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Identify and Analyze the Risks Involved in Tunnel Projects

MOHAMMAD ALI GAFARI[1]* and RAHIM AMINZADEH [2]

[1]Master Student of Construction Management and Engineering,
Azad University of Sirjan Research Sscience.
[2]Faculty Member of Professional and Technical University.

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ABSTRACT

Each year, large parts of credit and financial resources spent in large projects investment in construction and infrastructure. Tunneling is one of basic infrastructure of develop country even if faced with different risks. One of the biggest problems with project managers, identify and analyze the risks which causes efficiency reduction and sometimes is not successful to complete the project, In order should be tools decision, able to identify and analyze risks, created and developed. Many methods Have been proposed as a backup for identify risks, the one using breakdown structures of risk that would be hierarchy framework provides for potential sources of project risk. This study introduced a comprehensive tunneling project risks with method of risk breakdown structure.

Key words: Tunneling projects, Risk Breakdown Structure (RBS), Risk identification, risk assessment.

INTRODUCTION

One of the activities of developing countries to build their own economic infrastructures, implementation of development projects under the Building and so the principles planning was the essential and necessities special in this design so will extracted at least cost to efficiency.

Any engineering structures like an underground tunnel should be answered the aims and their define functions and in period of design and construction have special safe and economic conditions. Risks management has been evaluated totally favorable (Bagheri and Yousefi, F. 2012). Tunneling projects always is associated with high percentage because of the uncertainties related it. In a global traversal about tunneling projects has been reported increase 30 to 50 percent in time and cost because of management incomplete and mistake (ASGHARPOUR, M. 1995).

For example, tunnel line Jubilee London have associated Equivalent 67% cost growth, Boston central line 100% and Channel Tunnel 80%, examples of technical errors like tunnel collapse in Munich metro, Yorkshire England tunnel has damaged 5544 million dollars (Reilly, J.J. 2002).

Hence one of the pillars of risk management was the risk assessment. Due to the uncertain nature of tunneling projects and necessity to use of resources optimize is very important. The purpose of risk assessment is to measure risk based on various criteria such as the effect of the probability of occurrence (Reilly, J.J., Thompson, R. 2001). Any type of technique for risk assessment should be created with an appropriate method to identification

and classification of risks specific of each project. One of the best methods to identify and classify risks is creating a risk breakdown structure.

Risk management in tunnel plan

Guide to Risk Management in tunnel World Association defined based on progress type of risk phases of a project. Management considered all risk projects and this guide is major emphasis on risk management area. This means that at each stage which of Entities involved (employer or contractor) is responsible for risk management. Cognition risks design and construction steps are essential stage in project which should be do it at first because of created a good reference for all groups (owners, designers, companies insured and parties to the contract). A risk policy should be established by the owners of the project, including the scope of work, the risk goal points and risk management strategy (Hokm Abadi, M., 1999).

The initial design phase

For effective risk management is essential in tunneling projects that applied very soon even in early stage of feasibility study or during the early stages of design and it is noteworthy The fact that the success and effectiveness of the implementation of risk management related to quality of risk identification and Cooperation and interference, active consultation parties, because the risks management is not obtaining only with applying the stages and procedure and predetermined systems but in during seminars and meetings that importance and its features have been approved for organization.

- Risk policy-making

The responsibility of risk policy making and the use of risk assessment tools have responsibility of the owner of the Project.

- Risk acceptance criteria

Stages and notes on policy set by the owners should be translated into risk acceptance criteria to be used in progress of risk assessment which can be included:

- Risk acceptance criteria for use in risk quality assessment
- Risk acceptance criteria for use in risk quantitative assessment

Contract review phase

- Requirements contained in the documents
- Risk assessment to estimate
- Items risk of contracting

Risk Breakdown Structure

Risk breakdown structure is a hierarchical structure of project risks and can be used to structure and guidance of the risk management process. Due to high number and variety of risks that affect the tunneling projects virtually without any process systematic and correct to identification and its management, any attempts faced on problem for understanding and contrast the risk. Using this method (RBS) could be helped to do so because of it play an important role in the process of identifying and risk structure (Kyvanlu, and Atash Fraz, R.2009).

In fact RBS originated from the same idea of WBS which now has become the largest project management tool. In practice show the same the features, it means that the work widespread has identified and plus will define work.

According to WBS could Constitute foundation for many aspects of project management, RBS also could be applied for structure and guidance of process of risk management. First level of RBS could be used as a useful tool in preparing the list of risks to ensure that in risk identification phase, all RBS of project risks covered. This can be done through various methods. For example risk identify is done in during meeting of Brainstorming and or a Workshop,so should be invited participants to identify the Risks posed in each level of first or second, in main area of RBS. The next steps will be examined which of these items may occur or not that have the answers like “yes”, “no” or “do not know” that obviously, each of this will follow its appropriate reactions. In addition could be used for structure and classification of identified risks in the other methods. It could be clarified possible ambiguities and Turn on the blind spots and prevents rework. In fact RBS ensures that all sources of risk prone have been identified in front of project targets. However, with assumption of RBS is a comprehensive structure, the risk of incompletion of RBS structure would be partly covered by adding the items like “other risk” of RBS structure (Syady, et al,. M.2009).

Table 1: The risk breakdown structures internal and external resources tunneling projects

Risks arising from external sources	
1. Political risk	Foreign and domestic policy- government relationship- Change in\ government policies- Elections- Internal and external threats- The effect of applied pressure groups and interest groups-Potential changes with pressure groups and opposition political stability-Possibility of confiscation of property or nationalization-Changing expectations of the political events (Wars, revolutions, coups, etc.)-Scam(Bribery and administrative corruption)
2. The social risk	Comments and social approach-Ethnic and regional restrictions-The absence of collective consent-Strikes and turbulences-The unemployment rate in the construction industry- Of local contractors-Population growth rate-Vandalism and obstructions
3. Economic risk	Market conditions-Price volatility-Currency and deals-Interest rate-Inflation rate-Government economic policies and financing-Taxes, complications, customs duties-changes in stock prices-not match of items price and reality
4. Legal risk	Permissions and Confirmations-Changes in laws and regulations-standards and requirements of Environmental
5. The risk caused by environmental conditions at the project site	Access to the site-Density on the site-The site And nearby buildings-Geological conditions-Smoke, pollution, noise-Security on the site-No communication with the outside world-Archaeological and historical status of the project - Permits traffic , topography and land surface conditions
6. The risk caused by natural disasters	Earthquake-Storm-Natural fires and floods
The risk caused by internal resources	
7. The risk caused by damage and losses	Damage to a third party-Third party claims-Responsibilities of parties involved in the project-Accidents- Damage to third party ownership and assets, especially in historic buildings and infrastructure.
8. Contractual risk	Type of Contract-The number of competitors participating in the tender- suggestions of Unrealistically and under competitive pressure in tender- Policies and guidelines contractors in tender-project unrealistically aims written down in the contract.-Uncertainty in the job description.
9. Investment and Financial Risk	Unrealistic cost estimates-Incorrect methods of financing-Budget allocation-Failure to provide on time financial resources-the incomplete of cost plan-Cost control during design and carry-The cost of raw materials and-Bankruptcy of financial and budgetary-Non-beneficial investments-Projected cash flows and lack of compliance with the capital inventory.
10. Employer Risk	Capital stability employer-Client Experiences-Project management-Payments in proportion to the progress of work-Decisions-Launch operations-Communication and problem solving.
11. Management Risk	Unrealistically goals-Poor control-Organizing-Improper distribution of financial resources, human and material-The lack of definition of the tasks involved in the project-No use of techniques and techniques of project management.

12. planning Risk	Not clearly defined project goals-The absence or weakness of technical feasibility-Economic and environmental-Lack of strategic vision of the project-Weaknesses in project definition and the final performance and construction of the project.
13.The risk posed by Schedule Timing.	Schedule inaccurate and unrealistic-Change in the timing of completion of the project-Concurrency works and payments-Force Majeure-Business interruption and suspension-The uncertainty of the limitations and constraints in planning-The delay in the final approval-Scheduled by the Employer Adviser-The delay in the delivery of land and resources.
14. Human risk	Productivity and workforce skills- Strikes and labor turbulences-Access to Workforce-Labor rights violations- Salaries and wages-Work ethic-Motivational factors such as reward-Potential to disrupt the working conditions-Damage and loss of human resources.
15. The risk caused by equipment and materials resources	project Dependency to suppliers specific-Guarantees Sellers-facilities Quality And equipment theft and damage to equipment-Lack of equipment and access to them-Safety and storage depots-Supply of raw materials.
16. The risk caused by commitments and guarantees	Major damages Lack of achieve anticipated performance and cash flows damage.
17. Technical risk (Design and Implementation)	The effective factors of risk listed in the table 2.

Identification and classification of risks in tunneling projects

In discussion of risk management the important point is the identification and classification them at first. This work recognized the management area. Considering the extent of various risks therefore their management will be very diverse. Project risks in a macro view directly defines with issues such as time and cost of project If the definition and design and during runs more risk have in tools and different method.

Reilly & Brown (2004) types of associated risks with tunneling projects have enumerated such (Reilly and Brown, May 2004):

- The risk of damage or defects with death potential and personal injury, and equipment high and economic risks and the loss of credibility for people involved.
- The risk of lack of achieving standards and defined criteria in design, support operation, and quality
- The risks are a significant delay in the completion and launch of its income
- Risks, serious increase in the cost of project and its support

In some other sources risks are divided into three categories (Jafari, A. *et al*,. 2005):

- Material damage to the building, machinery, devices and equipment.
- Material damage to property of third parties.
- Physical injury to employees or third parties

Yogaranpan (1996) for risk management of tunneling projects has been used risk general classification He divided risks to four types: natural, (floods, storms, earthquakes, etc.) external (economic, political, etc.) internal (strategic, weak planning, etc.) and manpower (accidents resulting in injury, etc) (Yogaranpan, Yoga M., 1996).

- Risks construction and design
- The risk of operation and maintenance
- Other risks such as changes in the law, tax

Dud deck (1987) the risk of underground spaces projects is dividing in three categories: structural, contract and functional. This division has

Table 2: Factors influencing technical risk

Technical risks: Design and Implementation	
Design risk	**Implementation risk**
Performance and design standards	The complexity of the project Implementation
Unreliable data and information	Contractor Qualification, experience, capacity
The complexity of project in design	Inaccuracy in the Implementation
Defense of plan	The review
Consultant Qualification: Experience, capacity and capability	Rework
Inaccuracy design	Topographies of insufficient evidence
Surface Review	Communication within the team, buildings (old buildings), power plants
Rework	Technical Specifications weak
Insufficient evidence and drawings	Technological problems
The lack of documents	Technical specifications and standards respect
Experience and skills of staff	Inappropriate system performance
Testing, inspection and surveillance	Lack of timely supply of goods and materials
Community Team: buildings, installations and electrical	Lack of access to administrative equipment
defect of Detailed design	Manufacturer relationship with the operation
Technical Specifications weak	Type and size of project
Changes in design and scope of work	the project is duplicate or not
Lack of adjustment of plan in detail	Interruption of work
Designer communication with the final operation	component Contractors
Type and size of project	The non-executive
the project is duplicate or not	Delays
The non-executive	Failure to fulfill the project objectives.
Delays	Failure to achieve anticipated performance
Failure to achieve anticipated performance	Poor quality
Poor quality	Setup problems
Setup problems	Unacceptable results for roughing
Unacceptable results for roughing	Strategic issues, maintenance, operation and training
Strategic issues, maintenance, exploitation and training	Skilled and professional manpower
Non-consolidated in Important positions on the site and workshop equipment	

largely based on the time and duration of life is an underground structure. Functional risks were relating to the exploitation of an underground structure and is taking the failures is related to the purpose of construction of underground structures (Dud Deck, H. 1987).

Einstein (2006) Special problems are occurring in the construction of underground spaces and there are difficulties for Geotechnical studies makes it check and emphasize on the creation causes of accidents in underground spaces are essentially natural or technological, natural factors Contains:

Structure and properties of geological formations, uncoordinated, groundwater conditions, geological processes, events of related to the earthquakes, erosion, karst and geothermal heat. Technology factors are associated with human engineering activities. Disorder in the earth tensions field and deformations caused by drilling; Collision

with the surface infrastructure and the Changing balance level of static and ignoring criteria the construction (Hayati, M.1388).

We have failures in tunneling series, if the failure occurs after completion of the construction contract, the responsibility would be with the employer, examples of possible failure in Completion of structures construction is shown below:

- Concrete cover corrosion or erosion of rocks bolt over time (inadequate durability)
- Collapse stone blocks or the topical falling due to unstable rock mass
- Seal break
- Deformation of large reptile in rocks salt or erosion time function
- Instability Of time function in foundation stone among caverns

The risk of occurrence of these cases returns to the employer and the contractor. The main topic is risk division between the employer and the contractor as kind of risk. As was determined from the above classified in this division there are two kinds' attitudes. In the first attitude are considered all projects risks. In this type of classification should be measured all kinds of risks with their impact on project features that include: cost, time and objectives. Of course, it should be noted when evaluating the Risk of a project is considered as a macro can be used public divisions like management institute classification.

Another look Acceptance insurance risks or in other words acceptance insurance risks or operational risks are considered. In this type could be classified potentials failure in financial damages, staffing and responsibilities. In this type could be classified failure potentials due to financial damages, staffing and responsibilities. This type of risk can be classified as one of the branches of Project Risks. So that the classification Dud deck structural risk is considered. However, given to the area extent related risks to a project at first must be determined clearly the aim of risk before project definition and start it and tracing any kind of risk management.

Given the growing importance of tunnels and underground spaces of various aspects such as environmental protection, safety, energy saving, reducing the distances and direction necessary to study, design and implementation issues of this kind of structures is more than before evident.

Also, there are many reason losses of life and property in last decade in tunnel that it has special significance in risk management discussion rely on any appropriate method with basic of project in 1990 and recognized as one of a project (Hayati, M.1388).

Sets of tunneling projects risk have been classified in two categories of internal and external risks consist of seventeen levels according to the RBS method. Risks breakdown structure 17 fold of is presented in Table 1 (Edalati Pour, M.jlaly, S (2002) (Ansari, M. 2006) (Baloi, et al, 2003) (McCabe Brenda, 2003) (Miller, roger, et al, 2001) (Touran, et al., 1994):

CONCLUSIONS

It can be seen that given the variety and large number of risks that affect the tunneling projects practically without a systematic process and correct to identify and manage them any attempt to understand and deal with them faced with the problem and their success is seen with skepticism. For this reason especially in recent years, risk management and consequently the identification of appropriate and timely risks Is located in Particular attention. Using of RBS method could be help to this work, Because this method is offered an effective tool to identify targeted and risk classification finally, necessary measures should be done in right direction for monitoring and control the systematic process of risk management, in this study structure proposed can serve as a basis for explaining the risks of tunneling projects to be developed and be adjusted with the type of project.

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