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ANALYSIS OF RISK FACTORS AFFECTING MANAGEMENT AND MAINTENANCE OF URBAN TRANSPORTATION

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Abstract - *Urban transportation systems in most developing countries face major challenges. The existing road transport infrastructure capacity in most cities in the developing economies has reached critical level and is unable to meet the huge demand from the increasing number of vehicles. The challenges have been attributed to continuous growth in urban population, private vehicle ownership, ineffective traffic management system and the ineffectiveness of public transport services which are the causes of traffic congestion with dire consequences on social and economic activities.*

This project aims to identify the risk factors that influence the performance and operating of the urban transportation during its life cycle. The risk factors influence the longevity, fitness, and adaptability of the facility dictating the necessity and timing of renewal or rehabilitation. To identifies risk factors that influence the cost-effective management, operation, and maintenance of bridges, roads and highways, and terminal/stations as well as how and when in the project life cycle the identified risk factors impact the associated facility By knowing the risk factors gives better understanding in allocation of fund to management parties/stakeholders involved.

Key Words: **Infrastructure, Urban Transportation, Risk Identification, Risk Classification**

1. INTRODUCTION

Infrastructure is the basic physical and organizational structure needed for the operation of a society or enterprise or the services and facilities necessary for an economy to function. It can be generally defined as the set of interconnected structural elements that provide framework supporting an entire structure of development. It is an important term for judging a country or region's development.

The infrastructure sector covers a wide range of services such as transportation (including roadways, railways, airways and water transportation), power generation, transmission and distribution, telecommunication, port handling facilities, water supply, sewage disposal, irrigation, medical, educational, and other primary services.

Infrastructure projects are high on governments' agendas, and the infrastructure-development and investment pipeline is huge. The current global project pipeline is estimated at $9 trillion, one-third of it in Asia. India is expected to spend some $550 billion on large-scale projects over the next five years, half of which will be in the energy and utility sectors. Developed economies also have significant infrastructure plans.

Urban transportation refers to the system of transportation that provides access and mobility for people and goods within cities. Elements of urban transportation include public transit (collective transport); non-motorised transport (pedestrians, cyclists) and freight. Effective urban transport systems are essential to economic activity and quality of life.

Risk is also undermanaged in the later stages of infrastructure projects, destroying a significant share of their value. Crucially, project owners often fail to see that risks generated in one stage of the project can have a significant knock-on impact throughout its later stages.

Risk management begins with risk identification and classification (Al-Bahar, 1989; PMBOK, 2004). Thus before assessing risks in Urban Transportation projects, it is important to identify and classify the risks.

Risk management provides support for attempts to gain better control over a project when it comes to time, cost, quality, scope and organization. Risk management can help to promote progress of the activities within a project, instils confidence in the project, promote communication within the project and support the decision-making process within a project. Company does not have time or capacity to engage in risk management, mostly company not familiar or thinking cost involving process, so that risk management is generally not applied to every construction project.

The steps in the process of risk management are:

1. Risk Identification
2. Risk Classification
3. Risk Analysis
4. Risk Response

Infrastructure Construction projects are unique in character and do not lend themselves to standardization. The construction project of dynamic nature, with many seasonal and cyclical ups and downs. Hence, each construction project requires a lot of care in handling. Also, construction activity consists a number of agencies i.e. the client, consultant and

the contractor. In order to establish the duties, obligations, rights, responsibilities among the various agencies, a contract is required to be made between them which will establish a mutual relationship to do a work.

2. PAPER REVIEWED

Jennifer S. Shang, Youxu Tjader, and Yizhong Ding [1] have performed the potential of applying the analytic network process (ANP) to evaluate transportation projects in Ningbo, China. ANP differs from traditional hierarchical analysis tools in that it allows feedback and interdependence among various decision levels and criteria. Compared with the conventional transportation evaluation methods, our model has incorporated a much wider range of long-term and short-term factors, which are classified into benefits, opportunities, costs, and risks. Tactical and operational issues are taken into consideration.

Jie Li and Patrick X.W. Zou [2]have performed develop a risk identification framework from the perspectives of project life cycle, and an assessment framework for risks associated with PPP project using fuzzy analytical hierarchy process (AHP). Furthermore, the paper provides a framework for assessment of risks in PPP projects followed by an illustrative example where the data was obtained from survey questionnaires.

Roger Allport, Richard Brown [3] have performed examined the success of individual projects from three viewpoints – financial success, policy success and durability success – and have undertaken an assessment of the factors that led to success or failure, focusing on six factors that, based upon our experience we hypothesise are particularly important. Some of these case studies have considerable depth, and all are based on our understanding of the local situation.

John Lark and Mr. Lark [4] have performed Risk has consequences in terms of economic performance and professional reputation, but there are also environmental, safety and social considerations. These risks may be internal or external, direct or indirect. ISO 31000:2009 — Risk management — Principles and guidelines, provides a set of principles, a framework and a process for managing risk. Using ISO 31000:2009 can help organizations of all sizes increase the likelihood of achieving their objectives, improve the identification of opportunities and threats, and effectively allocate and use resources for risk treatment.

Sanjay Kumar Singh [5] performed Cities and towns play a vital role in promoting economic growth and prosperity. Although less than one-third of India's people live in cities and towns, these areas generate over two-third of the country's income and account for 90% of government revenues. Poor transport systems stifle economic growth and development, and the net effect may be a loss of competitiveness in both domestic as well as international markets. Although Indian cities have lower vehicle ownership rate, number of vehicles per capita, than their counterparts in developed countries, they suffer from worse congestion, delay, pollution, and accidents than cities in the industrialized world.

Roshan Shetty [6] performed and defined a huge gap between the demand and supply of the essential public amenities. The paper gives an overview of importance of infrastructure sector and also the need for the Private Public Partnership in the infrastructure development. The paper also discusses on Environment Impact Assessment (EIA) as tool to predict the consequences of any proposed or development project on the environment along with the economic and social aspects when planning infrastructure development.

Kamal Pande Kathmandu [7] have performed Some of the institutional risks that persist in this sector are lack of (i) budget planning, (ii) proper selection of road projects (projects are often selected based on political pressure), (iii) efficiency in management practices, (iv) timely mitigation of implementation issues and (v) clarity on procurement issues. There is an urgent need for clarity on contractual provisions and proper documentation of these arrangements for an effective project delivery.

Dr. O.P. Agarwal, Ms. Sujaya Rathi, Ms. Kanika Kalra [8] have performed and defined The total number of motor vehicles in many cities has more than doubled in the last 10 years alone, causing severe congestion, air pollution, increasing incidence of road accidents and a very rapid increase in the consumption of petroleum fuels. It is well recognized that poor transportation has the potential to adversely impact the economic efficiency of our cities as well as the health and well-being of urban Indians. Although the country adopted a National Urban Transport Policy in April, 2006 emphasizing on the prioritization of public transport and non-motorised modes over personal motor vehicles, the pace of motorizations has continued. Clearly there is a need to step back and review what has happened so far so that future directions can be better aligned to deal with the emerging problems.

K. Rajkumar, Dr. S. AnandaKumar [9] have performed A key motivation for governments considering PPP is the possibility of bringing in new sources of financing for funding public infrastructure and service needs. An introduction to PPP and a comprehensive review of literatures regarding Public Private Partnership projects are included. The observations from case studies and the literature studies were used to identify the critical factors influencing the infrastructure development projects under public private partnership. The data for this study will be gathered through a detailed questionnaire survey.

3. NEED OF STUDY

With a population of about 1.2 billion people, transportation in India is imperative to the nation's economy. Since the

economic liberalization of the 1990s, development of infrastructure within the country has progressed at a rapid pace, resulting in many modes of transport by land, water and air. Though the number of motor vehicles is low when compared to global standards, the automobile industry in India is rapidly growing, with a production of over 4.6 million vehicles.

Under existing approaches, urban infrastructure project financing is structured in a way which creates flaws inefficiencies and added costs, greater political (policy) risk, and a lack of diverse ownership needed for transparent incentives. A number of key risks need to be taken into consideration as well. These risks will need to be allocated and managed to ensure the successful financing of the project. The party that is best placed to manage these risks in an effective way.

4. AIM AND OBJECTIVES OF THE STUDY

- To identify the various critical risk factors in Urban transportation development
  To conduct a survey among urban transportation environment and predicting probability and expect impact of occurrence of the most critical risks
- To analyse the impact of the critical risk for management and operation of urban transportation
- To review the key trends in urban India that translate into negative externalities or problems in urban transportation

5. SCOPE OF THE PROJECT

The project is concentrated on Urban Transportation projects which come under the Indian scenario only. The scope of the research was the urban transport, which covered City of Gujarat and its suburbs. The perspectives of the key actors were framed into issues and recommendation with a view to identify the risk factors and quality of urban transport.

6. METHODOLOGY

[1] Objectives
[2] Review of literature & collection of case studies
[3] Data collection in terms of management and maintenance of urban transportation
[4] Identification of Risk Factors
[5] Questionnaire survey
[6] Data collection and analysis
[7] conclusion

7. IDENTIFICATION OF RISK FACTORS

The purpose of this research was to identify the various risk factors that have a potential to adversely influence in managing and operation of urban transportation. As the primary source of data for this research was available literature and personnel interviews, a subjective approach for identifying and analysing risk factors was preferred over an objective mode of analysis. The literature selected for this research dealt with potential failure modes that have been defined as discrete failures, deficiencies, or problems commonly encountered. Additionally, the selected material also identified the immediate physical causes of failure modes, and in many cases, proposed means of repair, correction, or prevention, all in great detail.

Risk factor have to be determined before the risk being allocated, they have to anticipate the risk so it will be more organize and prepared. In order to achieved at this stage, a study based on same research objective being used to develop idea for this study. The risk factor were generated based on extensive literature review.

TABLE NO.1 RISK FACTORS COMMON TO ALL URBAN TRANSPORTATION FACILITIES

A	**Management Risks**
1	Forecast and calculation
2	Design concept
3	Design details
4	Deterioration
B	**Operational Risks**
1	Road congestion
2	Parking problems
3	Deteriorating road safety
4	Infrastructure Risk
5	Risk of theft
6	Risk of overloading
7	Risk of Drivers
8	Weather condition
9	Relationship risk
C	**Environmental Risks**
1	Air pollution
2	Water pollution
3	Noise pollution
D	**Political and government risks**
1	Transportation Policy
2	Multiplicity of Laws*
3	Government duties and taxes
4	Unstable government

5	Attitude of government towards foreign investors/investors
6	Inconsistences in government policies
7	Change in law
8	Judicial risk
9	Corruption risk/Market-distortion risk
E	**Technological Risks**
1	Vehicular technologies
2	Traffic equipment
F	**Construction Risks**
1	Capital materialized problem
2	Completion delay
3	Too many late design variation
4	Construction cost overrun
5	Poor quality workmanship
6	Safety risk
7	Inflation rate volatility
8	Construction force majeure events
9	Accidents during construction
G	**Project finance Risks**
1	Financial Legislation change
2	Poor financial market
3	Inflation rate volatility
4	Little financial attraction of project to investors
5	Ill capital structure
H	**Other Risks**
1	Risk of man-made events*
2	Competitor Risks
3	Risk of natural disasters*

10. DATA COLLECTION AND ANALYSIS

The next step of this study is to identify the risks involved in urban transportation projects by means of survey questionnaires. The comprehensive list of risk factors obtained through a literature review was synthesized and reduced to 44 questions presented in a survey questionnaire. The questionnaire was prepared to get opinions from experts who are currently managing and maintenance various urban transportation-related projects in Gujarat.

The questionnaire was structured in such a way to determine which of the risks identified in this study occurred frequently during life cycle of transportation project in form of Likert scale which consists of a number of attitudinal statements of different polarities and degrees of extremity both on likelihood rating as well as Impact rating. The respondent rates each statement along a Six-point dimension denoted by: Negligible, Low, Medium, High, Very high and Full for likelihood rating and Nil, very small, small, average, high and serious for impact rating.

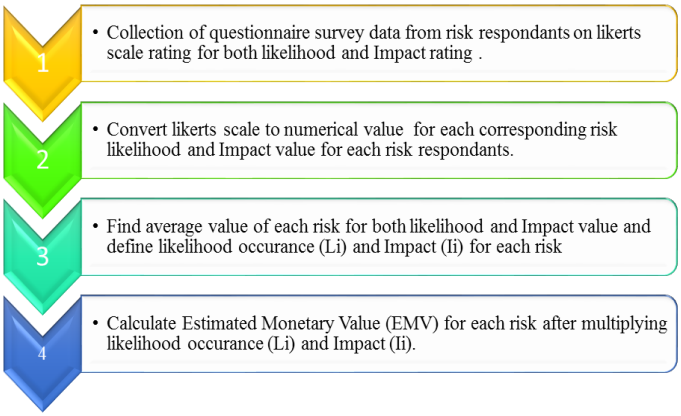
Total 30 risk respondents are taken through questionnaires survey and obtain their response against all other risk in form of Likert scale.

With the help of a questionnaire survey the following risks were found to exist in urban transportation management and maintenance. These risks were marked on a scale of 0-1 both on likelihood rating as well as impact rating.

Within the framework of qualitative methods, includes: Brainstorming, Delphi, Final project reports – lessons learned, Probability and Impact Matrix, AHP (Analytic hierarchy process) method and Root cause analysis of risk and so on.

The Estimated Monetary Value (EMV) formula is likelihood multiplied by impact. The formula is expressed as EMV = (likelihood) x (Impact)

FIGURE NO.1 METHEDOLOGY OF DATA ANALYSIS



The Estimated Monetary Value (EMV) [12] formula is likelihood multiplied by impact. The formula is expressed as EMV = (likelihood) x (Impact)

$$\mathbf{E(x) = L(x) * I(x)} \qquad \mathbf{X \in [0, 1]}$$

Where **E(x)** = Expected Monetary Value
L(x) = Likelihood Value
I(x) = Impact Value

The EMV rating thus obtained was then sorted in an increasing order to find the risks which caused maximum threat for the respondents. These were further divided into

categories based on the EMV ratings. This process is termed as risk categorization. The scale followed for risk categorization is shown below:

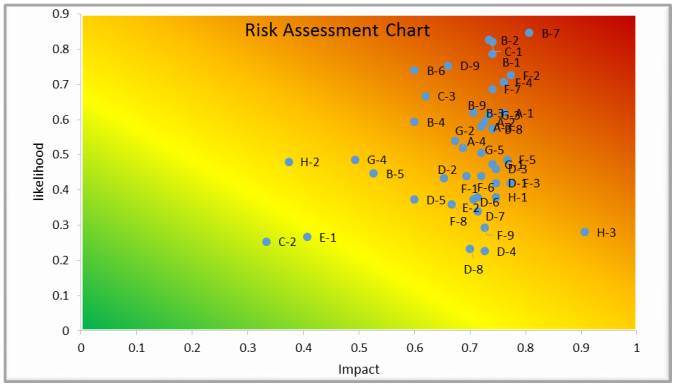
TABLE NO.2 RISK PRIORITY NUMBER

Sr. No.	Risk Code	Name of Risk	Estimated Monetary Value EMV	Categorization according to scale
1	B7	Risk of Drivers	0.683	Critical risk
2	C1	Air pollution	0.6068	Very high risks
3	B2	Parking problems	0.6062	
4	B1	Road congestion	0.5821	
5	F2	Completion delay	0.562	
6	F4	Construction cost overrun	0.5371	
7	F7	Inflation rate	0.5081	
8	D9	Corruption risk/Market-distortion risk	0.4972	High risks
9	A1	Forecast and calculation	0.4712	
10	G3	Inflation rate volatility	0.4498	
11	B6	Risk of overloading	0.444	
12	B3	Deteriorating road safety	0.4381	
13	B9	Relationship risk	0.4381	
14	A2	Design concept	0.4312	
15	B8	Weather condition	0.4243	
16	A3	Design details	0.4176	
17	C3	Noise pollution	0.4133	High risks
18	F5	Poor quality workmanship	0.3731	
19	G5	Ill capital structure	0.3648	
20	A4	Deterioration	0.3636	
21	G2	Poor financial market	0.3571	
22	B4	Infrastructure Risk	0.356	
23	G1	Financial Legislation change	0.3503	
24	D3	Government duties and taxes	0.3435	High risks
25	F3	Too many late design variation	0.3248	
26	F6	Safety risk	0.3168	
27	D1	Transportation Policy	0.3136	
28	F1	Capital materialized problem	0.3051	
29	H1	Risk of man-made events*	0.2837	
30	D2	Multiplicity of Laws*	0.2831	
31	D6	Inconsistences in government policies	0.2711	
32	E2	Traffic equipment	0.2638	
33	H3	Risk of natural disasters*	0.2539	
34	D7	Change in law	0.2425	
35	G4	Little financial attraction of project to investors	0.2401	
36	F8	Construction force majeure events	0.24	
37	B5	Risk of theft	0.2352	
38	D5	Attitude of government towards foreign investors/investors	0.224	
39	F9	Accidents during construction	0.2132	
40	H2	Competitor Risks	0.1792	
41	D4	Unstable government	0.1647	Medium risks
42	D8	Judicial risk	0.1633	
43	E1	Vehicular technologies	0.1084	
44	C2	Water pollution	0.0844	

TABLE NO.3 RISK SCALE

Scale	Range
Low risk	0.00-0.04
Medium risk	0.05-0.16
High risk	0.17-0.49
Very high risk	0.50-0.64
Critical risk	0.64-1.00

GRAPH NO.1 RISK ASSESSMENT CHART



11. CONCLUSIONS

In this paper, we analysis various Risk Factors in management and maintenance of Urban Transportation. The identification of risk factor one of the most important stages in order to allocate the risk for any project. Most frequent factors are Risk of Drivers, Parking problems, Air pollution and forecast and calculation can be mitigated by using proper management techniques and scheduling.

Due to interaction and merging of pedestrian and slow moving vehicles in urban traffic produce complex management issues. It can be reduce by using segregating slow and fast moving vehicles and provide safe spaces for pedestrians in the form of foot paths. Street vendors, trees and street lights are all carefully placed along the road side to create a boulevard feel. Effectively separating prioritize and non-motorized traffic.

It must be understood that each street stretch and junction calls for its specific design. Text Book Standards may not be feasible at all locations, and if applied literally, do not address the local requirement optimally. It is more pertinent to institute design principles or design guidelines supported by design examples. Detailed physical survey and consultation with residents, therefore a prerequisite for appropriate design. An appropriate response to neighborhood specificity calls for a coordinated exercise of survey, consultation and design, where the design agency has the authority and competence to incorporate all aspects of physical infrastructure of the street or public space in the design.

REFERENCES

[1] Shang, Jennifer S., Youxu Tjader, and Yizhong Ding. "A unified framework for multicriteria evaluation of transportation projects." IEEE transactions on engineering management 51.3 (2004): 300-313

[2] Li, Jie, and Patrick Zou. "Risk identification and assessment in PPP infrastructure projects using fuzzy Analytical Hierarchy Process and life-cycle methodology." Construction Economics and Building 8.1 (2012): 34-48.

[3] Allport, Roger, et al. "Success and failure in urban transport infrastructure projects." KPMG Intternational (2008).

[4] Lark, John. ISO31000: Risk Management: a Practical Guide for SMEs. International Organization for Standardization, 2015.

[5] Singh, Sanjay. "Urban transport in India: issues, challenges, and the way forward." (2012).

[6] Shetty, R. "Urban Infrastructure Development in India-An Overview." International Conference on Civil, Electrical and Electronics Engineering (ICCEEE'2012) December. 2012.

[7] Kamal Pande Kathmandu, Risk Assessment and Risk Management Plan: Transport Sector NEPAL (the Global Competitiveness Report of 2011-2012)

[8] Dr. O.P. Agarwal, Ms. Sujaya Rathi, Ms. Kanika Kalra, Ms. Megha Gupta, Ms. Sugandha Pal, Ms. Anantha Lakshmi, Ms. Shrimoyee Bhattacharya and Ms. Adyasha Mishra, Review of Urban Transport in India (Institute of Urban Transport (India))

[9] Rajkumar, K., and S. An. "A Study on Critical Factors Influencing The Infrastructure Development Projects Under Public Private Partnership." (2013).

[10] TRANSPORT IN INDIA: THE SKETCH FOR A POLICY (2013)

[11] Ministry of Urban Development Government of India, National Urban Transport Policy, 2014.

[12] Badiru, Adedeji B., and Samuel O. Osisanya. Project management for the oil and gas industry: a world system approach. CRC Press, 2016.