Chapter 7

RESULTS AND FINDINGS

7.1 RESULTS OF STUDY AREAS

Interpretation of Results

The final observations and values of risk contributors, causal equations, Percentage dependency of risk contributors, Risk priority nodes are obtained from the PCA analysis and causal techniques and from the following tables for study areas given below.

1) For Gaddiannaram municipality area – Tables 6.1, 6.3, 6.5, 6.7, 6.8, 6.9 and 5.8

2) For Rajendranagar municipality area - Tables 6.10, 6.12, 6.14, 6.16, 6.17, 6.18 and 5.16

3) For Qutubullapur municipality area - Tables 6.19, 6.21, 6.23, 6.25, 6.26, 6.27 and 5.24

7.2 RISK CONTRIBUTORS

With respect to speed as major criterion

1). For Gaddiannaram municipality area

Stopping Sight Distance (SSD), Intensity of Parking, business activities and road side activities (PBE), Delay (D), Overlap size of the link from static analysis (OS)

2). For Rajendranagar municipality area

Carriageway width (CW), Number of curves (NC), Stopping sight distance (SSD), Delay (D), Intensity of Parking, business activities and
road side activities (PBE), Overlap size of the link from static analysis (OS)

3). For Qutubullapur municipality area

    Pavement Condition index (PCI), Number of access points on the link (NA), Delay (D), Roadway width (RW), Carriageway width (CW), Stopping sight distance (SSD)

**With respect to Headway as major criterion**

1). For Gaddiannaram municipality area

    Stopping sight distance (SSD), Delay (D), Intensity of Parking, business activities and road side activities (PBE), Overlap size of the link from static analysis (OS)

2). For Rajendranagar municipality area

    Delay (D), Speed (V), Number of curves (NC), and Intensity of Parking, business activities and road side activities (PBE), Stopping sight distance (SSD), Overlap size of the link from static analysis (OS)

3). For Qutubullapur municipality area

    Overlap size of the link from static analysis (NA), Delay (D), Stopping sight distance (SSD), Speed (V), Carriageway width (CW), Roadway width (RW), Overlap size of the link from static analysis (OS)
With respect to Delay as major criterion

1). For Gaddiannaram municipality area

Carriageway width (CW), Stopping sight distance (SSD), Intensity of Parking, business activities and road side activities (PBE), Overlap size of the link from static analysis (OS)

2). For Rajendranagar municipality area

Pavement Condition index (PCI), Stopping Sight Distance (SSD), Speed (V), Number of curves (NC), Intensity of Parking, business activities and road side activities (PBE)

3). For Qutubullapur municipality area

Intensity of Parking, business activities and road side activities (PBE), Carriageway width (CW), Speed (V), Overlap size of the link from static analysis (OS), Number of access points on the link (NA), Stopping Sight Distance (SSD)

7.3 CAUSAL EQUATIONS

With respect to speed as major criterion

1). For Gaddiannaram municipality area

\[ V = (0.60SSD) + (-0.09PBE) + (0.06D) + (0.05OS) \]  \( \text{(7.1)} \)

2). For Rajendranagar municipality area

\[ V = (-1.33CW) + (0.23SSD) + (0.77NC) + (-0.3PBE) + (0.19D) + (0.035OS) \]  \( \text{(7.2)} \)

3). For Qutubullapur municipality area

\[ V = (-0.49RW) + (-0.22CW) + (-0.03SSD) + (5.33PCI) + (-0.55D) + (0.69NA) + (0.02 OS) \]  \( \text{(7.3)} \)
With respect to Headway as major criterion

1). For Gaddiannaram municipality area
   \[ H = (0.12SSD) + (0.03PBE) + (0.07D) + (-0.03 OS) \] ---(7.4)

2). For Rajendranagar municipality area
   \[ H = (-0.02SSD) + (0.10NC) + (-0.06PBE) + (0.13V) + (0.14D) + (-0.003 OS) \] ---(7.5)

3). For Qutubullapur municipality area
   \[ H=(0.04RW)+(0.05CW)+(0.09SSD)+(-0.08V)+(-0.11D)+(-0.19NA)+ (0.007 OS) \] ---(7.6)

With respect to Delay as major criterion

1). For Gaddiannaram municipality area
   \[ D= (2.39CW) + (0.73SSD) + (0.31PBE) + (-0.07OS) \] ---(7.7)

2). For Rajendranagar municipality area
   \[ D= (0.17SSD) + (0.12NC) + (1.05PCI) + (0.05PBE) + (0.12V) \] ---(7.8)

3). For Qutubullapur municipality area
   \[ D=(-1.25CW)+(0.03SSD)+(2.18PBE)+(-.36V)+(0.18NA)+ (0.24OS) \] ---(7.9)

7.4 PERCENTAGE DEPENDENCY OF RISK CONTRIBUTORS

With respect to speed as major criterion

1). For Gaddiannaram municipality area
   SSD-73.73%, PBE-11.36%, D -7.8%, OS-7.06%

2). For Rajendranagar municipality area
   CW-51.40%, NC-29.55%, SSD-8.80%, D-7.435, PBE-1.47%,
   OS- 1.35%,
3). For Qutubullapur municipality area

PCI-72.52%, NA-9.46%, D7.51%, RW-6.68%, CW-3.03%,
SSD-0.49%

**With respect to Headway as major criterion**

1). For Gaddiannaram municipality area

SSD-46.2%, D-28.3%, PBE-12.7%, OS-12.5

2). For Rajendranagar municipality area

D-30.45%, V-27.30%, NC-22.00%, PBE-14.50%, SSD-5.07%,
OS-0.67%

3). For Qutubullapur municipality area

RW-7.50%, OS-1.35%

**With respect to Delay as major criterion**

1). For Gaddiannaram municipality area

CW-68.0%, SSD-20.8%, PBE-8.9%, OS-2.3%

2). For Rajendranagar municipality area

PCI-68.56%, SSD-11.13%, NC-7.87%, V-3.59%, PBE-3.6%

3). For Qutubullapur municipality area

PBE-50.93%, CW-29.32%, V-8.45%, OS-5.77%, NA-4.24%,
SSD-0.9%

From above results it is observed that for risk generation first
major contributors are Geometric characteristic and then traffic
characteristics. It has been established scientifically and micro level
contributors have been found out for different zones or areas.
7.5 RISK PRIORITY NODES

With respect to Speed as major criterion

1) For Gaddiannaram municipality area

Risk contributors are SSD, PBE, D, and OS

   It is found that the risk is generated at M3 Link i.e, Dilsuknagar – Sankeswar Bazar links and distributed to M5, M1 i.e, Sankeswar Bazar-Saroornagar and Dilsuknagar-Chaithanyapuri

2) For Rajendranagar municipality area

Risk contributors are CW, NC, SSD, D, PBE, and OS

   It is found that the risk is generated at M2 Link i.e, Indirareddy-RJNR and distributed to M3, M6, M1 i.e, Indirareddy-Aramghar-Durganagar, Hyderguda-Indirareddy

3) For Qutubullapur municipality area

Risk contributors are PCI, NA, D, RW, CW, SSD

   It is found that the risk is generated at M8 Suchitra x roads – Kompally Link and distributed to M2, M1, M3, M5, M4, M6 i.e, Gajularamaram x roads – Jeedimetla bus stop junction, IDPL Junction – Gajularamaram x roads, Jeedimetla bus stop junction – Suraram x roads, Gajularamaram x roads – Usha mullapuda cadiac center, IDPL Junction – Venkata rami reddy nagar, Usha mullapuda cadiac center – Mahadevapuram
**With respect to Headway as major criterion**

1) For Gaddiannaram municipality area

Risk contributors are SSD, D, PBE, and OS

It is found that risk is generated in M2 Link i.e., Chaithanyapuri-Kothapet and distributed to M1, M3, M5 Dilsuknagar-Chaithanyapuri, Dilsuknagar-Sankeswar Bazar-Saroongar

2) For Rajendranagar municipality area

Risk contributors are D, V, NC, PBE, SSD, OS

It is found that the risk is generated at M2 Link i.e., Indirareddy-RJNR and distributed to M6, M5, M1, M4, M7, M3 i.e., Aramghar-Durganagar-Shamshabad, Hyderguda-Indirareddy, Hyderguda-Indirareddy-Aramghar-NPA, Durganagar-Bandlaguda Indirareddy-Aramghar in the following order

3) For Qutubullapur municipality area

Risk contributors are NA, D, SSD, V, CW, RW, OS

It is found that the risk is generated at M1 i.e., IDPL Junction – Gajularamaram x roads and distributed to M8 Link i.e., Suchitra x roads – Kompally

**With respect to Delay as major criterion**

1) For Gaddiannaram municipality area

Risk contributors are CW, SSD, PBE, and OS

It is found that the risk is generated at M1 Link i.e., Dilsuknagar-Chaithanyapuri

2) For Rajendranagar municipality area
It is found that no risk is generated in the links

3) For Qutubullapur municipality area

Risk contributors are PBE, CW, V, OS, NA, and SSD

It is found that the risk is generated at M5 Link only i.e, Gajularamaram x roads – Usha mullapuda cadiac

7.6 EVALUATION FOR CAUSAL MODELS

For all three municipalities all models are tested with Graphical analysis and computation analysis and the following conclusions are found out. All the major contributors are tested for good fitness and it is conclude that the all prediction graphs shows that they are within 95% prediction bounds, comparison of parameters to get good fit graphical analysis and to get good fit through computational analysis, strength and significance tests shows that they are good fit for 3rd, 5th, 6th degree polynomial and satisfied all parameters for Gaddiannaram, Rajendranagar and Qutubullapur municipality areas respectively.

7.7 FINDINGS OF THE STUDY

Study on urban mobility under the perspective of risk generation has given a unique platform on control strategies of urban congestion. This study has given a finding that urban risk is dependent not only on road user behavior, but also depends on infrastructure planning, land use pattern, traffic characteristics. Even though the road user who carries risk but need not be sole reason for generation urban risk. It is also found that risk is carried by user with dominant
influence of infrastructure, traffic, land use, road geometric characteristics.

From the research it has been identified that the factors and percentage of dependency of contributors to risk generation and major corridors which are leading to congestion and distributed to other corridors. Thus in the research analysis it is taken into account all the geometric, traffic, land use and the utility characteristics and assuming speed, headway, delay are major contributors of the risk.

7.8 THE FOLLOWING FINDINGS ARE OBSERVED FROM THE OUTCOME OF THE RESEARCH

a. Risk is representation on influence rendered to speed, headway and delay

b. Risk is the contribution carried by user who travelled under the multifaceted impact of influence generated by land use, road geometrics, network utility levels and traffic characteristics

c. Risk generated at a particular point of time or space is having transitional influence on neighborhood network, traffic attributes effects on congestion and accident risk either by specific road user or general traffic

d. Identification of each factor of influence and its role which give a lead on improvement of infrastructure, management of traffic planning, land use policies and in proper policies and improvement of road geometrics

e. Prioritize of urban consider planning is facilitated with PCA and causal model technique.
Chapter 8

SUMMARY, CONCLUSION AND FURTHER SCOPE

8.1 SUMMARY

Mobility patronage over time and space are highly valuable and subject to the influence of road geometric, land use, network access, and connectivity levels, road user behavior, and traffic characteristics. This study aims to consolidate risk patronage; influence factor impacts, characteristic analysis on risk which leads to congestion and accident prone travel. Risk generation and its impact on traffic links not only causes user economic travel for the user and sustains environment but also impacts psychological strain on road user.

Research on risk analysis is aimed with the objective of promoting planning strategies on infrastructure and urban land use design with due attention on influencing factor and its role on traffic. The following methodological frames are attempted.

Frame (1): Development of base map of study area with the input of satellite data, GPS technology, and knowledge base with GIS as supportive tool.

Frame (2): Development of static feature of road network with its connectivity patterns, access levels and density characteristics.

Frame (3): Development of Demand profile with reference to trip length, trip intensity and trip orientation by conducting primary source survey.
Frame (4): Characteristics of traffic over time and space with reference to headways, composition, delays, and speeds

Frame (5): Defining the risk quantification under the heads of speed, headway, delay and identifying data consistency with principal component analysis

Frame (6): Development of relational model platform with identification of influencing factor which contributes to risk of travel with defined heads of representation

Frame (7): Identification of data consistency in influencing the objective variable risk generation with each factor of influence over a time and space

Frame (8): Development of risk generation model with causal model defined with mathematical relationship from polynomial and multiple regression models

Frame (9): Identification of each factor and its role on risk generation and distribution over time on neighborhood links with model frame

Frame (10): Identification of each influencing factor and its impact on every urban corridor.

Frame (11): Development of planning strategies in handling the risk control issues with reference to geometric, land use, traffic mobility controls road utility levels
8.2 CONCLUSION

The amount of risk incurred, or generated, distributed and finally concentrated at a place is found out and from the key findings of the study. The studies related to the risk can have the advantage of concentrating more towards the contributors of the risk and can suggest the necessary improvement in to be followed order to reduce the risk generation.

The existing highly functional supply system entities (Major corridors and junctions) generate heterogeneous land-use development with the migration of socio-economic and demographic characteristics in the urban form. The land-use variation along the entities creates an imbalance in urban areas with respect to congestion, excess delay in travel, road accidents, pollution etc., In-order to reduce this congestion, it is very important to know where the risk has occurred and how it is distributed among many places and how it varies from place to place. Also it is important to know the factors contributing for the risk generation.

The analysis took into account all the geometric, traffic, land use and the utility characteristics and assumed the traffic characteristics as the major contributors of the congestion on the major corridors which lead to the risk are found out. Uniform spread and access to major corridors and junctions facilitates opening of more access to the area and effective utilization of the existing road network in the vicinity.
The thesis focuses on the improvement of operational performance of the supply system in terms of the risk occurrence and distribution with respect to congestion and the objective framed in the study. The study involves the planning of the road network with respect to congestion and the factors responsible for the risk generation. The study is framed in two modules.

1. Development of the road network and the factors responsible for congestion i.e., finding the dependency of the risk generators.
2. Existing supply system improvement through the prioritization of the major corridors with respect to congestion to serve as a tool for road administrators in improvements of road links. The input data is collected using output data generated by GPS technology, GIS based supportive approach data. The study is initiated with supply system. The spatial evaluation is assumed to be proxy to the operational performance evaluation of the network. These characteristics are often close to ideal in CBD areas which are subjected to constant transformations in functionality of the road systems and are regularized with respect to supply system.

The proposed plan for the reduction of the risk needs huge investment needs and careful road auditing for implementation at the field level, a short term plan for improvement in the operational performance to prioritize the existing functional roads based on the congestion criteria is suggested using the principal component analysis and the regression analysis. The correlation parameters between the observed field data and prioritization observed from the
model indicate that the critical links identified in the network through the analysis are the worst links with respect to geometric, traffic, land-use characteristics. This method of analysis is used for the development of the road links and the places where there is more congestion with limited budget constraints, and it serves as a promising role for the road administrators and the government to implement at field level.

The objective of the concluding chapter is to present a summary of the main conclusions of this thesis, highlight the contribution of this study and its limitations, and provide directions for further research.

This thesis has focused on the risk analysis of three municipalities in the Cyberabad region and on the analysis of the effect of congestion and the contributions of congestion on the major corridors of all the three municipalities. The research provides a new dimension for the urban congestion policies, the strategies for achieving the objectives and the implementation techniques at field level. It also provides an innovative understanding of the supply infrastructure in terms of demonstrating in a scientific way

Some trajectories perform better than others according to the analysis. Engineers, planners and policy makers are advised to plan according to control measures for major risk distributors and major risk generated nodes and links which are to ensure effective flow of traffic with less delay and congestion in the city.
8.3 SCOPE FOR FURTHER RESEARCH

Research design developed in this study is limited to consolidating the risk quantification and identification of quantifiable role of each factor of influence on urban risk of travel. Prioritization of urban corridors for generating planning policies on urban infrastructure, land use policies and traffic management plans over time and space. Apart from this study on a continuation of research, there is need to analyze the total network on single entity and develop an approach with multi-criteria framed levels of planning. The factors of influence and risk representation should be handled simultaneously in order to prioritize the planning policies on infrastructure and land use. Further, certain methodologies should also be developed on integrated frame for sensitive land use planning of infrastructure and traffic mobility system. It is also found that there is a need for further identify research models beyond the operational models like transitional models for dealing with uncertain issues which are most common phenomenal feature in urban travel demand dealing with the uncertainty under different steady and unsteady states like models of Markov chains heuristic algorithms/ knowledge based expert system trained/untrained knowledge cells in neural networks.