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***SUBJECT: Risk And Disaster Management In Construction***  
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***SUBMITTED TO:***  
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***Date: 26 April 2020***

***Question 1. Considering the Bus Rapid Transit (BRT) Peshawar, what were the risks involved during construction associated with the technical aspects of the project?***

**Risk:**

Risk is the possibility of something bad happening. Risk involves uncertainty about the effects/implications of an activity with respect to something that humans value (such as health, well-being, wealth, property or the environment), often focusing on negative, undesirable consequences. Different practice areas of risk management have used many different definitions.

Risk originates from the Latin term *residuum*, which means the challenge presented by a barrier reef to a sailor.

**Introduction:**

Millions of cities currently in the world are facing with serious problem of overcrowding and contamination; they are continuously searching for cost effective, efficient and reasonable source for public transports improvements. It is evident that a well-organized and cost effective/saving public transport system is vital for daily nonstop journey of peoples within big cities. Public transport is now dream for the peoples, proper Government transport system is not available in Pakistan and all the system has gone into the hand of private sector transportation whose management is flop and not coordinating with public demand. BRT system is now getting worldwide recognition as a unique system which provide best and optimal solutions for giving high standard mobility services with reasonable /affordable prices to the urban peoples in developed and as well as under developed countries in the world. BRT provides high-quality services with reasonable price customer care transportation that is responsible for providing standard and unique services to the urban peoples [III]. The purpose of BRT is to reduce traffic congestion; it is built on corridors - a separate and safe way. Future planner prefers those places for BRT where they expect more traffic congestion in future [V]. BRT contains similar features like a light rail or metro system, due to its virtue it is consider much more consistent, suitable and faster than any customary transport service. Due to its tremendous features, BRT is capable to control the causes of delay and other related issues such as being stuck in rush hour gridlock and lining to pay on board. BRT camber defined as inelastic, rubber tired, rapid transit means that combines locations, automobiles, facilities and ITS origins into a unified arrangement with solid progressive identity that summons an extraordinary picture. The concept of (BRT) is basically based on public transport system within a specific city, planned to improve mobility/ journey capacity and consistency with the view to improve the deficiencies of a conventional or traditional transportation system.

**Risks Involve During Construction Associated With The Technical Aspects Of The Project:**

Risk associated with technical aspect of project is sort of machines, processes, and materials risk in industry, transport, communication,

**Some of major's risks in technical aspects are given bellow.**

## ➤ **Extended Duration Of Construction**

*In most of the projects it seen that when the duration increase for project, greater chances of hazard can occur because project exposed to environment for risk occurrence. Where BRT extend from 6 month to*

*2.8 years. However, in certain circumstances, there are seasonal hazards which occur at specific times of the year and thus require special consideration if the period of construction is to be extended. These hazards include rainfall, temperature changes, flood, storm and wind. To illustrate this point, the example of BRT Peshawar may be cited.it is a project in very congested area which is exposed to every type of accident such as vehicle accident, traffic jam machinery fail, girder fall and heavy rain, due to BRT Peshawar, traffic every time jam in few areas, vehicle accidents occur and also due to time extension, budget increase from Rs49 billion to Rs68 billion.*

[The K-P government started the project in October last year with the former chief minister Pervez Khattak claiming that the project would be completed within six months. The first deadline set for the completion was April 20 which was extended to May 20. The then Project Director BRT and Director General of Peshawar Development Authority Israrul Haq then told media that the project's civil work would be completed by June 20 which too has been unachievable].reference: Peshawar BRT launch further delayed till end of the year

By [Sohail Khattak](#)

Published: June 29, 2018

*[The cost of the Peshawar Bus Rapid Transit project has gone up from Rs49 billion to over Rs68 billion due to the changes to its design and 'adjustment' of the Asian Development Bank funds, the provincial cabinet's last meeting was informed on Thursday].REFERENCE:*

[BRT cost goes up to Rs68bn](#)

[Bureau Report](#) May 25, 2018



## ➤ **Technical Complexity And Innovation In Design Requiring New Methods Of Construction And/or Erection**

When traditional materials or methods are used in construction, the familiarity of those involved with the design or the work itself may permit an occasional ambiguity in the drawings or specifications without them being misinterpreted. It may even provide correction of a mistake. However, in a new design, material or construction method, what is needed is precise and thorough communication between the designer, manufacturer or contractor, as the case may be, and others involved in the construction process. Examples

**BRT Peshawar is a new project and all technology new for a developing area such as KP where the designer was also a foreigner which was not familiar as required for such backward area project. Where BRT was design in first time.**

Brt Peshawar working and machines latest technology the Brt is one of the mega project in Peshawar in this project is showing you latest technology is unseeded like mixture machine and concrete machine and so on. Reference:[ [brt Peshawar working and machines latest technology](#)]



### ➤ **Defective Design:**

In project planning stage a lot of items are missed such as drainage routes, gas pipe line and crossways are not included in designing therefor during project execution stage engineers as well as executer face a lot of problem. After completion of major part of BRT, when buses were brought from china and start testing on road, the given design was defective and not suitable to given design. According to following paragraph.

The ADB has warned in clear words that BRT buses could collide at stations number 10, 12, 15 and 26 during operations because the lane width is less than the minimum requirement of 6.5 meters.

“It is disappointing that the directional arrows are entirely missing from the implementation. As a remedy, it will not be acceptable to merely place taped Arrows on the surface,” the ADB correspondence read.

In yet another glaring deviation, the curb interface between the vehicle and the platform does not meet the Kassel curb design mandated in the detailed design of the project.

“The lack of an effective curb means that the docking process will be slow, inefficient and potentially damaging to the vehicle tires,” the lender observed.

The width of the lane, against the requirement of a at least 6.5 meters, is generally below the minimum threshold at many stations, which the ADB noted “Causes concern over the safety and efficiency of the operations”.

“There is significant concern of corridor lane widths at turns near BS10, BS12, BS15 and BS26. Over the course of operations, the current design may well Result in collisions between BRT vehicles,” according to the ADB correspondence

reference: [Asian Development Bank finds 'deadly flaws' in Peshawar BRT project ]

By **Shahbaz Rana**

Published: July 7, 2019



➤ **Dangerous Substances And Items During Construction And/or Commissioning:**

*It is stated that poor substances low quality material is used during construction of BRT Peshawar. Such as corroded steal used and concrete which initial setting time over run, due to these dangerous substances the time as well as authenticity become lower. According to following statement:* the ADB stopped the provincial government from making future payments to contractors because of the poor quality of work. The ADB loan will not be disbursed further until the provincial government introduces changes in the design to address “Critical” deficiencies.

The inferior quality construction could damage the project’s reputation at the international level, warned the lender that had approved a \$335 million (Rs53 billion) loan for the project in mid-2017. reference: [Inferior quality material used in Peshawar BRT project: ADB

ANI | Asia Last Updated at July 7, 2019 19:40 IST



➤ **Defective Workmanship and Material:**

The warranty of incorporating or using only good workmanship and material is implied in construction contracts. Despite that warranty, one finds that as long as quality means perpetual care and high cost, this risk of defective workmanship and material will always exist. Even the smallest defect can sometimes cause a disastrous effect, as happened in the case described below.

The stair step height varies “considerably”, which presents a safety problem. “The mild steel flooring material utilized for the ramps and stairs is of an



Unacceptable quality,” the ADB noted.

At many places, pillars or stairways “do not align properly”. At certain stations, the stairs and escalators have been built in the middle of the stations, obstructing walking space. “The footpaths are blocked by the placement of the public toilets and stairways,” according to the correspondence. Reference: [ **ADB finds 'deadly flaws' in Peshawar BRT project**]

By **Shahbaz Rana**

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### ➤ **Defective design, workmanship and quality control:**

The critical deficiencies would result in improper docking of buses at the stations and could cause injuries to passengers as well. The tiles are slippery and directional arrow tiles are missing as well

The ADB noted that there were “significant design deviations from the agreed detailed design that impede or degrade system performance.

The provincial authorities also used “inferior material” that both harm system functionality as well as deliver an aesthetically inferior product, according to the correspondence.

The lender’s third major objection relates to the lack of adequate construction supervision and communication. The ADB seeking modifications to remove the defects might not only slow down the completion of the already much-delayed project, but also further surge its cost. Reference: [ **ADB finds 'deadly flaws' in Peshawar BRT project**]

By **Shahbaz Rana**

Published: July 7, 2019



### ➤ **Inadequate Site Management:**


*The inadequacies of site management not only delay the project but also sometime cause the main failure of whole project. See the following paragraph about BRT Peshawar*

**Considering his position at the BRT as an assistant engineer, Gohar went on to say, "The contractor has not yet submitted any schedule for the completion of BRT neither project nor progress report has been submitted to any concerned department.**

"The contractor of the project has [sublet] the entire project to different non-technical people who don't even know about construction."

He further claimed that the site inspector did not have any "drawings and specifications of the project" with him to help guide the engineers.

"The engineers were found just to visit the site without any drawing and specifications."reference[Peshawar BRT management dismisses corruption allegations as 'baseless']

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**Question 2.** You are going to initiate a construction project. During the project, annual probability of occurrence of a hazardous event is (1D/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 the risk matrix shown in Figure 2.1. Hint: You can take help from Lecture and book "Risk Analysis in Engineering and Economics" by Bilal M. Ayyub .

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)

### **GIVEN DATA:**

Annual probability of occurrence of hardiouse event is (ID/6585200), where

“ID” Show ID card no, my ID CARD NO=13544, NAME sheharyar khan

If event occur, the cost of the loss will be

“45275000US\$” NOTE: {by referring table 2.1 and 2.2}

### **REQUIREMENT:**

Identify the risk level in risk matrix in fig: 2.1

### **SOLUTION:**

#### **Step no 1:**

First to find out the annual probability from above mention

statement. Annual probability value= $ID/6585200$  1

Where ID=13544

Putting the value in equation no 1

Annual probability

value= $13544/6585200$

=.002057

#### **Step no 2:**

To select likelihood category for RISK matrix from table 2.1



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)

Putting the value in table 2.1

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	$\geq 0.0020$ 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)

So from table 2.1

It show category "C"

**Step no 3:**

To select the consequence category in table 2.2 for a risk matrix in monetary amount.

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	$< 1,000,000$

Putting the value in table 2.2

**Table 2.2**

**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

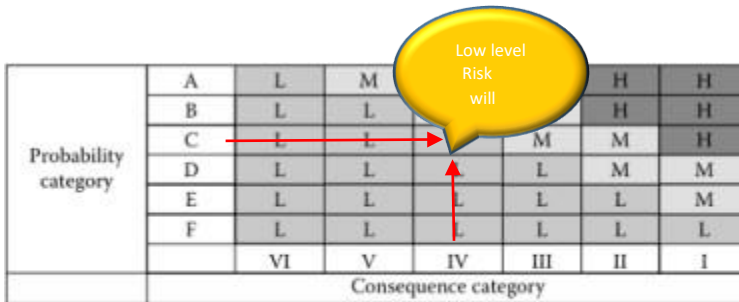
45275000 > 10,000,000 but < 100,000,000

So from given table it show “category IV” “significant loss” will occur

**Step no 4:**

To find out the risk level in the risk matrix

fig.2.1 put the value in Figure 2.1



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

**Conclusion:**

From above value this show that the risk is low level and it can be neglected because of the probability of occurrence is very low.