

## Zonation of Excavation risk according to regions in Tehran

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**Abstract:** Several reports on Excavation in Tehran and resulted risk have been released every year. Though, no estimation of the risk has been recorded. The present paper aims to base on various Fire reports in an 18month-period and classifying the damages including death, physical and financial losses prepare a model firstly in order to weight these damages. Then provide a map of available risks by use of data. The model is designed according to level of injury. The results show that the worst situation belongs to regions 13 and 14. Also, due to lack of clear information the 9, 10 and 11 regions were excluded. It should be said that the obtained map could be used for urban management from one hand and constructors and contactors on the other hand. Final conclusions indicate that the problems pertaining to Excavation not rely on soil conditions however more on lack of engineering information in field of Excavation as well as economic dominance on engineering activities.

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**Key words:** zonation, Excavation, Tehran, risk, Ranking

### 1. Introduction

Construction is known as one of most risky jobs (Clough et al., 2005). During years 2003 to 2005 more than 60 peoples lost their lives because of drilling accidents and damages to underground facilities which caused millions of dollar cost [12].

Doubtless, Iran is one of the risky countries because of Excavation operations that make material and human damages. The physical damages and death are more vital since an injured individuals in an accident may become disabled or lose his/her life.

Peoples are living with an interactional network (including family, friends and others ) thus, not only the injured person but other relatives and friends of him or her also will be affected as a result [5].

In recent years damages to buildings in urban regions because of Excavations have been more significant due to an increase in construction so more serious studies are demanding [17]. Inaccuracy in planning, calculation and operation of Excavations in these regions lead to irreversible damages to life and property.

Use of finite element softwares in spite of providing significant facilities in analysis of Excavation could also lead to poor and misleading results due to unfamiliarity with factors and

characteristics influencing on Excavation system behavior [14].

### Research background

Since this a relative new topic no comprehensive information found to help the present study. Though other studies have dealt with the topic indirectly.

They mostly discussed about zonation risk but no study argued about the risk of Excavation in direct. to name some, Gils et al [9], [10], [5], [13], [16], [9] are noteworthy in which risks of zonation, floods, landslides, liquefaction and flooding were examined.

### Scope of research

The city of Tehran with 18,800 km<sup>2</sup>, is located between 34 to 36.5 degrees north latitude and 50 to 53 degrees east longitude. Its height in the south is 1100, in central areas 1200 and in the north about 1,700 meters above sea level.

Tehran is overhanged with Qom province from south, from south-west to Markazi province, from west to Qazvin, from east to Semnan province and from north to Mazandaran province. It is relatively flat in southern slopes of the Alborz mountains [15]. This is, in the north the ground layers are hard and in the south the layers are often weak.

The location of Tehran in comparison to the rest of country is shown in Map (1).



The frequency of physical damage :  $n_3$   
Risk :  $Y$

Since there are no liability and engineering insurance reports according to type of accidents, the data of Taiwan were applied.

Table 1. Compensation paid per person for falling Excavation in years 1987-1997

activity	Compensation for the loss by the insurance arena in average (people / Taiwan Dollar)
falling Excavation	6700
Physical injury	140/000
death	328/000

Source: Institute of occupational Safety & Health, 1997

A=0.020427, B=0.426829

According to the data, ratio of A and B are calculated as follows:

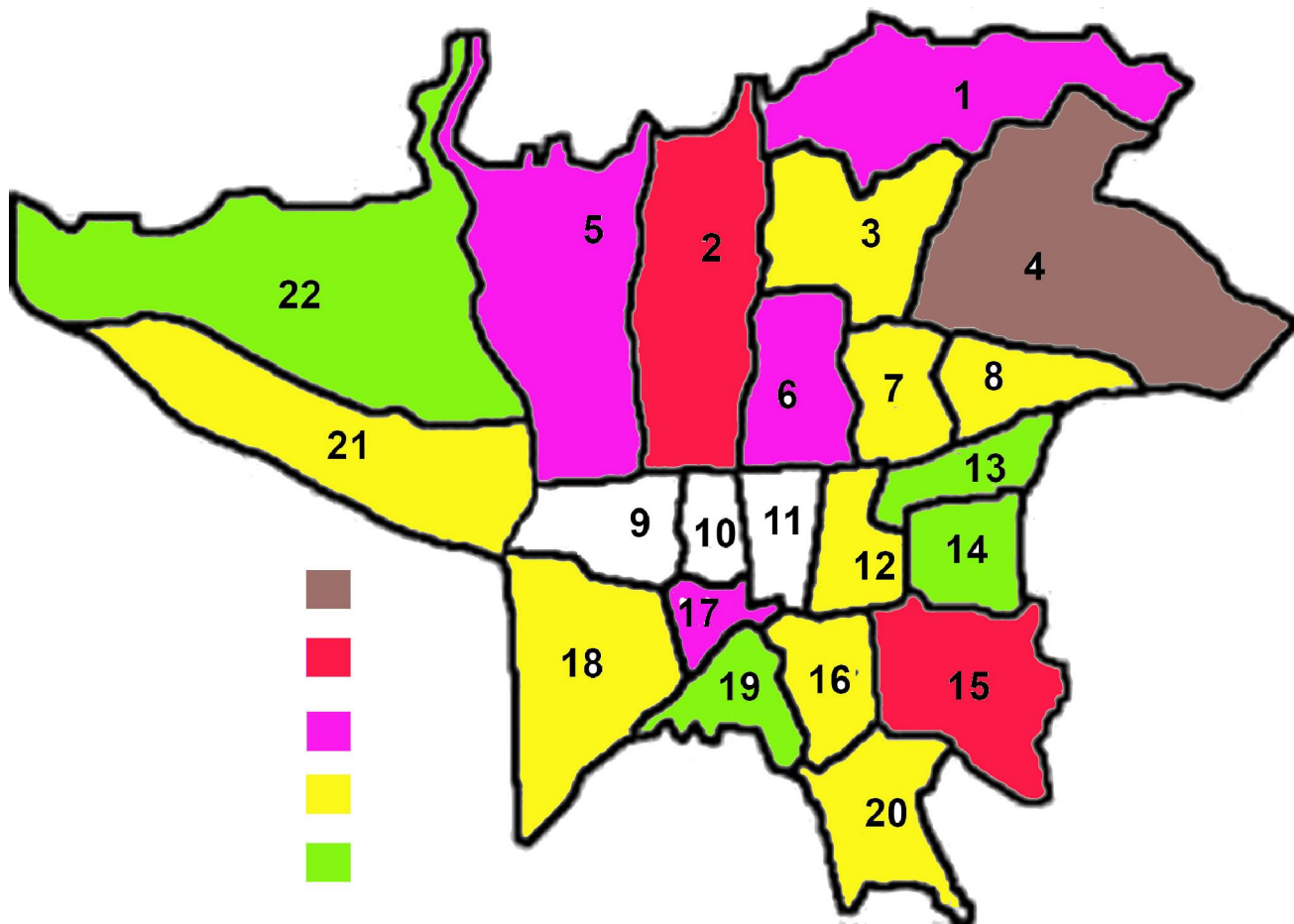
Based on the extracted data for Tehran and above coefficients, the below table shows score given to each region in Tehran.

Table (2): rating of different regions in Tehran according to risk of Excavation (By: author).

activity	falling Excavation	death	injury	pints
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
13	1	0	0	0.690963
14	1	0	0	0.690963
19	1	0	1	0.985886
22	2	1	0	1.39604
16	3	1	1	2.381925
21	3	1	1	2.381925
18	2	0	4	2.561618
3	2	1	4	2.575732
7	3	0	2	2.662734
20	3	0	3	2.957657
8	4	3	2	3.39604
12	3	2	5	3.575732
1	5	1	4	4.64862
5	5	2	4	4.662734
6	6	1	3	5.04466
17	4	1	8	5.13735
15	8	1	8	7.901201
2	10	5	5	8.454814
4	13	6	12	12.60628

It should be said that regions 9,10 and 11 were excluded from 18 month of Tehran Fire, thus they were not included in rating. Accordingly, the

below map shows the danger of Excavation in Tehran. It specifies three danger zones of Excavation Such as 1) very dangerous 2) dangerous and 3) poor.



Map 2: condition of Excavation in Tehran (by: author)

### 3. Conclusion

Though northern and southern regions of Tehran are in foothills and plain areas respectively in which there are stronghold lands in the northern and loose lands in the south. However, this distribution could not be seen in the map that explains the risk of Excavation in Tehran does not depended on type of land and soil mechanics. Other factors like engineering culture and training, economy of engineering may more likely affect the dangers. It is recommended to carry out similar researches using more data in other Iranian cities in order to confirm the present results.

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