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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: BUS RAPID TRANSIT (BRT) PESHAWAR:

Peshawar Bus Rapid Transit (Peshawar BRT) is a bus rapid transit system currently under construction by the Peshawar Development Authority (PDA) in Peshawar. Essentially the Peshawar BRT System will be a high quality bus rapid transit system which will provide fast, efficient, reliable and comfortable public transport system to the masses and cost effective urban mobility. The Peshawar Sustainable Bus Rapid Transit Corridor Project (PSBRTC) will contribute to the development of a sustainable urban transport system in Peshawar. The project outcome will be to improve public transport in Peshawar, directly benefiting a population of at least 0.5 million. The project will consist of two interlinked outputs:

- i) Full restructuring of a 26-kilometer BRT corridor, including BRT dedicated lanes, 31 stations, 3 depots, mixed traffic lanes, bicycle lanes, parking, sidewalks, green areas, energy-efficient streetlights and proper drainage to climate-proof the BRT infrastructure; and
- ii) Effective project management and sustainable BRT operations through institutional and organizational developments.

Risks involved during construction of Bus Rapid Transit (BRT) Peshawar:

Construction projects are sensitive to an extremely large matrix of hazards and thus to risks. This sensitivity is due to some of the inherent characteristics of construction projects. Peshawar Bus Rapid Transit Corridor Project is no different than any other construction project i.e. as with any other construction project, Peshawar Bus Rapid Transit Corridor Project has been associated with a number of hazards and risks. We will look into one (Technical) aspect of the risk associated with the project.

RISKS ASSOCIATED WITH THE TECHNICAL ASPECT OF BRT PESHAWAR:

Identifying the risks in a project is considered to be the first step in successfully managing/mitigating the risks involved in the project. It has been long established that construction project risks are interrelated and interdependent. Therefore, Technical Risks include, among others, poor design, inadequate site investigation, delay during construction and uncertainty over the source and availability of materials and appropriateness of specifications. Risks associated with the technical aspects of the BRT Peshawar are identified below:

1. Extended duration of construction:

The main risk associated and identified by the Asian Development Bank (ADB) at the start of the project was that of the unrealistic completion period of six months. The provincial government and the project's executing agency, the PDA, had earlier promised to open the project, launched in Oct 2017, within six months on April 20, 2018. However, the deadline was missed. The project managers kept changing the launch dates from May 20 to June 30 to Dec 31 in 2018 to March 23, 2019. This delay in completion of the project led to cost-overrun i.e. project's cost has jumped to Rs68 billion from earlier Rs49 billion (report compiled by the Provincial Inspection Team (PIT)). This critical delay in construction has also led to a myriad of severe consequences: stretching from increase in cost to immense negative impacts on the environment.

Mitigation/Countering the risks associated with the delay of the project:

Delay in construction projects has a negative effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, and cash-flow problems. Delay in project completion of BRT Peshawar could have been easily countered first by setting a realistic completion time period as opposed to the unrealistic six months completion period; and then by establishing a fix scope for the project before starting construction. Other measures that could have countered this unnecessary delay may include: Teamwork, Detailed investigations, Careful & regular monitoring and meetings, Effective management, Collaborative & effective working and coordination, Careful scheduling.

2. Defective design:

As with any other mega-project, the Peshawar BRT also has to face the risk of defective design. There was no detailed engineering design when the project was executed (Inayatullah, the former senior minister for Local Government and Rural Development).

BRT Peshawar is associated with defective and continuous changes to the design of the project. The continuous amendments to the design of various aspects of the Peshawar BRT project have seriously jeopardized the completion of the Peshawar BRT Project within the specified time limits. One example of such defective design is the reported changes or blunders that include deviation from the original design in the Aman Chowk where transit station was converted into an "S-shape" reverse curve. However, it was decided afterward that the initial design needed to be restored. One may also quote the report published by ADB regarding critical deficiencies in the project where ADB has identified that there is significant concern of corridor lane widths at turns near BS10, BS12, BS15 and BS26. ADB also warned that over the course of operations, the current design may well result in collisions between BRT vehicles. As per ADB annual report, minor changes in the design were carried out till the completion of structural elements.

There are a number of defective design blunders in the project such as the elevated structure at Tehkal Area, the design was changed on public demand and agitation for a U-turn provision; also no pedestrian crossing other than BRT bus station approaches had been planned in the project.

Extension of the route at various places has not only slowed down the pace of the work but is considered to be the leading cause of increase in speculated budget. The project has been started without any proper evaluation of roads, feasibility and planning due to which it has been

causing socio-economical and hazardous health issues (Inayatullah, the former senior minister for Local Government and Rural Development).

Mitigation/Countering the risks associated with Defective design:

Defective design in a project not only slows down the pace of the project but also induce unnecessary financial constraints on the project. Mega projects, as is the case of BRT Peshawar, having international reputation should have identified as well as mitigated this risk. Under no circumstances the construction should have started without detailed design and drawings. Moreover, it is essential to enforce a change control system for all changes in the design process to efficiently manage all the changes incorporated in the design of the project.

3. Defective workmanship and material:

After an on-site inspection of the Bus Rapid Transit (BRT) project by a technical team of the ADB, recorded that the Khyber-Pakhtunkhwa (K-P) government significantly deviated from the original, agreed design and used inferior quality material in the Rs70 billion Peshawar rapid bus project putting lives and assets at risk in the process.

The Audit report also pointed out, “Honeycombing of columns at Dabgari Staging Facility and using low standard material compromising strength of the construction and leading to failure of structure. Defective materials have been used throughout the project such as cheap and glossy porcelain tiles are used in the bus stations against the non-glassy and lustrous titles as described in the original specifications. These tiles are considered slippery and thus dangerous for elders, children, etc. Poor quality and design of guardrail/ fence along BRT Corridor has been installed, comprising road safety in future.

One of the glaring examples of defective workmanship is the fact that concrete work of the project had been executed in stretched upto 40 meters in length instead of casting them in panels. Therefore the work was not done according to standard engineering practice. Resultantly, cracks were found propagating in the concrete works.

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. Inferior quality construction materials have compromised the safety of the people as well as international reputation of the project.

Mitigation/Countering the risks associated with Defective workmanship and material:

There are six possible measures that are suggested by researchers in order to minimize workmanship and material quality problems. These six measures could have been easily incorporated in the construction of BRT Peshawar; they are: i) Strict supervision, ii) Training and education of workers, iii) Proper communication among parties involved, iv) proper construction management, v) Proper manpower management, vi) Proper design.

4. Lack of planning of alternative routes for the traffic:

The construction of BRT Peshawar essentially meant that most of the traffic in the city will be affected. Thus the risk associated with the traffic congestion from the start of the construction was substantially high.

Since BRT was to be constructed along the main GT Road, it was necessary to provide alternative routes to the large traffic on the road. However, keeping in view the international

image of the project, it was astonishing to the people of the city that the planners of the project have made a blunder by not giving appropriate time to design alternative routes. One can always cite the example that the government asks the motorists to use Board Bazaar as alternative route from University but the same is full of Afghan refugees, who have set up businesses on the road (The News). Such irresponsibility on the part of the planners has marred the image of the project as well as undue stresses were imposed on the riders. Continuous high traffic congestion has also lead to delayed vehicular movement along the route.

Mitigation/Countering the risks associated with Lack of planning:

Since BRT Peshawar has been constructed at the heart of Peshawar city, it was bound to completely disrupt the flow of the traffic. However, this disruption to the traffic could have been minimized by devising an efficient Traffic management plan. Proper management plan would have saved the riders from unnecessary stress as well as their time; at the same time it would have minimized the damage to the vehicles.

5. Inadequate soil investigation:

Peshawar BRT Project was planned, designed and started in immense haste due to all sort of political pressure. Such hurry on the design lead to inadequate soil investigations for the project.

The inquiry report submitted to Peshawar High Court pointed out that the design was changed several times at various locations, citing the existence of drain during excavations. Not only was the entire lane strip pavement was changed to full length concrete rigid pavement but payments were made against the already work done and dismantled. This lead to increased project cost as well as waste of the time; in addition inadequate site investigations also lead to structural complexities that manifested itself in the shape of critical cracks throughout the structure (Report submitted in PHC).

Mitigation/Countering the risks associated with inadequate soil investigation:

Without site investigation ground is a hazard (G. S. Littlejohn). In case of BRT Peshawar construction, appropriate site investigation needed to be carried out with adequate time resources. The project should not have started without proper soil investigation. Researchers around the world have recommended that that an appropriate level of resources for a site investigation is of the order of 3% of the total project budget which wasn't the case with BRT Peshawar.

6. Inadequate site management:

Adequate and efficient site management is considered an essential element of any construction project. However, in the construction of Peshawar BRT the risk associated with the inadequate site management was neglected altogether.

Engineer Gohar Muhammad Khan, ex- assistant resident engineer, has accused that Peshawar BRT has suffered due to poor supervision by the consultants and [the Peshawar Development Authority (PDA)]. He also explained that a structural failure could occur at "any time due to poor foundation provided to the BRT and, as a result, casualties and damages can happen at any time in future". He further claimed that the site inspector did not have any "drawings and specifications of the project" with him to help guide the engineers. Such strong accusations

from within the organization have marred the image of the project both at national and international level.

Inefficient site supervision has not only compromised the quality of the work but has also put the lives of millions at risk. Project Management and Construction Supervision Consultant (PMSCS) for the Peshawar Bus Rapid Transit (BRT) project have written a letter to the director general of the Peshawar Development Authority (PDA), in mid-2019, stating that the contractor working on building the project is ignoring most of our critical recommendations.

Mitigation/Countering the risks associated with inadequate site management:

Efficient site management plays a defining role in the success of construction process. Inadequate site management has caused the most damage to BRT Peshawar project in the shape of lower quality work, rampant corruption, deviation from designs and specification, and risking the lives of millions. In BRT Peshawar project inadequate site management could have been avoided by clearly defining roles and responsibilities between contractors and consultants. Moreover, ADB should have its own team of consultants who would visit the site at regular interval, to conform that the project is proceeding according to the design and specifications.

Solution # 2:

Required = Risk Level

- To identify Risk Level of an event from the given Risk Matrix, we need to calculate the probability and consequence of the same event.

- **Finding probability of the event:**

Probability = $ID/6585200$ ----- eq 1 given

ID = 13571 Name: Muhammad Waqar Khan

Putting ID= 13571 in eq = 1,

We get;

Probability = $13571/6585200$

Probability = 0.00206

Identifying likelihood category for the risk matrix:

As per table 2.1, probability of 0.00206 falls within the range of

$$0.001 < 0.00206 < 0.01$$

Therefore;

Category of likelihood is C (very unlikely)

- **Consequence of the event:**

Consequence (loss) = 45,275,000 US \$ ----- From Given Data

Identifying Consequence category for the risk matrix:

From table 2.2, the loss of 45,275,000 US \$ falls within the range of
 $10,000,000 < 45,275,000 < 100,000,000$

Therefore;

Category of consequence is IV (significant loss)

- **Identifying risk level of the event:**

We have:

Category of likelihood = C

Category of consequence = IV

Comparing the above data with the given risk matrix (figure 2.1),

We get that:

The Risk Level is Low.

Therefore,

The required risk level is low. ----Answer