Comparison of Transport Noise With Risk Index

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Abstract

Risk evaluation is the general process of evaluating the risk rate and decision about its acceptability. Noise Pollution in big cities is caused by numerous factors that each factor has a specific role in creating ecologic problems. This analysis is an attempt to study the noise pollution with use of measurement index (Risk priority number) of effective factors causing noise pollution in Rah Ahan square in Tehran. In this case, with considering different modes of transportation in the studied area and use of Risk priority number, the noise produced by vehicles included the highest index and this result shows the highest sources of noise in the studied area, are the vehicles.

Key words : Noise pollution, Transportation, Risk Priority Number, Vehicles.

1-Introduction

Noise is unwanted sound, allowing sound to interrupt the conversation , or cause pain , as well as the convenience of living activities impede the environment. Nowadays the noise has become a problem for many people. Noise sources can be produced by transportation, such as vehicles, airplanes, trains. Noise can cause deafness, also can affect a person's mental health, such as stress or tension. If the tension of the soul cannot be resolved then further impact is declining physical health. Airports, trains, industry and traffic are some examples of sources that cause noise pollution. Light and heavy vehicles, do to their big number, have a big share of causing noise pollution in metropolitan cities. Noise pollution could be defined as any undesirable sound that causes inconvenience and lack of concentration for an individual at work[1]. The main sources of noise in urban environments are transport vehicles that are divided to three main groups of road traffic, air traffic and rail traffic. We are surrounded by noises in today's world, from our colleagues' conversation at the work place to the traffic noise outside

or the loud speakers of public transport speakers. We often do not pay attention to these daily noises around us but the truth is that noise such as movement of personal vehicles or the noise caused by takeoff or landing of the planes in distance and the noise caused by construction work could have a serious effect on our well being and health[1, 3].

2-Definitions and Terminology

In the beginning, it is required to define risk:

- **Risk**: probability of suffering a loss.

-**Risk Management**: systematic use of management policies, approaches and processes related to risk analysis, evaluation and control [2].

2.1-Risk management objectives

-Survival	-Economy
-Acceptable level of anxiety	-Stable earnings
-Did not stop working	-Continued growth

2.2-Function of Risk Management System

The stages and function of risk management system are depicted in figure 1.

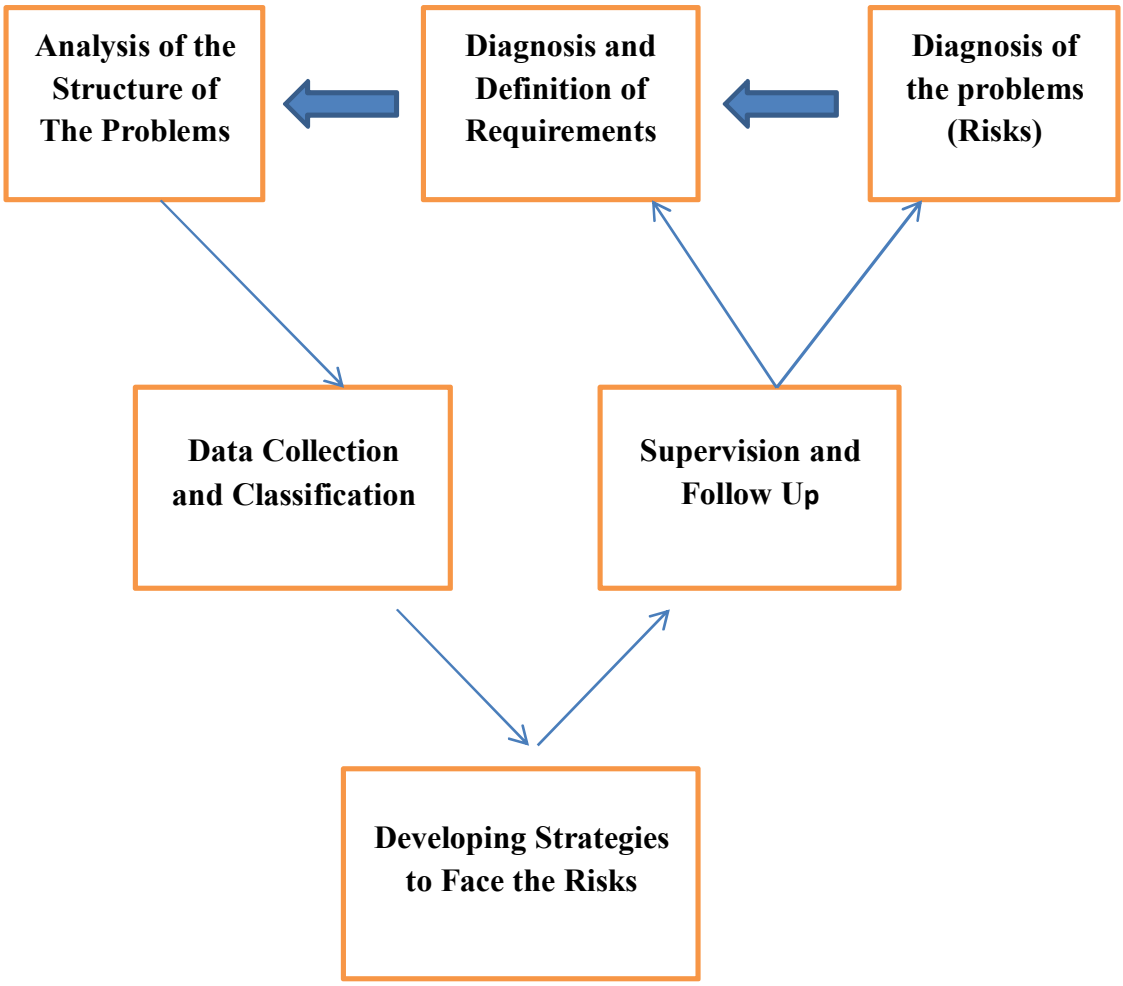

FIGURE 1: Process performance and risk management system

Risk analysis is a process between science and industry, between pure principles and the usage of other principles, between an analysis of the world and our understanding of it. In general, the methodology of risk analysis, and specifically ecosystem risk analysis based on scientific data and models have been implemented.

2.3-Decision Stages and Action in Risk Management

Physical damages to the asset ---------- Identification of different potential damages

Damages due to responsibility,

Damages due to personnel,

Delay in the ability of generating revenue

Intensity (1

Probability Distribution---Evaluation of the Dimensions of Anticipated Damages

Frequency (2

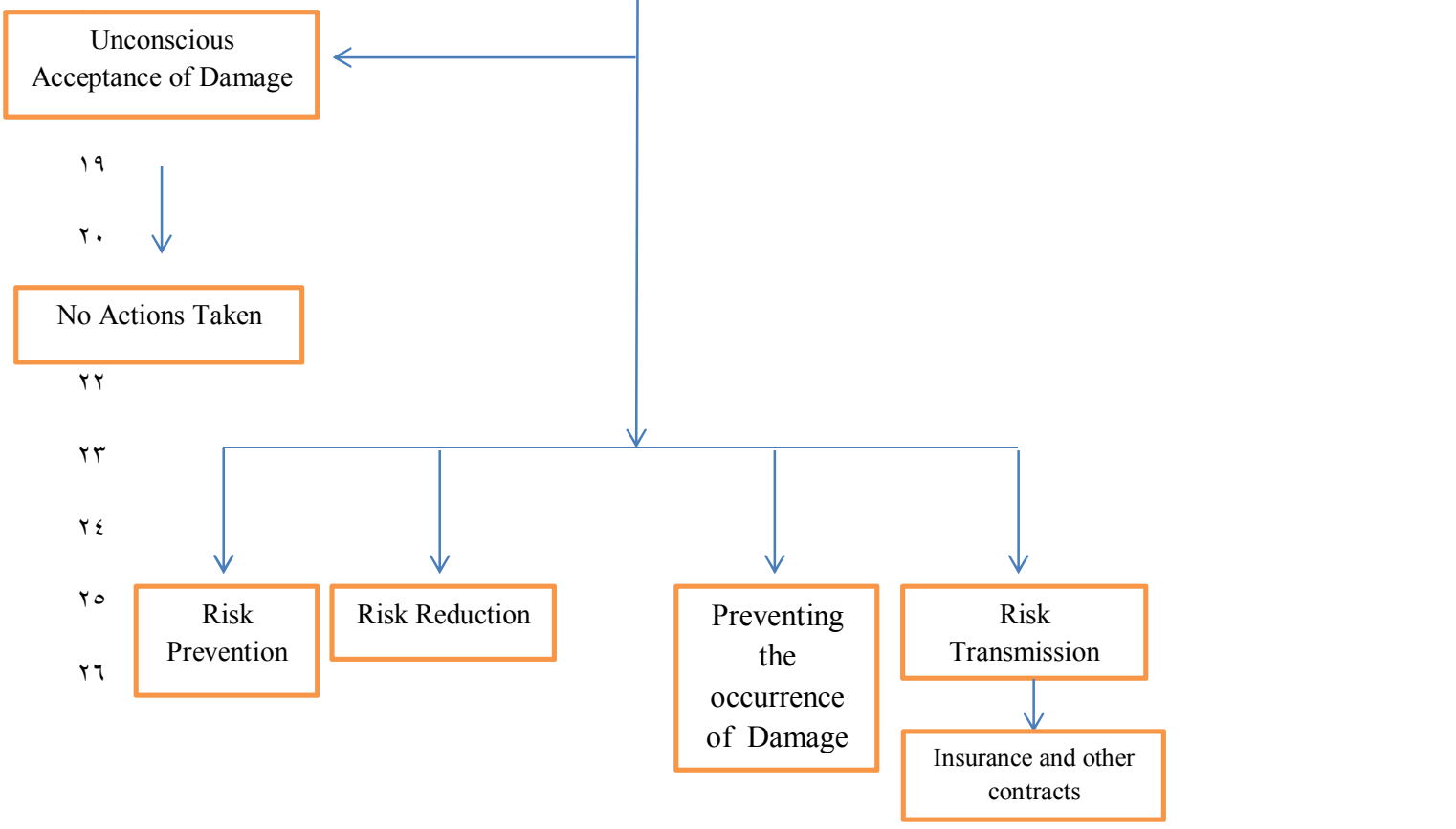

FIGURE 2: Summary of Risk Management Stages for a Specific Subject.

2.4-Risk Management Strategies

1) Transmission: in this case, the studied parameter is transmitted to another condition.

2) Refusal: in this case accepting the parameter and its effects is refused.

3) Reduction (Relief): in this case introducing some approaches should cause reduction.

4) Acceptance (Maintenance): in this case the subject in focus must be kept [2].

3-Problem Definition

Local visits, Interviews and survey for 120 people (above 18 years old) have been used to study the environmental effects in Rah Ahan square in Tehran. With using their results and calculating the considered index which has been used in the tables below, the environmental factors have been graded and the most important factor will be chosen. These factors include:

- Noise pollution caused by vehicle traffic.

-Airport noise pollution due to aircraft flying in the area.

- Noise from the railway station.

-Noise from construction and industrial activities in the desired location.

-Noise resulting from Bus Rapid Transit station.

With use of statistical methods of analysis, which for example a few cases are mentioned below, it is possible to evaluate the risk disclosure of environmental factors. In this analysis the third method that mentioned below, has been used, which is risk priority number index.

1) Use of mathematical formula and distributions of probability and risk effect:

Poisson distribution:

$$f(x) = \frac{m^r \times e^{-m}}{r!}$$

Formula (1)

Normal distribution:

Formula (2)

$$f(x) = 1/\sigma\sqrt{2\pi}EXP^{\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)}$$

2) Probability rating matrix/ Risk intensity

Risk effect shows the intensity of the risk effects. Combination of probability and effect scales, risk rank (very high, high, average, low and very low).

3) Risk priority number calculation:

(Risk Priority Number) = RPN = Occurrence × Intensity × Recognition

$1 < RPN < 1000$

In this research the RPN index has been used to study several noise producing factors in the studied area. Three parameters including diagnosis, intensity and occurrence must be considered for this index. The tables below indicated the use of these three factors[2,4].

TABLE 1: Offered Guide for Intensity Ranking

Description	Impact	Rank
Deterioration is Regrettable, example: The risk of death, total destruction	Dangerous-Without Warning	10
Regrettable Deterioration is but followed by a warning	Dangerous-with Warning	9
Irreparable Deterioration – Failing to fulfill the main tasks (Loss of a body part)	Very High	8
High Deterioration, like equipment setting on fire, body burn.	High	7
Low Deterioration, like injury, minor food poisoning	Average	6
very low Deterioration, injury, minor food poisoning	Low	5
Very Low Deterioration but the majority of people feel it, (minor gas leak)	Very Low	4
The hand leaves a minor trace during milling	Minor Effects	3
The effect is pretty minor	Very minor	2
No effect	Nothing	1

TABLE 2 : Offered Guide for the occurrence rate

Probability of risk	Rate risk	Rank
Very high - risk is almost inevitable	1 of 2 1of3	10 9
High risk repeating	1 of 8 1 of 20	8 7
Medium	1 of 800 1 of 400 1 of 2000	6 5 4
Low - relatively rare risk	1 of 15000 1 of 1500000	3 2
Unlikely- risk is unlikely	1 of 15000000	1

TABLE 3 : Offered Guide for Recognition Ranking

Criteria: Probability of risk discovery	Detection Capability	Rank
There is no control or if there is any, it's not capable of discovering potential risk	Absolutely Zero	10
Very negligible probability for the risk to be detected	Very Negligible	9
negligible probability to detect the risk with the available controls	Negligible	8
Very low probability of risk detection with the available controls	Very Low	7
Low probability of risk detection with the available controls	Low	6
Risk detection is probable in half of the cases with the available controls	Average	5
Relatively High probability of risk detection with the available controls	Relatively High	4
High probability of risk detection with the available controls	High	3
Very High probability of risk detection with the available controls	Very High	2
Almost imminently the potential risks are detected With the available controls	Almost Imminent	1

4-Analysis and Results

Sampling locations are shown in Figure 3.

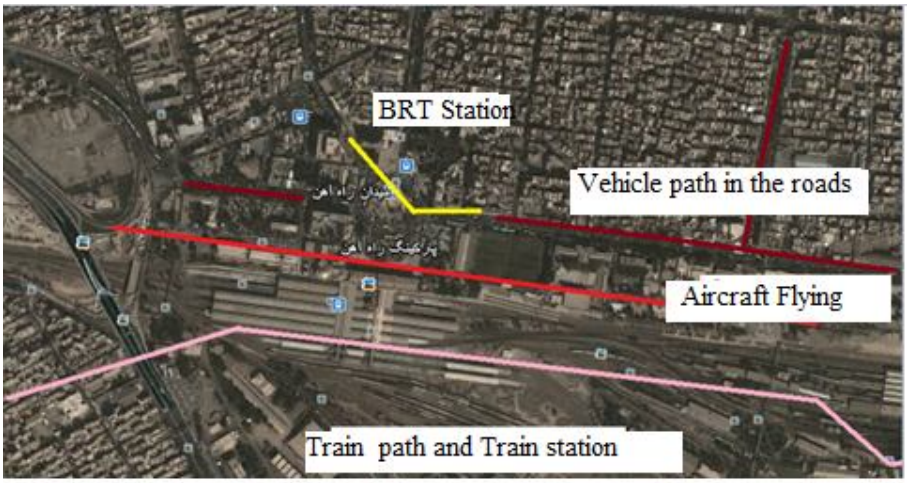

FIGURE 3 : Sampling locations of transportation modes in Rah Ahan Square

With the implemented studies and use of grades of the three parameters, which included Occurrence, Diagnosis and Intensity, in Formula (3), tables 1,2,3, RPN is calculated.

TABLE 4 : RPN calculation of risks identified in noise pollution

RPN criteria	Recognition	Intensity	Occurrence	Effects and Results	Risk Requirements
810	10	9	9	Undesired and long term effects on workers' health in the studied areas	Noise pollution caused by vehicle traffic
720	10	9	8	Increase in the discomfort of inhabitants and the workers' is harmful to their health condition	Airport noise pollution due to aircraft flying in the area
504	9	7	8	Mental disorders will appear in people's behavior on the long run	Noise from the railway station
180	5	6	6	Water and Air pollution , destruction of vegetation	Noise from construction and industrial activities in the desired location
294	7	6	7	Reduction of green space, elimination of green space and increase in environmental pollution	Noise resulting from BRT station

As observed above, the noise caused by urban traffic and vehicles includes a higher index than other studied modes of transport in this research and it shows the noise caused by vehicles disturbs the people living in the area more than the other factors.

5-Discussion

According to World Health Organization's report, and the research conducted by Joint Commission Center of Europe in 2011, living in noisy areas, specially areas with noise produced by heavy vehicles and heavy traffic and airplane landing or take offs, could result in high blood pressure and it could increase the risk of heart attack and eventually jeopardize the individual's life.

Evaluation of the risk of environmental effects is one of the subjects that should be studied in development plans in order to decrease the undesired consequences in future. In this research, noise pollution of modes of transport was studied and it was determined the noise caused by vehicles had the highest index, and proper actions, are required to control it. With utilizing the effects caused by noise pollution that on the long run and after short periods of time have irreparable damages on the people living in the studied area, a proper solution for reducing noise effects must be sought. We hope to be able to reduce the effects caused by the noise during the daytime and the night time, with correct analysis and proper user defined around the studied area and implementing the needed reforms. Implementing the risk priority number index method was one of the approaches used in this research[5]. Risk analysis without considering the requirements in decision making and systematic approach in support of decision makers is not possible. This approach's result has been the appearance of environmental risk evaluation in which a considerable amount of complicated data that is impossible to analyze with certainty, apart from actual measurement, transform into a risk number. Hence, government agencies such as public transport designers, must try to defend the public about the idea that appearance of one case of hearing loss or one casualty caused by the pressure of the airport noise between 1 million individuals is an acceptable fact [1, 5] . But unfortunately risk analysis hasn't reached that point in our country yet and probably one of the reasons behind that is inadequate familiarity with the basic principles of quantitative and qualitative evaluation of risk. Regarding this gap and the necessity of discussing and development of this knowledge, it is hoped to utilize risk analysis in constructional projects and land user design.

6-References

[1] Engel Z, Zawieska WM. The state of protection against noise in the environment in the year of Poland's accession to the European Union. In: 13th International Conference on Noise Control. Warszawa, Poland: CIOP-PIB; 2004.

[2] Li Sh. , Chen Sh. , Zhu L. , et al., Concentrations and risk assessment of selected in buses and bus stations of Hangzhou, China, Science of The Total Environment, Volume 407, Issue 6, Pages 2004-2011.2009.

[3] Clark Allison. The Effects of Roads and Off-Road Vehicles on Reptile Populations. Handbook 2005.

[4] Ruzbehi,S; Goda, Kh. "Standard Book of Practical Project Risk Management", pendar pars Publications, 2009.

[5] Saffar zadeh , M; Rahimi, F. " Noise pollution in transportation system" , Environmental Protection Agency Environmental Publications, 2003.