**Iqra National University, Peshawar**

Department of Civil Engineering

**Course title: Risk and Disaster Management in Construction**

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**I.d:15252 (MS Transportation Engineering)**

**Assignment**

**Question no : 1**

**What is the difference between hazards and threats? Provide examples**

Hazard: A source of danger that may cause harm to an asset.

A hazard is:

* A property, a situation, or a state.
* Not an event but a prerequisite for the occurrence of a hazardous event..
* Often, but not always, related to energy of some kind.

|  |  |
| --- | --- |
| * Acoustic * Atmospheric * Chemical * Corrosive * Electrical * Electromagnetic * Explosice, pyrophoric * Flammable * Gravitational * Hydraulic * Kinetic (linear) | * Kinetic (rotational) * Magnetic * Mechanical * Nuclear * Pathogenic * Pneumatic * Potential * Pressure * Thermal * Toxic |

**Triggering event:**

* An event or condition that is required for a hazard to give rise to an accident.
* Triggering events and hazardous events may be the same.
* Triggering events may also be interpreted as events that cause a hazardous event.
* Active failures: Events that trigger unwanted events.
* Latent conditions: Not triggers, but conditions that may increase the probability of active failures.

**Classification of hazardous:**

Natural hazards:

* Floods, earthquakes, tornados, tsunamis, lightning

Technological Hazards:

* Industrial facilities, structures, transportation systems, consumer products, pesticides, pharmaceuticals

Organizational hazards:

* Long working hours, inadequate competence

Social hazards:

* Assault, war, sabotage, communicable disease

Specific hazardous:

* Drug abuse, alcohol, smoking, and so on
* Types of technological hazards
* Mechanical, electrical, radiation
* What are the effects (type of harm)?
* Cancer, suffocation, pollution, burn
* Where is the origin of the hazard?
* Endogenous – “inside” the system
* Exogenous – “outside” the system
* Mechanical hazards
* Kinetic energy
* Acceleration or retardation
* Sharp edges/points
* Potential energy
* High pressure
* Vacuum
* Moving parts
* Rotating equipment
* Reciprocating equipment
* Stability/toppling problems
* Degradation of materials
* Dangerous materials
* Explosive
* Oxidizing
* Flammable
* Toxic
* Corrosive
* Carcinogenic
* Electrical hazards
* Electromagnetic
* Electrostatic
* Short circuit
* Overload
* Thermal radiation

**Threat:**

* Anything that might exploit a vulnerability.
* Any potential cause of an incident can be considered a threat
* Closely related to hazard
* A threat is a hazard, but a hazard need not be a threat

Threat agent:

* A person, organization, thing, or entity that acts, or has the power to act, to cause, carry, transmit, or support a threat.
* Who could want to exploit vulnerabilities, and how they might use them against the system
* Intention, capacity, and opportunity
* Availability:
* The accessibility of systems, programs, services, and information when needed and without undue delay
* Confidentiality:
* The sensitivity of information or assets to unauthorized disclosure, recorded as classification or designation, each of which implies a degree of ‘loss’ should unauthorized disclosure occur
* Integrity:
* The accuracy and completeness of information and assets and the authencity of transactions
* Compromise:
* Unauthorized disclosure, destruction, removal, modification or interruption.

Technical failure:

* Vulnerability:
* A weakness of an asset or group of assets that can be exploited by one or more threat agents, for example, to gain access to the asset and subsequent destruction, modification, theft, and so on, of the asset or parts of the asset.
* The weaknesses may be physical, technical, operational, and organizational.
* Failure:
* The termination of the ability of an idea to perform a required function.
* In other words: A failure is the non-fulfillment of a functional (or performance) requirement.

Failure mode:

* Consider a water pump:
* A required function of the pump is to “pump water.
* The functional requirement related to this function is that the output of water should be between 100 and 110 liters of water per minute.
* The pump has failed if the output of water is outside this interval.

Failure mode:

The effect by which a failure is observed on a failed item.

General failure:

* A failure mode is a state and specifies the actual deviation from the performance requirements of the item.
* This definition is not totally clear, but a failure mode should tell us in which way an item is no longer able to fulfill a required function.
* Failure during operation
* Failure to operate at a prescribed time
* Failure to cease operation at a prescribed time
* Premature (spurious) operation

Example:

* Fail to open (on demand) I Fail to close (on demand)
* Cannot fully close
* Leakage through ( dripping )
* Leakage out (from tap seals)
* Too high temperature
* Too low temperature

Failure mechanism:

* A physical, chemical, or other process that leads to failure.

Examples of failure mechanisms include

* Corrosion
* Erosion, Fatigue, Primary failure:

Caused by natural aging that occurs under conditions within the design envelope of the item.

* Secondary failure:

Caused by excessive stresses outside the design envelope of the item.

* Command fault:

A failure caused by an improper control signal or noise (sometime referred to as a transient failure).

* Critical:

A failure that causes immediate and complete loss of the system’s capability of providing its output.

* Degraded:

A failure that is not critical but that prevents the system from providing its output within specifications.

* Incipient:

A failure that does not immediately cause loss of a system’s capability of providing its output, but which, if not attended to, could result in a critical or degraded failure in the near future.

**Question 2:**

**Definition:**

* Risk implies future uncertainty about deviation from expected earnings or expected outcome. Risk measures the uncertainty that an investor is willing to take to realize a gain from an investment.
* Risks are of different types and originate from different situations.
* We have liquidity risk, sovereign risk, insurance risk, business risk, default risk, etc.
* Various risks originate due to the uncertainty arising out of various factors that influence an investment or a situation.

**Systematic Risk :**

* Market Risk :
* Market Risk is the risk that the value of an investment will decrease due to movements in market factors. The reason for such uncertainty is market forces represent. in two markets, viz Bull Market and Bear Market
* Interest Rate Risk :
* Interest rate risk is the possibility of an unexpected. change in interest rates prevailing in the market. which affects the value of an investment adversely. Generally the value of debt instruments like bonds. debentures, commercial papers. etc. is directly affect. by Interest Rate Risk.
* Purchasing Power Risk :
* Purchasing power risk is the possible reduction in the purchasing power of the expect. returns. Due the high rate of inflation. there is erosion in the purchasing power of money, which results in decrease in the returns.

**Unsystematic Risk:**

* Unsystematic risk may be specification to an industry or company and is caused due to deficiencies in one or more of the following
* Lack of managerial ability
* Technological advancement in the process of production.
* Procurement of raw materials
* Lack of human resources
* Change in consumer preference

Business Risk:

* Market business risk is a part of the unsystematic risk.
* Which basically comes from the operational activities of the business.
* Due to certain inbuilt deficiencies in the operations of the business.
* Due to certain inbuilt deficiencies in the operations of a company.

**Internal Business Risk :**

Internal risk is related to with the operational effectiveness of a company. The operational effectiveness of a company is measured in terms of the level of its targeted achievements and keeping the promises made to its investors.

1. Research and Development (R&D)
2. fixed Cost
3. Single Product
4. Sales variation
5. Personal management

**External Business Risk :**

External business risks are the risk caused by the circumstances. which are external to a company’s business. The company has no control over these circumstances or factors.

1. Social and Regulatory Factors: e.g. Telecommunication. Similarly the profitability of banks is affected by some of the regulatory directions issued on the lending policies.
2. Political risk : Frequent changes in the Govt and its policies have a negative impact on business environment.
3. Business cycle :boom and recession is the best example business cycle. Textile industry will be in boom for short period after that the demand will be decrease.

**Financial Risk :**

* Financial risk is a function of financial leverage which is the use of debt in the capital structure.
* The presence of debt in the capital structure creates fixed payments in the form of interest which is a compulsory payment to be made whether the company makes profit or loss.
* This fixed interest payment creates more variability in the earnings per share(EPS) available to equity share holders.
* Credit Risk
* Currency Risk
* Country Risk
* Economic Risk
* Liquidity Risk

**Measurement Risk :**

* Risk in investment is associated with return.
* The risk of an investment cannot be measured without reference to return.
* The return. in turn. depends on the cash inflows to be received from the investment to return.
* The return in turn depends on the cash inflows to be received from the investment.
* Let us consider the purchase of a share.
* While purchasing an equity share.an investor expects to receive future dividends declared by the company.
* In addition he expects to receive the selling price when the share is finally sold.

Example:

Suppose a share is currently selling at Rs.120. An investor who is interest in the share anticipates that the company will pay a dividend of Rs. 5 in the next year. Moreover he expects to sell the share at Rs. 175 after one year. The expected return from this can Ix calculated as follows.

Expected Return

The expected return of the investment is the probability weighted average of all the possible returns. If the possible return are denoted by Xi and the related probabilities are p(Xi). the expected return may be represented as

Key information to Reminder before

Possible returns = would indicate the expected return from the investment. (denoted by Xi) Probability of Occurrence = This indicates the risk of the investment.( denoted by p(Xi))

Example

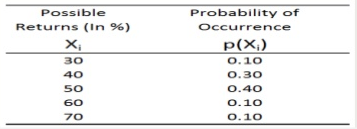
A share is currently selling at Rs.50. It is expected that a dividend of Rs.2 pershare would be paid during the year and the share could be sold at Rs. 54 at the end of the year. Calculate the expected return from the share.

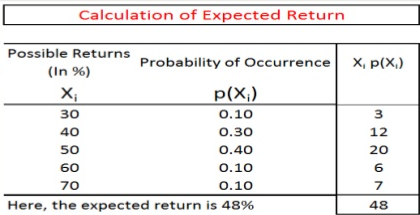
Solution: R ­­= Forecast­ Dividend + Forecasted end of the period stock - 1

Initial Investment

Example (based on Previous example)

Calculate expected return



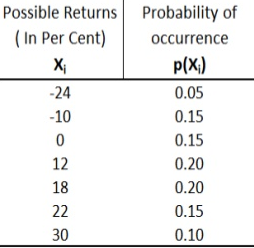


Risk

Expected returns are insufficient for decision-making. The risk aspect should also be considered. The most popular measure of risk is the variance or standard deviation of the probability distribution of possible returns.

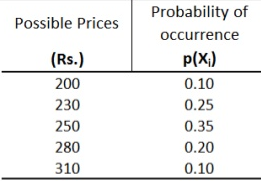
Example:

Calculate the expected return and the standard deviation of returns for a stock having the following Probability distribution of returns

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Example:

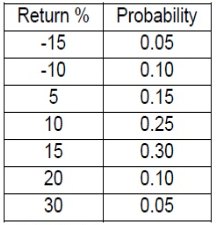
A stock costing Rs. 250 pays no dividends. The possible prices that the stock might sell fax at the end of the year and the probability of each are

:

A) What is the expected return?

B) What is the Standard Deviation of the returns?

6 Mr. RKV invested in equity shares of Wipro limited, it's anticipated returns and associated probabilities are given below:



You are required to calculate:

(a) The expected rate of return.

(b) Risk in terms of SD.

**QUESTION NO#3**

ANS:

**Introduction**

Over the last few years, the public transport industry in many developing countries has been involved in a process of deep transformation. At present, personal mode usage is more than public transport mode, causes. series of problems in daily life like, traffic congestion, delay, air pollution, noise pollution and large amount of energy wastage which has a negative impact on environment as well as on public health. Mobility requirements in metropolitan cities causes continuous growth of personalized vehicles leading to pollution and traffic congestion. To reduce the current pollution level, congestion and make the cities environment friendly, it is necessary to encourage the commuters to use the public transport system. To provide the desired service delivery level for public transport, it is essential to evaluate the existing transport systems using a reliable performance evaluation technique which can eventually help in enhancing the transit service delivery to their trusted passengers.

**Performance Evaluation**

Performance evaluation of public transport system requires to understand the terms on behalf of performance of the system to be evaluated. The evaluation can be done in two ways i) based on present perception of users about the service deliverd ii) based on the feedback provided by experienced evaluation team. Performance evaluation is defined as the technique to evaluate how good or bad is the performance of a transit service is under the prevailing operating condition. The performance of transit system can be enumerated based on two distinct dimensions i.e., *Service* and *Service quality*. *Service* is described as “the business transaction that take place between a donor (Service provider) and Receiver (Customer) in order to produce an outcome that satisfies the customer” (Ramaswamy, 1996). Whereas, *Service quality* gives the measure of how well the service level delivered to the commuter’s as per their expectation. Parasuraman (1988) and Gronroos, (1984) defines service quality as a comparison between customer expectation and perception of service

**Factors Effecting Service Quality**

Estimation of service quality in terms of user perception is purely based on psychological behavior of the commuters. It is necessary to understand the key parameters upon which transit performance depends, as these factors internally and externally affect the user perception and creates a perception of the transit system in the user's mind. The selection of factors differs from one public mode to another.

Various number of factors to define the service quality. The different service attribute dimensions are described in

Table 1.

|  |  |  |
| --- | --- | --- |
| **Researcher’s Name** | **Type of Transit System** | **Service Quality Attributes** |
| Parasuraman et al.(1985) | Bus, Train, Metro | Reliability, Assurance, Tangibles, Empathy and Reliability |
| TRB USA (1999) | Buses, Tram, Metro and Rail | Reliability, Competence, Access, Courtesy, Communication, Credibility, Security, Understanding of customer and Tangibles. |
| Chang, Hepu and Yu-Hern (1999) | Bus transit system | Safety, Comfort, Convenience, Operation, Social duty (Vehicle air pollution level, Vehicle noise level) |
| Y. Tyrinopolus and Antoniou (2008) | Bus and Metro | Service frequency, Service hour, Time table info, Behavior of personnel , Distance and time to access and regress trip, Waiting condition at stop ,Driver behavior, Information in vehicle, Accessibility w.r.t Disabilities, Transfer distance, Transfer waiting time, Info regarding transfer |
| Margarita Friman (2009) | Buses | Frequency, Travel time, Punctuality, price, Information, Cleanliness, Bus comfort, Staff behavior, Seat availability, Bus stop security, Safety from accident, On board security, Bus stop condition and Info bus stop |
| Eboli and Mazzulla (2009) | Buses | Route characteristics, Service characteristics, Service reliability, Comfort, Cleanliness, Fare, Information, Safety and security, Personnel and Customer service |
| Sudin Bag and Som Sankar Sen (2012) | Metro | Air condition & lighting, Seating and free space, Inside atmosphere, Parking space, Smart card and multi ride facilities, Staff behavior, Management attitude, Helpfulness of staff, Attentiveness and resolve quarries, |
| Marta Rajo, Harnan, Luigi and Angel (2012) | Bus and Train transit system | Journey time, frequency, Condition of vehicle, Route , Number of intermediate stop, Bus stop location, Connection with other transport mode, Time table info, Possibility of buying ticket at home, Journey distance, Cost of journey, Number of delay bus and train services, Average speed of journey, |
| Adris.A.Putra (2013) | Bus Transit System | Safety, Accessibility, Affordable Tariff, Capacity, Regularity, Swift and fast, On time, Integration, Efficicent, Easyness, Orderly, Security, Cozy, Low Pollution, |

**Method of collecting user perception data**

Surveys and interviews are the most popular methods of primary data collection. The User perception data can be collected by conducting a Station/Stop Survey or Workplace survey by direct face to face interview or by using alternative (telephonic interviews) indirect techniques. Paper-and-Pencil Interview (PAPI) is very popular for data collection, in which an enumerator asks questions to the respondent by holding a printed set of questions. PAPI surveys should be carried out by taking proper precaution by randomly selecting a person from the population, so that it eliminates the chance of nonresponsive and responsive biasness. At present internet based survey methods have taken over the place of PAPI method as it reduces the manpower, time and provide readymade scrutinized results. However, a major drawback of this method is its inability to cover of the population who are not familiar with the internet.

**Performance Evaluation Models**

Major works on “performance evaluation” began after 1970, many of the transportation planners and researchers had started trying different approaches and techniques for developing different models to estimate the transit system performance in terms of user perception. Since service quality is a qualitative parameter hence modeling of qualitative parameters creates more difficulties.

**SERVQUAL Model**

Parasuraman (1985) suggested a model for measuring service quality by measuring the gap between the service delivered and service received. It is mostly used by market researchers to identify customer satisfaction on behalf of service delivered. This model represents the service quality in terms of 10 dimensions namely, Reliability, Responsiveness, Competence, Access, Courtesy, Communication, Credibility, Security, understandability and Tangibles. But after 1988, these ten components were merged to formulate five distinct dimensions namely, Reliability, Assurance, Tangibles, Empathy, Responsiveness .These components are collectively called RATER. However, limitation of this model is SERVICE QUALITY (SERVQUAL) factors are inconsistent and it is not incomprehensible for different applications [9].

**Impact Score Technique (IST)**

Federal Administration of the U.S (1999) developed a simple and effective measurement method to evaluate customer satisfaction for transit services termed as Impact Score Technique. The IST approach determines the relative impact of attributes on user satisfaction by measuring relative decrease in user satisfaction when there is a problem with the attributes. For each attribute the whole sample is divided into two categories, user who faced a recent problem and those who haven’t faced any problem (within past 30 days). The gap between mean overall ratings of two groups is known as “Gap Score”. A composite index is found out by multiplying gap score to problem incident rate. The impact score is obtained from this it listed in the descending order to identify top attributes that drives major satisfaction. This technique is one of the simple methods for the estimation of important attributes which can impact the satisfaction of the user and it would be easily understood by the operator as well. The limitation of this technique is that all the data have to be collected within the past 30 days

**Important Performance Analysis (IPA)**

IPA was first introduced by Martilla (1977) . IPA is also known as quadrant analysis which is used in many areas due to its ease of identification of different quality parameter that can lead to the improvement in Service quality. In IPA, user satisfaction is translated into Cartesian diagram where two lines perpendicularly

divide it into four sections as shown in Figure 1. Where (Q) represents the average of average scores of level of implementation of all factors and (P) represents the average of average scores of the importance of all factors.

**Conclusion:**

Among above discussed models, SERVQUAL model is one of the simplest model to enumerate the service quality but it isn’t vastly used in transportation reasearch domain as it fails to specify a proper model and its attributes are inconsistent. The IPA and CSI based models provide good results but are unable to give the reasons for the impact of each attributes on service quality, while Artificial Neural Network (ANN) and Fuzzy inference based methods presents better accuracy in analysis of service quality attributes, obvious drawback of ANN and fuzzy logic stems from the fact that it fails to yield any direct numerical model as an output. If one makes comparison on all the available models, it can be inferred that the Structure Equation Modeling (SEM) is one of the best modeling approach in the field of research on service quality measurement.

**Question no#4**

**Define security vulnerabilities of a university campus?**

Generally speaking, a vulnerability scanner will scan and compare your environment against a [vulnerability database](https://www.rapid7.com/db/), or a list of known vulnerabilities; the more information the scanner has, the more accurate its performance. Once a team has a report of the vulnerabilities, developers can use [penetration testing](https://www.rapid7.com/fundamentals/penetration-testing/) as a means to see where the weaknesses are, so the problem can be fixed and future mistakes can be avoided. When employing frequent and consistent scanning, you'll start to see common threads between the vulnerabilities for a better understanding of the full system.

Security Vulnerability of university campus Examples

A Security Vulnerability is a weakness, flaw, or error found within a security system that has the potential to be leveraged by a threat agent in order to compromise a secure network.

There are a number of Security Vulnerabilities, but some common examples are:

**Broken Authentication:** When authentication credentials are compromised, user sessions and identities can be hijacked by malicious actors to pose as the original user.

**SQL Injection:** As one of the most prevalent security vulnerabilities, SQL injections attempt to gain access to database content via malicious code injection. A successful SQL injection can allow attackers to steal sensitive data, spoof identities, and participate in a collection of other harmful activities.such as sarkhad university data was blocked by indian engineer.

**Cross-Site Scripting**: Much like an SQL Injection, a Cross-site scripting (XSS) attack also injects malicious code into a website. However, a Cross-site scripting attack targets website users, rather than the actual website itself, which puts sensitive user information at risk of theft.

**Cross-Site Request Forgery:** A Cross-Site Request Forgery (CSRF) attack aims to trick an authenticated user into performing an action that they do not intend to do. This, paired with social engineering, can deceive users into accidentally providing a malicious actor with personal data.

A. Computer vulnerabilities Sample university network is given in Fig. 1, It is a fact now that computer vulnerabilities are steadily increasing since 1995 . Malicious activities are still rising despite all the efforts to reduce it which includes:

* More patches and updates supplied by vendors
* Increased Public awareness and media attentions.
* Creating computer crime units.
* More tools in the security arsenal.
* The creation of Computer Crime and Intellectual Property Section by The Department of Justice

B. Base Profile Metrics Once discovered and analyzed, there are certain aspects of vulnerability that remain unchanged, assuming the initial information is complete and exact. The properties of the vulnerability will remain unchanged overtime and will not change by changing the environment. The access and impact qualities are captured by the base profile metrics. The following are the metrics used to identify if the vulnerable system is exploitable. These are of following types:

* Access Vector- identify wither the vulnerability can be exploited locally or remotely.
* Access Complexity- it measures the attack complexity in order to exploit a given vulnerability once the attacker access the system.
* Authentication- identify wither authentication is required or not to exploit the vulnerability.
* Confidentiality Impact- this metric will measure the impact of confidentiality in the exploited system
* Integrity Impact- it measure how much the integrity have been impacted on the exploited system.
* Availability Impact- in an exploited system how much the availability has been impacted.