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STUDENT REGISTRATION NUMBER (ID): 14662

SUBJECT: Risk and Disaster Management in Construction

### 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.

Hint: You can take help from book "Risk and Insurance in Construction" by Neal G. Bunni I.

### Short Introduction of BRT:

BRT stands for Bus Rapid Transit. Bus rapid transit (BRT, BRTS, bus way, transit way) is a bus-based public transport system designed to improve capacity and reliability relative to a conventional bus system.

### BRT Corridor

A BRT corridor is section of road or contiguous roads served by a bus route or multiple bus routes with a minimum length of 3 kilometers (1.9 miles) that has dedicated bus lanes.

### Peshawar BRT

The project is named as "Peshawar Sustainable Bus Rapid Transit Corridor Project".

### Planning and Execution

A 20 year public transport road map was developed in Urban Transport Pre-feasibility Study (PFS) which was completed under City Development Initiative for Asia (CDIA) in May, 2014. Six corridors were identified by the Pre-feasibility Study which formed the basis for Bus Rapid Transit (BRT) system of Peshawar. They are to be developed through a phased, corridor-based investment program as part of the 20-year public transport road-map. The project is being undertaken by the Go KP as a high priority project conceived by CDIA pre-feasibility study and PPTA feasibility/ preliminary engineering design study (Dec, 2016). Both studies were undertaken through ADB grant.

Planning and Development Department Government of Khyber Pakhtunkhwa (Annual Development Program) with Financial Assistance from Asian Development Bank (ADB) are the main sponsors of this project whereas, Trans Peshawar and Peshawar Development Authority (PDA) under the Khyber Pakhtunkhwa Urban Mobility Authority (KPUMA) is executing the project. The maintenance and operations of the BRT Peshawar will also be carried out by KPUMA and Trans Peshawar.



Figure 1. BRT Feeder Route reach 2

### WHAT IS RISK?

In the middle of 1700 AC English language/literature picked the famous word RISK from French language, which is actually risqué in French.

The concept of risk can be linked to uncertainties associated with events. Within the context of projects, risk is commonly associated with an uncertain event or condition that, if it occurs, has a positive or a negative effect on the objectives of a project.

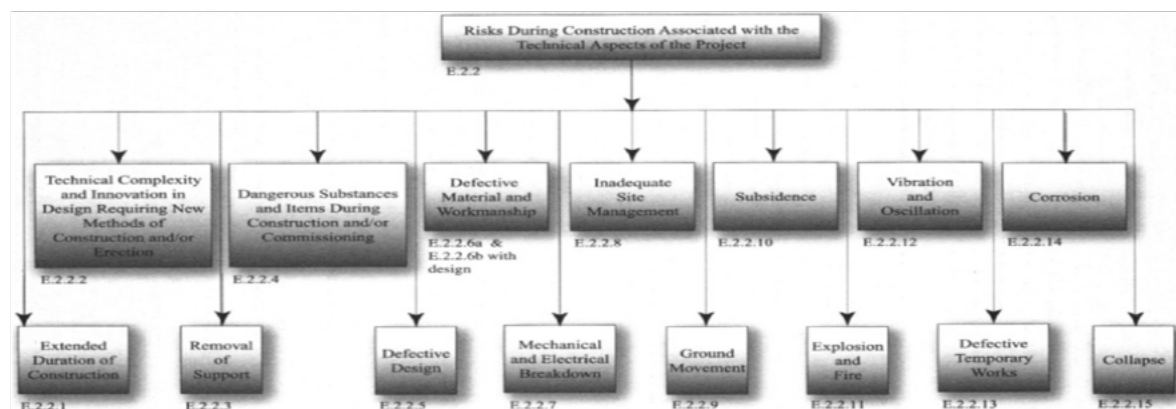
Risk originates from the Latin term *risicum*, which means the challenge presented by a barrier reef to a sailor.

Oxford Dictionary defines risk as the chance of hazard, bad consequence, loss, and so on, or risk can be defined as the chance of a negative outcome.

**Risks involve during construction associated with the technical aspects of the project:**

In above definitions we define that risk is uncertain events or conditions so technical means involving the sorts of machines, processes, and materials that are used in industry, transport, and communications.

**Risks During Construction Associated with the Technical Aspects Of BRT Project.**



**1. Technical complexity and innovation in design requiring new methods of construction and/or erection**

Once a project passes from the feasibility stage to the design stage, the decision-maker, amongst other things, must have assessed the implications of the various risks. 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. Example:

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 as for London BRT design.

**2. Dangerous substances and items during construction and/or commissioning:**

The following example from BRT highlights the effect of such substances on construction work. Shortly after commencement, the boring process was carried out in reach III when boring machine driver accidentally touch the electricity wire, whole of the machine become short and the driver die on the spot, another dangerous event that was very common in BRT sit back, that was sanitary pipe/channel which was not properly design in BRT and when drainage come a cross, after that event occurrence design was repeatedly changed.

It is stated that poor substances low quality material is used during construction of BRT Peshawar. 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 projects 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

### **3. 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. The critical deficiencies would result in improper locking of buses at the stations and could cause injuries to passengers as well. The tiles were 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 lenders 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

### **4. Inadequate site management Mechanical and electrical breakdown**

Inadequate site management in BRT Peshawar has been held several times. Traffic system in the city is totally mess with thousands of motorist suffering due to poor management BRT site work. Traffic congestion on the road of KP capital of Peshawar getting worse day by day .Considering the statement of an assistant engineer, he says, "The contractor has not yet submitted any schedule for the completion of BRT 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 'PUBLISHED IN

Thursday May 31 2018  GEO NEWS

### **5. Extended Duration Of Construction**

According to Neal G. Bunni the longer the period of construction, the greater is the probability of

occurrence of the hazards to which a project is exposed. 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 extended 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 failure, girder collapse and heavy rain. Due to BRT Peshawar, traffic mostly jam in few areas, vehicle accidents occur and also due to time extension budget increase from 10billion to 90billion because of devaluation of Pakistani rupees.

#### **6.Defective Design**

After completion of major part of BRT, when buses was brought from china and start testing on road the given design was defective and not suitable to given design of bus so major portion of BRT was redesign for buses and due to this defective design some part of BRT demolish for redesign and thus the whole project delayed. Under the BRT project, 220 buses were to be purchased: 65 of them with 18-metre size for the main corridor, while 155 buses of 12-metre size were to be run on feeder routes. However, until now only 21 buses of 12-metre size have reached Peshawar. The project manager was responsible for it because the design of road was just about the design for buses which it length and width was change then those which PM given design to BUS company and also the design of BRT changed several time because of defective designer.

#### **7.Corrosion**

The corrosion seems to be an all-pervasive phenomenon causing widespread destruction of all types of structures in all countries across the world and has come to be termed as Cancer for concrete. According to ADB the bodies of the buses are made of non-corrosive material. Similarly, the body is made up of a material which is durable enough to handle direct sunlight. The source believes that there is a risk of corrosive material that is used in BRT buses so there is a risk of corrosion.

#### **8.Removal Of support:**

The risk of removal of support has usually very serious consequences, even in minor parts of the work. During execution of false work in section 2, several risks of collapsing the fly over and bridges were countered. The plywood that support the structure in several point of flyover near Phase 3 collapse several times. The big reason why the false work in BRT collapse due concrete placing methods or the use of form vibrators which can transmit compressive waves to the outermost members of the false work.

#### **9.Ground Movement:**

Ground movement could take place from a number of causes, including landslides, frost heave, earth slips and ground pressure leading to collapse. Ground movement in BRT Peshawar has only occur near Hayatabad Depot during construction of flyover.

#### **10.Subsidence:**

In a natural example of groundwater-related subsidence, the erosion of bedrock due to moving groundwater can cause cave-ins, which are an extreme case of subsidence. In BRT no subsidence occur.

#### **11.Explosion and fire:**

No explosion and fire incident occur in BRT Project.

#### **12.Vibration and Oscillation:**

No vibration and oscillation incident occur in BRT Project.

### 13.Collapse:

Sources have said that roof of Gul Bahar underpass is at the risk of collapsing because of seepage of water from the sewerage line. The sewerage water has started accumulating on different places in the underpass.

### Disclosure Of Monitoring Reports:

A report into the matter has been summoned from Peshawar's deputy commissioner. The mass transit project by the Pakistan Tehreek-e-Insafs Khyber- Pakhtunkhwa government has drawn strong criticism for costing billions more than the original estimations and missing completion deadlines on multiple occasions. It has also added to public woes due to lack of proper planning. Earlier on April 1, the provincial inspection team submitted a detailed report on the BRT project with an estimate that some people received kickbacks totaling around Rs7 billion.

### Idle Peshawar BRT corridors turned into stunt area by youngsters

Officials said the project was launched without any proper planning, blaming this for the repeated changes in the road construction plan. The inspection report submitted by the provincial inspection team to K-P Chief Minister Mehmood Khan expressed serious reservations over the entire project by stating the project was initiated without any comprehensive plan. The team has found that the route was constructed without feasibility, geotechnical, sewerage, traffic and water supply studies, among other factors, being undertaken before construction of the route.

**QNO: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 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.

ANS: Risk matrices, also called heat maps, are basically tools for representing and displaying risks by defining ranges for consequence and likelihood as a two-dimensional presentation of likelihood and consequences. According to this method, risk is characterized by categorizing probabilities and consequences on the two axes of a matrix. Risk matrices have been used extensively for screening of various risks. They may be used alone or as a first step in a quantitative analysis.

Hazardous event =  $14662/6585200=0.00222$

Which fall under category C, VERY UNLIKELY.

Now according to given data the cost of loss is = 45,275,000 US\$

Which fall under Category IV, Significant Loss.

Likelihood Categories for a Risk Matrix

Category	Description	Annual Probability Range
A	Likely	$\geq 0.1$ (1 in 10)
B	Unlikely	$> 0.01$ (1 in 100) but $< 0.1$
<b>C</b>	<b>Very unlikely</b>	<b><math>\geq 0.001</math> (1 in 1,000) but <math>&lt; 0.01</math></b>
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)

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

Now in below the Risk Matrix are Given (LOW, MEDIUM AND HIGH) having two above parameter i.e Probability and Consequences Category.

According to given data the Risk Matrix Found to be "LOW"

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							

Result: Risk is LOW Category by using id no 14662.