



**Risk and Disaster Management in Construction**  
ENGR. YASEEN MAHMOOD

**MID ASSIGNMENT**

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## **QUESTION 1**

**Considering the Bus Rapid Transit (BRT) Peshawar, what were the risks involved during construction associated with the technical aspects of the project? Support your answer with logical and factual arguments along with references. State how we could counter the risks associated with the technical aspects.**

## **ANSWER:**

### **TECHNICAL RISKS**

Technical risks include anything that restricts you from creating the product that your customer wants. This can include uncertainty of resources and availability of materials, inadequate site investigation, environmental hazards or incomplete design. These risks can commonly occur when there are changes in project scope and requirements, and if there are design errors or omissions.

Bus Rapid Transit is a huge mega project in the center of Capital City of the KPK Province, Peshawar. It has been a question of risk management since then.

The major technical risks & the ways that could have been encountered, in BRT Project are as follows:

#### **1. OWNER INVOLVEMENT IN DESIGN**

The involvement of the political and ruling party created a high risk for the smooth execution of the project in designed time. The personal and unprofessional attitude of the owners i.e. The Ruling Political Government, created technical issues in the project. Disturbing the design makes it a technical risk in the project.

This risk could have been countered by letting the experts and professionals handle the design in a suitable time frame and the owner should have not interfered in the process.

#### **2. INADEQUATE AND DEFECTIVE DESIGN**

One of the highlighted and main risk at design level is carried out in the initial stage of the project. The consultant designers needed 2 years for designing the Project of BRT in a proper and planned manner and instead they were pressurized and insisted to carry it out in 6 months. That is why the design is changed multiple times during the construction. This created a high risk for the project on technical side. The design of the project is highly disturbed and compromised. The inadequate and incomplete design is due to the haste nature of political agendas. From East to West of the city the only corridor is compromised and the mix traffic carriage way is restricted and congested by constructing the BRT Track at grade makes it a technical risk in the design. In the areas where the track is elevated (Reach 2 of BRT), the risk is minimized.

This Technical Risk could have been resolved by authorizing the design consultant to make a proper design in a designed time frame. The designer should have considered all the possible perspectives of the project into consideration, so that the issues pertaining to the project, would have been minimized.

#### **3. INADEQUATE SITE MANAGEMENT:**

The site activities were not properly supervised and monitored. The contractor, consultants and client had their differences that created a risk for the project in every aspect. All of the work packages include a single lead contractor, which compromised the ability to maintain sufficient staff on all the sites at all times.

This risk might have been catered for by properly following the project management principles and developing a good communication between all the prime stakeholders.

#### **4. ERRORS IN COMPLETION OF STRUCTURAL / GEOTECHNICAL / FOUNDATION**

Due to the hasty design, no proper geotechnical investigation is carried out, because of which in the city area, Pile depths created a serious issue in the later stages and they were to be increased, that cost the government, financially and physically.

A proper geotechnical investigation in a sufficient time frame, standardized field testing and adequate strata reports could have been minimized this risk of the project.

#### **5. TAKE OFF DATA AND TRAFFIC DEMAND**

The project from its initial stages is always of a hasty nature. Due to the shortage of time, no proper traffic count is calculated and congestion is created on the mix traffic carriageway. The traffic demand is not properly encountered and is not supported by accurate data.

This is a huge project in a built-up area of the city and a detailed traffic data survey and collection should have been gathered in a sufficient time period to encounter this risk. A third party should have been involved to review the design based on this data which may have minimized the risk on certain level. Moreover, A proper time shall be given to the designer in the end stages of the project to minimize this issue.

#### **6. POOR DRAINAGE SYSTEM**

Another major technical risk in the BRT project is the ill planned drainage system. That is why every time when there is rain in Peshawar, the public has to face minor floods and the traffic is jammed at Reach 1 and Reach 3. This is also because of the flawed design of the project that creates such a major risk.

As the major portion of this project is traversing a huge built up area, a new drainage system should have been designed at areas where the corridor is at grade, but instead the drainage of the corridor was connected to the old drainage system with minor improvement, that does not fulfil the demand of the city.

#### **7. EXTENDED DURATION OF CONSTRUCTION**

The project was announced to be completed in a period of 6 months, which is not feasible for such an enormous construction. The project was extended multiple times due to the lack of proper plan for the execution of works in due time. The extended duration of construction created the whole fuss in the public and created a major risk for the public and project.

The said risk could have been addressed in the initial phase by calculating the total feasible time required for the completion of such a mega project. The previous such like projects and the prevailing conditions at the project location, should have been taken into consideration before fixing the time period of the project.

#### **8. WORK PERMISSIONS**

The permissions of many of the departments delayed the work and increased the risk remarkably. WAPDA, SUI GAS, PTCL, RAILWAYS and most importantly, The Cantonment Board created a chaos during the execution of the work. This risk was not brought into light in the start and that is why the project has to pay for it. The Aman Chowk Situation is still a conflict between Peshawar Development Authority (PDA) and the Cantonment Board.

In order to minimize this risk and smooth work flow, all the involved client departments along with the cantonment board should have been taken on board to remove any conflicts and do their part, in the execution phase of the project. Moreover, this is an ongoing issue and can be addressed through proper channel and as soon as possible so that the project won't suffer anymore and shall not be delayed any further.

## **9. UTILITIES**

The Underground Utilities were not visible and no proper investigations were carried out to encounter it. Telephone Cables, Gas Pipelines, Water Supply Pipelines and Electric installations were to be found out after execution of work. Such as the gas pipeline situation that arose at the Hashnaghri bus station.

This could have been a minor issue if the project would not have been in such built up area with high traffic volume. However, to reduce the impact of this risk the charges associated with the utility shifting should have been paid to the concern departments prior to the commencement of execution phase.

## **10. MECHANICAL AND ELECTRICAL BREAKDOWN**

The BRT Elevators, Intelligent Transport System (ITS), Automatic Doors, Escalators and the control room machinery is run through electrical and mechanical system. If at any time any breakdown in this system occurs, it's going to shut the whole conveyance and thus is a major risk to the project. As the project is currently undergoing mechanical and electrical installation phase, suitable precautionary measures and standard operating procedures, should be adopted to encounter this risk in future.

## **CONCLUSION:**

The BRT Project has been criticized over a couple of years now. The risks associated with the technical aspect of the project are considered to be major issues of the project. Encountering and addressing these risks, shall make the way smooth for the project execution and minimize the delays.

## QUESTION 2.

You are going to initiate a construction project. During the project, annual probability of occurrence of a hazardous event is (ID/6585200). If the event occurs, then the cost of the loss will be 45,275,000 US\$ (consequence). By referring to Table 2.1 & Table 2.2, identify the risk level in risk matrix shown in Figure 2.1. Hint: You can take help from the lectures and the book "Risk Analysis in Engineering and Economics" by Bilal M. Ayub.

**Table 2.1**

Likelihood Categories for a Risk Matrix

Category	Description	Annual Probability Range
A	Likely	$\geq 0.1$ (1 in 10)
B	Unlikely	$\geq 0.01$ (1 in 100) but $< 0.1$
C	Very unlikely	$\geq 0.001$ (1 in 1,000) but $< 0.01$
D	Doubtful	$\geq 0.0001$ (1 in 10,000) but $< 0.001$
E	Highly unlikely	$\geq 0.00001$ (1 in 100,000) but $< 0.0001$
F	Extremely unlikely	$< 0.00001$ (1 in 100,000)

**Table 2.2**

Example Consequence Categories for a Risk Matrix in Monetary Amounts (US\$)

Category	Description	Cost (US\$)
I	Catastrophic loss	$\geq 10,000,000,000$
II	Major loss	$\geq 1,000,000,000$ but $< 10,000,000,000$
III	Serious loss	$\geq 100,000,000$ but $< 1,000,000,000$
IV	Significant loss	$\geq 10,000,000$ but $< 100,000,000$
V	Minor loss	$\geq 1,000,000$ but $< 10,000,000$
VI	Insignificant loss	$< 1,000,000$

Probability category	A	L	M	M	H	H	H
	B	L	L	M	M	H	H
	C	L	L	L	M	M	H
	D	L	L	L	L	M	M
	E	L	L	L	L	L	M
	F	L	L	L	L	L	L
		VI	V	IV	III	II	I
Consequence category							

**Figure 2.1 Risk Matrix (L: Low, M: Medium, H: High)**

# ANSWER:

## STEP 1: ANNUAL PROBABILITY OF OCCURRENCE

ID: 15489 and Annual Occurrence: ID/6585200

Therefore; **Annual Probability of Occurrence = 15489/6585200 = 0.00235**

## STEP 2: LIKELIHOOD PROBABILITY CATEGORY

From Table 2.1, the said hazardous event comes under, **CATEGORY C (VERY UNLIKELY)** having Annual Probability Range of **≥ 0.001 (1 in 1000) but < 0.01**.

Likelihood Categories for a Risk Matrix

Category	Description	Annual Probability Range
A	Likely	≥0.1 (1 in 10)
B	Unlikely	≥0.01 (1 in 100) but <0.1
C	Very unlikely	≥0.001 (1 in 1,000) but <0.01
D	Doubtful	≥0.0001 (1 in 10,000) but <0.001
E	Highly unlikely	≥0.00001 (1 in 100,000) but <0.0001
F	Extremely unlikely	<0.00001 (1 in 100,000)

Table 2.1

## STEP 3: CONSEQUENCES CATEGORY

Cost of Loss in Case of Occurrence = **US \$ 45,275,000**

From Table 2.2, the above-mentioned cost of loss is categorized as

**Category IV (Significant Loss) with range of ≥ 10,000,000 but < 100,000,000.**

Example Consequence Categories for a Risk Matrix in Monetary Amounts (US\$)

Category	Description	Cost (US\$)
I	Catastrophic loss	≥10,000,000,000
II	Major loss	≥1,000,000,000 but <10,000,000,000
III	Serious loss	≥100,000,000 but <1,000,000,000
IV	Significant loss	≥10,000,000 but <100,000,000
V	Minor loss	≥1,000,000 but <10,000,000
VI	Insignificant loss	<1,000,000

Table 2.2

## Step 4: Risk Matrix

The risk matrix given in Figure 2.1 shows that for **Probability Category of C** and **Consequences Category of IV**, the Risk Level shall be **“LOW (L)”**.

Probability category	A	L	M	M	H	H	H
	B	L	L	M	M	H	H
	C	L	L	L	M	M	H
	D	L	L	L	L	M	M
	E	L	L	L	L	L	M
	F	L	L	L	L	L	L
		VI	V	IV	III	II	I
	Consequence category						

Figure 2.1