

IQRA NATIONAL UNIVERSITY PESHAWAR
DEPARTMENT OF CIVIL ENGINEERING

M.S TRANSPORTATION
ASSIGNMENT

Submitted To:

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Course:

Risk & Disaster Management in Construction

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M.S (T.E)

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Q.No.1: What is the difference between hazards and threats? Provide examples.

Answer:

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.

Classification of hazards

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

Behavioral hazards

- 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

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 authenticity of transactions

Compromise:

Unauthorized disclosure, destruction, removal, modification or interruption.

Example:



The above diagram showed various example of Hazard & Threat.

Water:

A baby is sitting on the bank of river (Hazard). Jumping or fall down to water then its threat, if she didn't know swimming she might be drowned.

Gasoline:

If someone filling His car (Hazard) in Gas Station then He is in Hazard because there are chances fire if he didn't switched off Car Engine or someone else lighting a march. Lighting a Match or Switch on Engine the Driver or nearby area in Threat because there might chances of damages.

Driving:

While driving a car the driver is in Hazard (Car). Meanwhile while driving if he wants to Text through Mobile then He is in Threat. Because now he partially focus on driving which need full attention. There are also chances of sudden crossing/interruption by Pedestrian or Animals which leads to threat.

Conclusion:

From the above 3 examples, it is concluded that Sitting of Child/Baby near river bank, Driver standing at Gas station and Driving a Car are initially at Hazard, but at the mean time interruption/ disturbance occurred that happening is threats which ultimate leads High, medium & Low risks.

Q.No.2: Define risk and provide a classification of risk based on its sources. Provide an example for each risk source.

Answer:

Risk definition

Risk and uncertainty are the two most often used concepts in the literature covering RM field. Although these terms are closely related, a number of authors differentiate between them (Samson, 2009). Also practitioners working with risk have difficulty in defining and distinguishing between these two. Often definitions of risk or uncertainty are tailored for the use of a particular project. To make it more systematized, a literature research was done. The findings of this search resulted in a number of definitions of risk and uncertainties. These have been compiled and are presented in below Table.

Author:	Risk definition	Uncertainty definition
Winch (2002)	A stage where there is a lack of information, but by looking at past experience, it is easier to predict the future. Events where the outcome is known and expected.	Uncertainty is a part of the information required in order to take a decision. The required information consists of the amount of available information and uncertainty. The level of uncertainty will decrease the further a project is proceeding throughout the lifecycle.
Cleden (2009)	Risk is the statement of what may arise from that lack of knowledge. Risks are gaps in knowledge which we think constitute a threat to the project.	Uncertainty is the intangible measure of what we don't know. Uncertainty is what is left behind when all the risks have been identified. Uncertainty is gaps in our knowledge we may not
Smith <i>et al.</i> (2006)	Risks occur where there is some knowledge about the event.	There might be not enough information about the occurrence of an event, but we know that it might occur.
Webb (2003)	Risk is a situation in which he possesses some objectives information about what the	Uncertainty is a situation with an outcome about which a person has no knowledge.

	outcome might be. Risk exposure can be valued either positively or negatively.	
Darnall and Preston (2010)	Risk is a possibility of loss or injury.	
Cooper <i>et al.</i> (2005)	Risk is exposure to the consequences of uncertainty.	

All risk definitions compiled in Table 2 describe risk as a situation where lack of some aspect can cause a threat to the project. Lack of information and knowledge are those factors which are most commonly mentioned by all the authors as leading reasons for a failure. The description provided by Cleden (2009) will best fit the purpose of the projects mostly implemented in our country. It concerns how risk is defined as a gap in knowledge which, if not handled correctly, will constitute a threat to the project.

Following are the main classification based on its sources.

1. Risk Classification by its perimeter
2. Risk Classification by Target
3. Risk classification by organization

The above classification are explained below with help of tabulated form:

1.

		Controllability		
Organization		<i>Controllable</i>	<i>Partially controllable</i>	<i>Uncontrollable</i>
	Internal	Quality and cost of products	Environmental impacts	Incidents and accidents
	External	Technological progress	Demand variation	Natural disasters

2.

Model	Dimension	Classes
Risk Management Standard	Level of interaction (internal and external)	<ul style="list-style-type: none"> - Strategic risks (partner and market) - Financial risks (economic-financial cycle) - Operational risks (process) - Potential risks (social and territorial environment)
Strategy Survival Guide	Decisional level	<ul style="list-style-type: none"> - External risks (PESTLE - Political, Economic, Socio-cultural, Technological, Legal/regulatory, Environmental) - Operational risks (delivery, capacity and capability, performance) - Change risks (change programs, new projects, new policies)
FIRM Risk Scorecard	Area of impact	<ul style="list-style-type: none"> - Infrastructural risks - Financial risks - Market risks - Reputational risks
Enterprise Risk Management	Area of impact	<ul style="list-style-type: none"> - Strategic risks - Operational risks - Reporting risks - Compliance risks

3.

Risk Category	Risk Factors
Demand (Customers)	<ul style="list-style-type: none"> - Number and size of customers - Changes in number and frequency of orders - Changes to orders - Seasonal and promotional effects - Forecasting - Warehouses and inventory - Level of innovation and competition - Life cycle of the product - Timing and mode of payment - Retention rate
Offer (Suppliers)	<ul style="list-style-type: none"> - Number and size of suppliers - Level of quality and performance - Level of flexibility and elasticity - Duration and variability of lead time - Length and mode of transfers - Forecasting and planning - Just-in-Time or Lean approaches

	<ul style="list-style-type: none"> - Cost efficiency - Price levels - Outsourcing - Internationalization - Disruption
Processes (Organization)	<ul style="list-style-type: none"> - Flexibility of production-distribution systems - Variability in process management - Variability in process performance - Level of productivity - Capacity - Handling - Operational and functional failures - Redundancy of backup systems (quantity and quality) - Profit margins - Technological standards - Technological innovation of product and process - Product customization
Network and collaboration (Relations)	<ul style="list-style-type: none"> - Trust and interdependence among partners - Level of collaboration - Design and development of relations - Level of integration - Level of service - Opportunism and information asymmetry in transactions - Bargaining power - Strategic objectives and mission - Corporate cultures - Business Logic - Relationship and stakeholder engagement - Social and administrative responsibility - Availability and reliability of information systems - Intellectual property
Environment (Externalities)	<ul style="list-style-type: none"> - Regulations - Policies - Laws - Taxes - Currency - Strikes - Natural events - Social events (i.e. terrorism)

Q.No.3: How would you assess the performance of a transportation system of a city?

Answer:

Performance Evaluation of Public Transport system is very much essential to understand the effectiveness of the plans in vogue as well as to devise plans for its improvement. Most of the major metropolitan cities of the world are presently witnessing rapid growth in industry, infrastructure, economic activities and population over the past few decades which makes them more attractive to job seekers, causing major increase in personalized modes. As a result, the cities are subjected to increase in traffic congestion resulting in huge delays and environmental pollution. To tackle the huge transportation demand and to provide a sustainable environment there is a need for the provision of better public transportation facilities. To fulfill the high demand for better public transport system, there is a need to establish attractive, safe and highly sophisticated public transport systems. In this regard, it is essential to conduct a thorough evaluation of public transport modes. This paper gives an overview and presents the possible ways to identify and measure the performance of public transit system. It presents the definition and literature in respect of different measurement models towards the public transit performance assessment coupled with comparative study of different measurement models that can be used for performance evaluation.

In view of the above 3 Key words for performance of transportation system of City chosen.

- Performance Evaluation
- Public Transit
- Evaluation Process

1. 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. This paper discusses reliable methodologies to evaluate the public transport with respect to user perception.

2. 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 delivered 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) [1]. 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 [2], [3].

2. 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. Different researchers have given various number of factors to define the service quality. The different service attribute dimensions are described in Table 1.

Table 1 : Performance variables by different researchers

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,
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, Efficient, Easiness, Orderly, Security, Cozy, Low Pollution,

4. 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 eliminate 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.

5. Survey Scale Selection

Survey scale selection is solely based on the type of research work. Range of scales used is based on the type of data needed for research. The scale comes from psychological researchers, as suggested by “Rensis likert” [4]. Most of the people used 10 point likert scale to evaluate the user perception by using a set of questions. Though researchers like Friman (2004) used a 9 point scale [5], Tyrinopoulous in 2008 used a ranked scale which ranges 1 to 4 [6], Eboli et al. (2009) used a 10 point likert scale [7] and Putra (2013) used a 5 point likert scale [8]. It was observed that when the scale range increases it will enable us to grasp the detailed variation in data. Transportation researchers suggest to use a constant scale for each variable in a set of questionnaire for better results and to avoid complex issues.

6. 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. Service quality measurement models for different systems proposed by various researchers are discussed below.

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 rating 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 [10].

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.

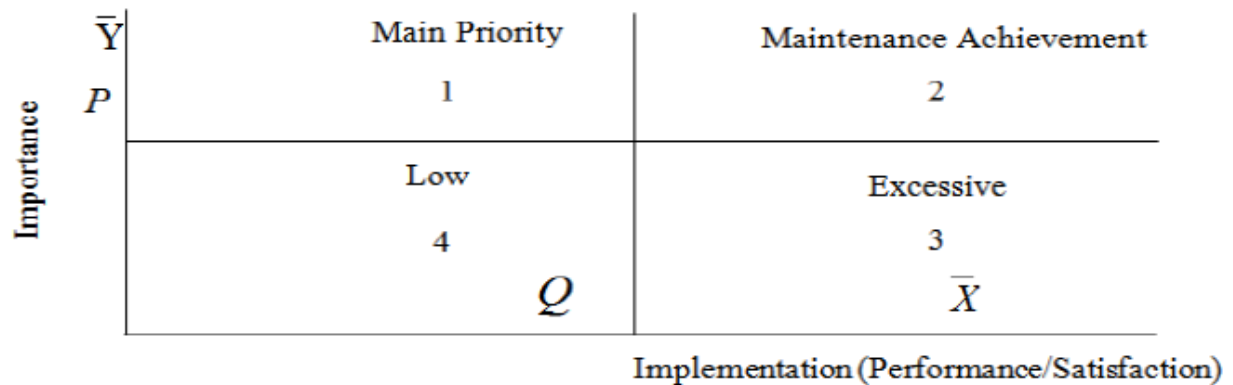


Figure 1: Cartesian Diagram or IPA Diagram (Supranto, 1997)

It can be used for comparing two or more systems[11]. This method does not reflect the dependence between two or more variables and effect of the presence or non-presence of different variables on overall service quality.

Customer Satisfaction Index (CSI)

Customer Satisfaction Index is a method to determine the level of satisfaction that has been achieved with respect to the service delivered. CSI was proposed by Supranto (1997). CSI can be computed by using the average value of the level of expectation and the performance of each service item. It enables estimation of service in terms of customer satisfaction in a very simple and systematic way based on the score provided by the customer but fails to take in account for the differences in user perception about different service aspects. Supranto suggested rating for CSI ranges as very satisfied (0.81-1.00), satisfied (0.66-0.80), quite satisfied (0.51-0.65), less satisfied (0.35-0.50) and not satisfied (0.00-0.34) [12].

Ordered Logit Model

The ordered logit models are regression models for ordinal dependent variables and the genesis behind using this model is to understand how well that output can be predicted by the responses to other questions. This model was used by Tyrinopoulos and Antoniou (2008) for interpretation of the quality implications of the variability of the users' perceived satisfaction across operators in Greece [6]. Laura Eboli and Gabriella Mazzulia introduced discrete choice logit models to calculate the probability of choice of some alternative transit services and determined the importance of each service aspect [13]. Cinzia Cirillo et al. investigated the heterogeneity of transit users in perceiving service quality through a mixed logit model with a non-parametric distribution of the coefficients [14]. Although ordered logit model can be used in rating systems (poor, fair, good, excellent), opinion surveys (strongly agree, agree, neutral, disagree, strongly disagree), and Ranking (senior, junior, sophomore, freshman).

Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) methodology is a powerful multivariate analysis technique in which a set of relationships between observed and unobserved variables are established. It is relatively new method which began in the 1970s (Fornell, 1981), it has been widely applied in various domain of research, including psychology, education, social science, economics, statistics, etc [15]. SEM methodology refers to a series of statistical techniques such as factor analysis, path analysis and regression models which are used to analyze data. Over the years, there has been a rapid development of different software packages such as LISREL (Joreskog, 1988, 1989) and the AMOS (Arbuckle, 1995) which have greatly enabled the use and application of SEM techniques in diverse contexts [16], [17]. SEM tools consist of two parts, i) Latent variable model which describes the relation between the endogenous and exogenous latent variables and allows the direct assessment of both path strength and their underlying impact among those variables. ii) Measurement model which depicts the correlation between latent and observed variables. Due to the popularity and simplicity in estimation, this method is used by various researchers. A. putra (2013) used SEM method for evaluation Bus service performance in terms of users expectation and satisfaction [8]. Other researchers like Irfan (2012) [18], Laura eboli (2012) used this method to identify transport performance in their respective countries [19].

Soft Computing Techniques

At present soft computing techniques are also being used by researchers for performance appraisal of different transit system. Among different soft computing techniques Artificial Neural Network (ANN), Fuzzy logic and Genetic algorithm now a days quite popular. An Artificial Neural Network is a parallel information processing unit that's has working function same as biological neuron. Artificial neural network consist of large set of processing unit called neurons. Each of the neuron connects with each other by means of a direct link and each link associated with a specific weight. ANN based performance evaluation increase the accuracy of computing. Few researchers used this ANN concept to evaluate the performance of different transit systems. Shen and Li (2014) used a hof field neural network for studying performance of bus transport for five different routes [20].

The fuzzy inference system is one of the latest and advanced soft computing technique for detecting the fuzziness and defining the service quality parameter when going towards system performance comparison of large set of transit companies. Fuzzy theory was introduced by Zadeh (1965), which deals with positions that cause true to a certain degree (somewhere from 0 to 1) [21]. Few researchers used this fuzzy set concept to evaluate the performance of different transit systems. Chung-Hsing (1999) are among those few who studied the performance of 10 bus systems in Taipei using fuzzy inference system and set different membership functions different variables that impact the performance of transit system by considering five major factors i.e, safety, comfort, convenience, operation and social duties and also defines ranking of the systems based on a new approach of Overall Performance Index (OPI) [22]. The main drawback of this technique is that the application of fuzzy set theory in system performance evaluation needs higher expertise and knowledge for application and is also difficult for an operator to understand [18].

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 research 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 modelling approach in the field of research on service quality measurement. This is because, SEM enables understanding the impact of each variable on service quality and customer satisfaction in a more pragmatic manner and thus provide appropriate model for the estimation of each factor score and overall satisfaction in terms of quantitative measurement.

References:

- [1] Ramaswamy, R. Design and Management of Service Processes: Keeping Customers for Life, 1996, MA: Addison-Wesley Publishing Co.
- [2] Parasuraman, A., Zeithaml, V.A. and Berry, L.L. SERVQUAL. A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality: Journal of Retailing, US, Texas A and M University, 1988, Volume- 64 (1), pp. 5-6
- [3] Gronroos, C. A Service Quality Model and its Marketing Implications”, European Journal of Marketing, Swedish school of economics Arkadiagatan: Finland, 1984, vol-18 (4), pp. 36.
- [4] Likert, Rensis. A Technique for the Measurement of Attitudes, Archives of Psychology, 1932, 140: 1-55 Likert, Rensis.
- [5] Friman, M. Implementing quality improvements in public transport, Journal of public transport, 2004, 7 (4), 49-65.
- [6] Tyrinopoulos, Y. and Antoniou, C. Public transit user satisfaction: variability and policy implications, 2008, Transport Policy vol-15 (4), pp 260–272.
- [7] Eboli, L., and Mazzulla, G. A new customer satisfaction index for evaluating transit service quality, Journal of Public Transportation, Italy, 2009, vol-12(3), pp. 21–38.
- [8] Putra, A. Adris. Transportation system performance analysis urban area public transport, International Refereed Journal of Engineering and science, 2013, Vol: 2(6), PP. 01-15
- [9] Parasuraman, A., Zeithaml, V. A., and Berry, L. L. A Conceptual Model of Service Quality and Its Implications for Future Research, Journal of Marketing, U.S, Texas A and M university, 1985, Volume 49(4), pp. 10.
- [10] Aoyagi, Gordon, Barker , J Barry, Barnes, L E E ,Barnes, Ronald L, Blair, Gerald L, Garber,, Constance, Hunter-zaworski, Katharine, Lerner-lam, E V A and Monroe, D O N S. A handbook for measuring of customer satisfaction and service quality: US, 1999, TRB,.
- [11] Martilla, J.A.; and James, J.C. Important –Performance analysis, the journal of marketing, 1977, 41 (1), 77-79.
- [12] Supranto, J. Measurement of customer satisfaction, Jakarta: 1997, PT, Rineka Cipta.
- [13] L. Eboli and G. Mazzulla. How to Capture the Passengers' Point of View on a Transit Service through Rating and Choice Options, TRANSPORT REVIEWS, 2010, vol. 30, pp. 435-450.
- [14] C. Cirillo, L. Eboli and G. Mazzulla. On the Asymmetric User Perception of Transit Service Quality, International Journal of Sustainable Transportation, 2011, vol. 5, pp. 216-232.
- [15] Fornell, C., and Lacker, D.F. Evaluating structural equation modeling for travel behavior research, Transportation research part B, University of Michigan, 1981, vol-37, pp 1-25.
- 10
- [16] Joreskog, K. G., & Sorbom D. Lisrel 7: A guide to the program and applications: 1989, Chicago: SPSS, Inc.
- [17] Arbuckle, L. L., & Wothke W. Amos 4.0 User's Guide: Chicago, 1995, Small Waters Corporation.
- [18] S. Irfan, D. kee, S. sagbaz. Service quality and rail transport in Pakistan: A passenger prospective, 2012, Vol: 18 (3). Pp- 361-369.

- [19] L. Eboli, G. Mazzulla. Structural Equation Modelling for Analysing Passengers' Perceptions about Railway Services, 2012, Vol: 54 , pp-96-106.
- [20] Shen, J., & Li, W. Discrete Hopfield Neural Networks for Evaluating Service Quality of Public Transit, International Journal of Multimedia & Ubiquitous Engineering, 2014, 9(2), pp-331-340.
- [21] Zadeh, L. Fuzzy sets, Information and Control, 1965, 338-353
- [22] Yeh, C., Deng, H., and Chang, Y. Fuzzy multi-criteria analysis for performance evaluation of bus companies, , 2000, Vol:126(3), pp-459-473.

Q.No.4: Define security vulnerabilities of a university campus.

Answer:

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.

Today's campus public safety officer doesn't view his or her profession as a job, but as a calling. We make it clear that working at a college campus is special – our next generation of leaders is depending on studying at safe place. A campus must select security officers who have a personality that is hospitable, professional and helpful. A commitment to campus security excellence must begin with recruiting and hiring and it is essential to hire the right personality type as well as identify security officers who will work well within the demographics and culture of a particular campus. While the right fit is critical, it is just the beginning. We know it takes a continuous commitment to build off this base with training and practice so that each security officer understands how to conduct themselves on campus.

So much more is expected of a campus security officer these days. The shift from the traditional security-only mentality to campus security officers who take on multiple roles of first responder, customer service liaison and brand ambassador has fundamentally changed the job. And, we are expecting the work to be done by individuals who have lived in the shadow of these schools though possibly never attended, but must now learn their value systems.

Major issues that today's security officers encounter?

Drug and Alcohol Abuse

Drug and alcohol abuse is an ever-present problem and catalyst to violence. Training helps educate the security officer in how to identify an individual under the influence of drugs and alcohol and how to effectively and safely manage the situation. Security officers are trained to understand their enforcement responsibilities and their obligation to "see something and say something" before tragedy occurs. Many colleges are creating an environment where heavy drinking and drug use are not tolerated. Prevention programs are increasingly promoting improved behaviors with regard to these substances and the anticipation of a drinking or drug-related problem before it occurs.

Signs of Abuse

Physical and emotional abuse is a growing threat on college campuses. Security officers are trained to handle interpersonal abuse scenarios by learning how to define, identify and respond to domestic violence incidents which include rape and assault, stalking, verbal abuse and threatening texts and emails. The Clery Act has increased awareness of major crimes. Now the Campus Sexual Violence Elimination Act (SaVE) requires schools to be more transparent, collaborative and accountable for a range of these behaviors. Security officers must know how to identify, record and report incidents, and refer victims for help.

Gender Discrimination

As schools become more diverse, promoting acceptance isn't just the expectation – it is the law. The heightened sensitivity to gender discrimination extends to all populations including gay, lesbian, bisexual, transgendered and those questioning their sexual identities. Campus security officers must be sensitive and proactive to the needs of all community members and nurture an environment free from discrimination.

Cultural Diversity

Most colleges and universities serve a widely diverse population. New challenges arise as students, faculty, staff and visitors represent a wide array of backgrounds, cultures and traditions. Security officers help support the overall mission to establish and nurture an environment that values diversity and is free from racism and other forms of prejudice, intolerance or harassment.

Workplace Violence on Campus

Active shooter situations on campuses are widely publicized and feared. Any violence is clearly too much, and today's colleges and universities prepare by engaging in effective crisis planning. An incident response plan provides a framework within which a college or university can manage the crisis, creating clear and defined objectives for recovery. These plans include operational and strategic overviews to ensure that a crisis is contained and controlled properly. Communications with staff, students, the media and the community, together with university leadership's ability to determine post-crisis goals and recovery strategies, can determine the college's survival prospects.

All of these issues require awareness, sensitivity, an appreciation for the campus environment and a commitment to supporting the campus's culture and policies. Today's campus security officers receive continual, state-of-the-art training to fulfill their responsibilities and understand the regulatory environment of a campus. Above and beyond all of their training, campus security officers must understand their role as observer, protector and champion of students. They are trained to understand young adult behavior, be sensitive to different cultures, and realize the anxiety of a newcomer to campus looking to find their way. Training, practice and experience helps them better

understand the needs and concerns of the student population, communicate more effectively and positively, and develop productive and professional relationships with students and community members.

Campus security plays a pivotal and evolving role in four-year colleges and universities, community colleges, two-year colleges and trade and vocational schools. Effective campus security finds the right balance between creating an open and free environment and upholding the duty to protect people. This starts with the acknowledgement that security must be part of the campus's evolution. The right solution balances expenditures between personnel, technology, and facility design and crime prevention education to develop a program that is efficient and affordable.

Today's security officers are the front-line of an academic institution's brand, interacting with campus community members while serving as the eyes and ears to help keep the campus safe. With new expectations and growing responsibilities, the campus security officer continues to evolve.