MUSADDIQ NAWAZ

REG NO 14036

RISK AND DISASTER MANAGEMENT

SIRENGR. YASEEN MAHMOOD

Answer: 1

The **Peshawar Bus Rapid Transit (BRT)** is first of its kind project in Khyber Pakhtunkhwa (KP), Pakistan, which is under construction now, supervised by Peshawar Development Authority (PDA). The worth of the project is Rs. 70 billion funded by Asian Development Bank (ADB).

There are two phases of the project; east-west corridor and north-south corridor. East-west corridor (main corridor) is the first phase. PDA started construction on 29th October 2017. Its length is 26 km with 31 stations and 383 busses. (al)

Risk:

Risk is any potential harm or danger. It can be faced intentionally or unintentionally.

Risk Management:

Risk management is identification, analyzation and taking precautions to avoid the potential harm.

Risk can be associated to different spectrums. Here we discuss the spectrum of risk in construction.

Spectrum of risk in construction:

i.   Risk linked with the feasibility stage.
ii.   Risk linked with the design stage
iii.   Risk linked with site and location of project
iv.   Risk linked with the technical aspects of project
v.   Risk linked with acts of man
vi.   Risk linked with post-construction stage

Risk involved during construction with the Technical Aspects of the BRT Project:

Risk involved during construction with the technical aspects of the BRT Project	
Technical complexity and innovation in design requiring new methods	Dangerous substances and items (construction and commissioning)
Defective material and workmanship	Inadequate site management
Subsidence	Vibration and oscillation
Corrosion	Extended duration of construction
Removal of support	Defective design
Mechanical and Electrical Breakdowns	General movement
Defective temporary works	Collapse
Explosion and fire	

Technical risks associated with BRT are discussed below;

The Asian Development Bank (ADB) presented an audit report. The report pointed out twenty-two critical deviations from the original design in implementation stage which not only undermined quality but also safety of the public.

1. **Defective design:**
   It lacks universal accessibility features provisions for senior citizens and disable persons at some stations, glossy and slippery tiles in stations with potential threats to elders and children, road

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crossing, pedestrian flyover bridges, roundabout and parking facilities. The bus stations have not been designed properly. (Abbasi, n.d.) The width requirement for lanes is 6.5 meters in general. However, certain stations have lane width below the minimum threshold. The under designed station roofs would expose passengers to rain. Too much use of window glass could turn the stations into heat sinks. (Rana, n.d.)

2. **Technical complexity and innovation in design requiring new methods of construction:**
The poorly constructed substandard station designs have created blind spots that present potential risk of collision manifests certain technical complexities that needs new methods to overcome these problems. (Abbasi, n.d.) There is a significant deviation from the original design in curb interference between vehicle and platform. The implemented model does not comply with the Kassel curb design. It would affect the docking process. (Rana, n.d.) There are concerns about lane width near turns in BS10, BS12, BS, and BS 26. (Rana, n.d.)These imperfections might lead to safety concerns in future. So additional technical expertise and innovative solutions are required to address these issues.

3. **Defective material:**
Cheap, glossy and substandard porcelain tiles have been used instead of non-glossy and lustrous tiles, ignoring the original design specifications. This present a potential slippery threat to children, elderly and disable persons. The ADB audit report highlights substandard material used for sheds in bus stations. Poor quality of road fences has compromised road safety. The poor construction of transoms using substandard material undermines the strength of the structure leading to failure. (Abbasi, n.d.)

4. **Inadequate site management**:
There is a lack of coordination and clarity. The roles and responsibilities have been vague. There is no clarity in the purview of executive and implementing agencies. There has been a lack of transparent supervision and communication. ((ADB))

5. **Extended duration of construction:**
The deadlines of completion of the project have been extended multiple times. Delays are due to pre-construction and implementation elements. The pre-construction elements are delayed bidding and procurement time. Delays in design complexity and implementation in city center and cantonment area added to the extended duration of the project. ((ADB))

6. **Mechanical and Electrical breakdown:**
Electricity and telephone poles, underground gas, water and sewage lines have been interrupted due to excavation and construction works. These disturbances could have huge impact on certain factions. ((ADB)) According to ADB, the poor planning for drainage caused flooding on the University Road area. This could lead to mechanical failure of the structures and electrical failures resultantly. (Abbasi, n.d.)

7. **Corrosion:**
The roofs of stations lack finishing, hence poor aesthetic and lack rain catching channels. This would lead to corrosion in metallic parts of the roofs. The flooding would also lead to corrosion in metallic parts of structures. The elevated stations have no or under designed drainage system that makes them prone to corrosion. (Abbasi, n.d.)

8. **Vibration and Oscillation/Collapse:**
The poorly designed and constructed with substandard material structures have potential threat of vibration and oscillation that could lead to failure and collapse of the structures.

The above-mentioned risks associated with technical aspect of construction have been identified by the Asian Development Bank in its audit report. (Asian Development Bank, n.d.) It has identified twenty-two glaring technical issues in the BRT. The withdrew further funding until the flaws in BRT are addressed.

Suggestions:

Many of the mentioned issues could be addressed by sticking to the detailed mandated design of the project. For instance, the tiles could be used according to the specifications in the design. Similarly, the rail guards should be anti-cut and anti-climbing as mentioned in the design.

However, the drainage system in the underpasses, the turns and lane width issues on the flyovers requires special innovative solutions and technical expertise.

The window glass use in the station has the potential to turn them into heat sinks. That risk could be mitigated by planting more green trees around the stations.

Regarding the material quality, at certain points, items with lower quality could be replaced with better quality but there are certain points where substitution might not be possible, for instance columns. In such cases, reinforcement material could help in maintaining the strength of the structure. Additionally, those points with sub standard material should be announced low load areas and bus stations and crowds should be avoided at such points.

The corrosion issue could be addressed in two ways. First is to provide rain channels in the roofs where possible. Second is regarding the structures that could not be possible to change, for instance under passes and flyovers. In such a case, corrosion resistant materials should be applied to the corrosion prone material. For example, using galvanized material instead of bare material.

Certain issues could be addressed with better management. However, there are certain issues that could only be fixed with innovative solutions.

Addressing these risks would surely increase cost of the project and extend time duration of the project but safety of public should be the primary concern. If these issues are not addressed now, these are going to have certain implications. In case of future causalities, it is going to consume further resources that would ultimately add to the cost and repairing time would add to extended time. Better address them now before risking the public.

References

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Answer: 2

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.

GIVEN DATA

Annual probability of Hazardous Event $=14036/6585200=0.002213$

Cost of loss $=4527500\$$ US

REQUIRED DATA

Identify the risk level in the risk matrix

SOLUTION

$14036/6585200=0.002213$

Category C, VERY UNLIKELY

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)

The cost of loss is $= 45,275,000$ US$

Which fall under Category IV, Significant Loss

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	$<1,000,000$

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

Which is required.

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					