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Risk and Disaster Management in Construction

Question 01.

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

SOLUTION:

Risks in Construction:

Construction is a risky business. Each construction project is unique and comes with its own set of challenges and opportunities. Identifying and managing risks can be tricky but not impossible with careful planning and execution. When a risk turns into a reality it can disrupt and derail a project.

Risks can be financial, contractual, operational and environmental and can be caused by both internal and external sources.

Common risks in most of Projects including BRT:

- Safety hazards that lead to worker incidents and injuries
- Managing change orders
- Incomplete drawing and poorly designed scope
- Unknown site conditions
- Poorly written contracts
- Unexpected increase in material costs
- Labor shortage
- Damage or theft to equipment's and tools
- Natural disaster

- Issues with subcontractor and supplier
- Poor project management

When these risks come true, it may have serious impact on cost, schedule and performance of project which will lead to delay and disputes.

Types of Construction Risks:

If these risks are analysed on the basis of the effect they generate once they eventuate, two basic types of risk can be identified. The first type incorporates the risks which could lead to damage, physical loss, or injury and the second type incorporates risks which could lead to lack or non-performance of the contract, delay in completion of the works and/or cost overrun of the constructed project.

Examples of the first type of risk which involves damage, physical loss or injury include defective design, defective material, defective workmanship, acts of God, fire, human error and failure to take adequate precautions. Examples of the second type include late possession of the site, delay in receipt of information necessary for timely construction, changes in design, and variations to the original contract

Risks Involved During Construction of BRT:

Bus Rapid Transit(BRT) Corridor consists of about 29km long corridor starting from Chamkani and ends at Industrial State having 31 Bus stations.

In order to address risks involved during construction of BRT and to adopt proper risk control measure, Site Specific Environmental Management Plan (SSEMP) is developed and enforced by executing agency that providies specific guidelines for the implementation of necessary risk control measures in specific area of project.

Since construction of BRT conists of different type of activity, so nature of risks involved and its control measures are different for different construction activity.

Different activities involved in construction of BRT:

- Site Surveying and vegetation clearance
- Establishment of Work camp, Batching Plant etc.
- Dismantling of Asphaltic and existing structures including utilities.
- Earth work for Embankment
- Preparation of Sub-base and aggregate base course
- Construction of underpasses and sub-ways
- Bridges and Flyover

- Rigid Pavement
- Asphaltic Works
- Bus station Development
- Bus Depots Development
- Landscaping

Risks Accociated with different Activities:

S.No	Activity	Risks Involved	Risk Controls
01	Establishment of working camp, Batching Plant etc	Soil Deposited onto road from tires	• Establish road network within camp area to minimize soil deposits on external roads • Arrange regular washing of tires
		Stockpile erosion	• Cover the construction materials and spoils stockpiles with suitable material • Ensure curbing of stock piles at toes
		Noise and Vibration	• Construction Equipments and machinery should be properly maintained to reduce equipment noise. • Ensure strong foundation of fixed construction plants to minimize vibrations • Avoid un-necessary operations of machinery
		Traffic Congestion	• Properly plan movement of different machinery to avoid congestion • Installation of sign boards and ensure traffic regulations • Provide sufficient lighting at night within camp site.
		Fuel Spills	• Spill prevention trays will be used at refueling stations • Onsite maintenance of vehicles will be avoided • Regular inspections to

			check fuel leakages in construction machinery • Fuels, Lubricants and chemical will be stored in covered bounded areas.
		Dust Generation and Smoke	• Stack height of generators will be atleast 03 meters above groung • Water should be regularly sprinkled within project area • Stockpile material shall be slightly wetted before loading, particularly in windy conditions.
02	Dismantling of Asphaltic and existing structures and construction of rigid pavement	Noise and Vibration	• Construction Equipments and machinery should be properly maintained to reduce equipment noise. • Ensure strong foundation of fixed construction plants to minimize vibrations • Avoid un-necessary operations of machinery
		Dust Generation and Smoke	• Water should be regularly sprinkled within project area • Ensure covering of trucks by Tarpaulin sheets during disposal of dismantled material • Limit speed of such vehicles
		Community Safety	• Protect Public major hazards by providing Buffer strips or other method • Restrict public to enter into construction sites • No machinery will be left unattended
		Workers Safety	• Provide Job specific training to workers through TBT & Induction • Provide PPEs to all

			workers • Provide adequate warning signs to make aware workers
		Traffic Congestion	• Properly plan movement of different machinery to avoid congestion • Installation of sign boards and ensure traffic regulations • Lane availability for smooth traffic flow
03	Construction of underpasses and Flyovers	Noise and Vibration	• Construction Equipments and machinery should be properly maintained to reduce equipment noise. • Avoid un-necessary operations of machinery • Disallow excessive noise emitting equipment • Provide temporary Noise Barriers to mitigate exceeding noise DB
		Dust Generation	• Water should be regularly sprinkled within project area • Ensure covering of trucks by Tarpaulin sheets during disposal of dismantled material • Limit speed of such vehicles used in activity
		Labor Safety	• Provide Job specific training to workers through TBT & Induction • Provide PPEs to all workers specially working at height • Barricade site properly and provide standard scaffolding for easy access • Provide adequate warning signs to make aware workers
		Traffic Congestion	• Properly plan movement of

			different machinery to avoid congestion • Installation of sign boards and ensure traffic regulations • Lane availability for smooth traffic flow
04	Construction of Bus Depots and Bus stations	Noise and Vibration	• Equipment noise will be reduced by proper design and repair of construction machinery. • Noise from vehicles and power Generators will be reduced by use of proper silencer and mufflers • Avoid unnecessary use of machinery causing vibrations
		Falling Hazards	• Harness belt are provided for workers working and 2nd and 3rd floor of Depots • Loose materials or tools should not be placed at height unattended. • Safety mesh be provided where necessary
		Community Safety	• Protect Public major hazards by providing Buffer strips or other method • Restrict public to enter into construction sites • No machinery will be left unattended

Question 02.

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.

Table 2.1

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 2.2

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

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)

SOLUTION:

Annual Probability of hazardous event = ID/6585200

= 14914/6585200

= 0.002265

Comparing it with Table: 2.1.

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)

It means that Occurrence of said hazardous event falls in Category C, i.e. Probability of risk occurrence is Very unlikely (Rare and exceptional risks which have a less than 10% chance of occurrence).

If the event occurs, financial consequences (Loss of cost) = $45,275,000/-

Comparing Loss with 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

In terms of Loss in Cost, Consequences fall under Category-IV. It means that if event occur, there will be significant loss.

Now Comparing both these results with Figure: 2.1.

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						

Risk Level is Low (L).
Low (L) Risk Level can be treated as acceptable without review.

The End