferential statistics.

4.1 Descriptive statistics

Descriptive analysis was first conducted to summarize the responses of experts regarding the questionnaires and their components. Key statistical indicators including mean, maximum, minimum, standard deviation, and variance were calculated for each item and component. These results provide an overview of the degree of agreement and variability among the experts' responses and are presented in [Table 1](#).

4.2 Inferential statistics

To examine the relationships and influence of passive defense on project risk management in civil engineering projects, Pearson correlation analysis was employed. This method allowed

Table 1 Descriptive Statistics of Research Variables

Variable / Component	N	Min	Max	Mean	SD	Variance
Camouflage	58	2	10	5.74	2.439	5.949
Concealment	58	2	10	6.07	2.470	6.100
Deception	58	2	10	6.05	2.910	8.471
Coverage	58	1	5	3.24	1.525	2.327
Site Selection	58	2	10	6.40	2.595	6.735
Dispersion	58	2	10	6.14	2.275	5.174
Segregation & Relocation	58	1	10	5.97	2.541	6.455
Reinforcement & Secure Structures	58	2	10	5.90	2.851	8.129
Alert & Communication	58	1	5	3.19	1.492	2.227
Civil Engineering Project Risk (Overall)	58	21	104	62.48	24.323	591.587

for identifying the strength and direction of associations between the components of passive defense and the overall risk management variable.

Furthermore, multiple linear regression analysis was conducted to determine the relative contribution of each passive defense component to project risk management outcomes. This analysis enabled the identification of the most influential factors, providing insight into which aspects of passive defense play a critical role in mitigating project risks.

The combination of descriptive and inferential statistical analyses provides a comprehensive understanding of both the distribution of responses and the predictive relationships between key variables. All analyses were performed using SPSS version 27, ensuring accuracy and reliability of the findings.

The results of Table 1 show that the highest mean value belongs to the variable civil engineering project risk, while the lowest mean value belongs to the variable Alert & Communication.

4.3 Inferential statistics

To test the research hypotheses, the results of the correlation coefficients are considered, and each of them is examined individually. (see in Table 2)

Table 2 Pearson Correlation Coefficients Between Research Variables

Variables	Camouflage	Concealment	Deception	Cover	Site Selection	Dispersion	Separation & Relocation	Fortifications & Safe Structures	News Announcement	Civil Engineering Risk
Camouflage	1	0.178	0.237	0.135	0.177	0.373**	0.157	0.216	0.240	0.356**
Concealment	0.178	1	0.212	0.266*	0.198	0.198	0.258	0.253	0.163	0.392**
Deception	0.237	0.212	1	0.290*	0.081	0.179	0.337**	0.371**	0.268*	0.441**
Cover	0.135	0.266*	0.290*	1	0.073	0.117	0.396**	0.240	0.334*	0.383**
Site Selection	0.177	0.198	0.081	0.073	1	0.249	0.183	0.205	0.229	0.343**
Dispersion	0.373**	0.198	0.179	0.117	0.249	1	0.374**	0.376**	0.214	0.408**
Separation & Relocation	0.157	0.258	0.337**	0.396**	0.183	0.374**	1	0.288*	0.159	0.313*
Fortifications & Safe Structures	0.216	0.253	0.371**	0.240	0.205	0.376**	0.288*	1	0.264*	0.429**
News Announcement	0.240	0.163	0.268*	0.334*	0.229	0.214	0.159	0.264*	1	0.665**
Civil Engineering Risk	0.356**	0.392**	0.441**	0.383**	0.343**	0.408**	0.313*	0.429**	0.665**	1

Note: $p < 0.05$ is indicated by *, and $p < 0.01$ by **, $N = 58$.

The results in Table 2 indicate that there are significant positive correlations among most of the research variables. In particular:

(1) Civil Engineering Risk shows the strongest and most consistent correlations with other variables, especially with News Announcement ($r = 0.665, p < 0.01$), Deception ($r = 0.441, p < 0.01$), Fortifications & Safe Structures ($r = 0.429, p < 0.01$), Dispersion ($r = 0.408, p < 0.01$), and Cover ($r = 0.383, p < 0.01$). This suggests that as these variables increase, the level of civil engineering project risk also tends to rise.

(2) The highest correlation observed in the matrix is between News Announcement and Civil Engineering Risk ($r = 0.665, p < 0.01$), indicating a strong linear relationship.

(3) The tactical variables (such as deception, cover, dispersion, and fortifications) are positively and significantly interrelated, implying that they function in a complementary manner within the studied framework.

(4) Some variables (e.g., camouflage and concealment) have weaker or non-significant relationships with others, suggesting a more limited direct effect on the overall model.

Overall, these findings support the hypothesized relationships between project risk and the strategic or protective measures investigated in the study. To identify the best predictor

of civil engineering project risk among the passive defense variables, a regression model was employed. It should be noted that the passive defense variable includes the following components: camouflage, concealment, deception, cover, site selection, dispersion, separation and relocation, fortifications and safe structures, and news announcement. The results are presented in Table 3.

Table 3 Summary of the Regression Model for Predicting Civil Engineering Project Risk

Model	R	R ²	Adjusted R ²	SE of the Estimate	Durbin–Watson
Main Hypothesis	0.803 ^a	0.645	0.579	15.788	1.939

Note: ^a. Predictors: Camouflage, Concealment, Deception, Cover, Site Selection, Dispersion, Separation and Relocation, Fortifications and Safe Structures, News Announcement. Dependent Variable: Civil Engineering Project Risk.

The regression results in Table 3 indicate that the model explains approximately 64.5% ($R^2 = 0.645$) of the variance in civil engineering project risk based on the set of passive defense components. The adjusted R^2 value (0.579) confirms a good level of explanatory power after adjusting for the number of predictors. The Durbin–Watson statistic (1.939) falls within the acceptable range (approximately 1.5–2.5), suggesting that there is no significant autocorrelation among the residuals, and thus the regression assumptions are met.

Overall, these findings indicate that the passive defense variables collectively provide a strong and reliable prediction of civil engineering project risk.

In Table 4, the results show that the regression model is statistically significant ($F = 9.698$, $p < 0.001$). This indicates that the collective set of passive defense variables has a significant effect on civil engineering project risk management, confirming their predictive power.

Table 4 ANOVA Test for the Significance of the Regression Model

Model	Sum of Squares (SS)	df	Mean Square (MS)	F	Sig.
Regression	21,755.756	9	2,417.306	9.698	0.000 ^b
Residual	11,964.727	48	249.265		
Total	33,720.483	57			

Note: ^b. Predictors: Camouflage, Concealment, Deception, Cover, Site Selection, Dispersion, Separation and Relocation, Fortifications and Safe Structures, News Announcement. Dependent Variable: Civil Engineering Project Risk.

In Table 5, the results show that the regression model is statistically significant ($F = 9.698$, $p < 0.001$). This indicates that the collective set of passive defense variables has a significant effect on civil engineering project risk management, confirming their predictive power. The regression coefficients indicate that all variables except Camouflage and Separation & Relocation are statistically significant predictors of civil engineering project risk at the 0.05 level, while News Announcement is significant at the 0.01 level. This suggests that factors such as Concealment, Deception, Cover, Site Selection, Dispersion, and Fortifications play important roles in predicting and influencing civil engineering project risk management.

Table 5 Significance of Regression Coefficients

Model	Unstd. Coeff. (B)	Std. Error	Std. Coeff. (β)	t	Sig.
Constant	-9.568	9.009		-1.062	0.044
Camouflage	0.661	0.955	0.166	0.692	0.092
Concealment	1.713	0.919	0.374	1.864	0.048
Deception	1.470	0.830	0.286	1.771	0.033
Cover	1.235	1.610	0.277	1.767	0.037
Site Selection	1.092	0.864	0.417	1.914	0.012
Dispersion	1.613	1.114	0.381	1.877	0.045
Separation & Relocation	-0.086	0.998	0.009	-0.086	0.931
Fortifications & Safe Structures	0.727	0.861	0.385	1.945	0.002
News Announcement	7.620	1.583	0.467	4.812	0.000

5 Conclusion

Implementing an effective and efficient risk management process requires close attention to the various sources of uncertainty and risks throughout different stages of the project life cycle. Determining the optimal time to initiate the risk management process within the life cycle—and understanding the potential damages that may arise from late initiation—are of

critical importance. One approach to risk management is the application of passive defense measures to control and mitigate these risks.

Passive defense refers to a set of non-armed measures and actions designed to reduce vulnerability, casualties, and damages, thereby increasing resilience. In simple terms, passive defense means ‘defense without weapons against threats.’ Creating secure structures is one aspect of passive defense. One of the fifteen principles of passive defense is the reinforcement and securing of vital structures. Such vital and sensitive facilities include refineries, power plants, ports, airports, industrial complexes, important administrative buildings, shelters, and safe halls. Power outages during military attacks—or even natural disasters like earthquakes—are among the major concerns of authorities and the public. The use of polycarbonate sheets as glazing and cladding in critical structures provides daylighting while reducing dependency on electric power before, during, and after attacks or natural disasters. Moreover, the high impact resistance of these sheets (polycarbonate is virtually shatterproof) helps preserve glazing and cladding elements during earthquakes or blast waves and shrapnel.

The advantages include:

(1) Unlike glass, which breaks into shards that endanger occupants and equipment, polycarbonate does not shatter. In historical incidents, broken glass significantly contributed to casualties and equipment damage.

(2) Broken glass fragments complicate rescue and reconstruction after incidents; this is less of an issue when using polycarbonate. This problem was notable at Bam Airport following the devastating earthquake in 2003.

(3) Due to polycarbonate’s low thermal conductivity and shatterproof nature, heating energy requirements are reduced in cold climates, which is an additional advantage compared to glass glazing.

(4) Although tempered and laminated glass may mitigate some of these issues, their higher weight, cost, and installation complexity remain limiting factors. Polycarbonate sheets, by contrast, offer multiple benefits without these drawbacks.

(5) The application of passive defense to counter threats and reduce damages from hostile attacks (e.g., aerial, missile, ground attacks) or invasions is a fundamental national priority. Its scope encompasses virtually all vital military, economic, and sensitive civilian centers. Effective passive defense contributes to national security, political and economic independence, and resilience. Passive defense management seeks to embed the ‘defense gene’ within societal structures potentially subject to attack. Equally important is understanding potential attack modalities; without recognizing how an aggressor operates, it is impossible to develop effective preventive measures. Therefore, threat analysis is the first step in defense planning. When active defense measures are combined with effective passive defense, they can deter aggression or, in the event of an attack, significantly impair the aggressor’s ability to achieve objectives.

(6) Given Iran’s strategic geographic position and natural resources—as well as a history of threats—investing in passive defense within the civil engineering sector is essential. Incorporating passive defense principles into construction planning and project risk management is thus an indispensable requirement for national resilience and protection of critical infrastructure.

Conflicts of interest

The authors declare that they have no conflict of interest.

References

- Bakhshi Shadmehri, F. (2016). Analysis of passive defense considerations in the construction of safe hospitals with focusing on the physical dimension of the building. *Geo-Research Journal*, 3(1), 45–58. <https://doi.org/10.22059/georesearch.2016.45>
- Bitarafan, M., Bagher Hosseini, S., hashemi-fesharaki, S. J., & Esmailzadeh, A. (2013). Role of architectural space in blast-resistant buildings. *Frontiers of Architectural Research*, 2(1), 67–73. <https://doi.org/10.1016/j.foar.2012.11.003>
- Fathi Biranvand, A. (2017). Project Risk Management. In *Third Annual Conference on Architectural, Urban Planning and Urban Management Research* (in Persian).
- Huang, H., Li, L., & Gu, Y. (2022). Assessing the accessibility to fire hazards in preserving historical towns: Case studies in suburban Shanghai, China. *Frontiers of Architectural Research*, 11(4), 731–746. <https://doi.org/10.1016/j.foar.2022.03.001>

- Jamshidi, Z. (2020). Passive defense considerations in the design of specific buildings. *Journal of Environmental Engineering and Management*, 30(3), 45–56.
<https://doi.org/10.1016/j.joem.2020.02.004>
- Man, S. S., Alabdulkarim, S., Chan, A. H. S., & Zhang, T. (2021). The acceptance of personal protective equipment among Hong Kong construction workers: An integration of technology acceptance model and theory of planned behavior with risk perception and safety climate. *Journal of Safety Research*, 79, 329–340.
<https://doi.org/10.1016/j.jsr.2021.09.014>
- Narimisa, M. R. (2019). Passive defense: Measuring and evaluating urban safety. *International Journal of Human Capital and Urban Management*, 4(2), 123–135.
<https://doi.org/10.22059/ijhcum.2019.36182>
- Narimisa, M. R. (2019). Passive defense: Measuring and evaluating urban safety. *International Journal of Human Capital and Urban Management*, 4(2), 123–135.
<https://doi.org/10.22059/ijhcum.2019.36182>
- Okudan, O., & Budayan, C. (2020). Assessment of project characteristics affecting risk occurrences in construction projects using fuzzy AHP. *Sigma Journal of Engineering and Natural Sciences*, 38(3), 1447-1462.
- Ostad-Ali-Askari, K. (2024). Design and Implementation of Reservoirs with Passive Defense Approach. *SSRN Electronic Journal*.
<https://doi.org/10.2139/ssrn.4825508>
- Salimi, M. (2019). Risk assessment from a passive defense perspective: A case study of chemical storage tanks. *Iranian Journal of Occupational Health*, 16(4), 429–437.
<https://doi.org/10.22038/ijoh.2019.429>