Traffic Crash Prevention in the context of Analysis & Management

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***Abstract*—Amongst various health and risk associated issues, Road safety is also now treated as Public health problem as per the recommendations of World Health Organization (WHO). This is so particularly due to significant increase in number of traffic injuries. Pakistan is adversely affected with the problem of fatalities. It is the common practice that issues of crash prevention is not given consideration in the context of effective management. The safety issues are only dependent on imbalanced Police data governing general cause over speeding which is surely not at all.**

The research focuses on the operational model for mega city Karachi. The idea is designed to emphasize the trends including severity in road crashes, victims, and on major arterials. The idea integrates a connection between Engineering and Management with the help of exemplary system and provision of suitable infrastructure. Different year's data record is manipulated only to hit way forward actions that can be chosen for prevention. Trauma surveillance model is also discussed as a guideline in recommendations.

Keywords*— *Road safety, Traffic, Pakistan, Management, Accidents

I. An Introduction to Crash Prevention

Traffic accident is somehow now-a-days treated as severe safety issue leading towards major health problem at all. This is why because the injuries and fatalities occur during road accidents correspond to major issues. The crash or accident happens at once but the dependents of the victims adversely affected with the same throughout the life. Prevention rather than remedy is more important and should be highlighted phenomenon in road traffic accidents. Unfortunately the matter of road safety is not given much consideration in between the other issues of traffic and transportation management but symbolically the system of road safety is the key parameter of every agenda of transportation or infrastructure management. It could be pavement design, geometric design, traffic engineering and management, level of service, calculation of flow parameters; in fact every single concept of traffic is indirectly dependent on the issue of road safety.

The problem of increase in number of traffic crashes cannot be sort out only by overlooking the police reports, mentioning the two straight causes like over speeding and over taking. It should give the importance in the similar fashion as any surveillance system. Collection of judicial data as record keeping is not only the ultimate way; it requires a lot more than that. It requires certain application of management tools with effective coordination in between government sector, police department and hospital or specific institution in which a victim is registered as patient. The story is not ended over here, in the long run; data modeling with implication of analytical tools may be used for nominal outputs. Crash prevention is only possible if the graph of accidents of road users is proportionally decreased and this could be done by drawing impact studies of specific black spots [1].

II. Integration in Road Safety Management

Improvements in the problems of traffic crashes are important in the context of road safety. There may be several causes of an incident or accident but the system lacks proper management actions [2]. This complaint is to be received form most of the organizations in response of an accident. Integration in road safety management corresponds to be balance between three E's of transportation including Education, Engineering and Enforcement. If a system fails to produce balance in these three E's then big problems will arise. Management works are substantially transformed with improved coordination in between the stake holders of each project.

For a road safety project, the management action is dependent on injury surveillance data base system while the system will ensure the daily updating of data by designated coordinators [3]. In later sections of the paper, similar improved and operational models for a metropolitan city is also discussed. The discussion is presented keeping in view the gravity of issue of road safety management and identified loop holes that must be filled out by analytical and modeling perspectives.

III. Crash Reporting Standard Criteria

For having the corrected measures in the context of road safety, designed criteria must regulate as a whole and might not be changed or altered in long run as well. Extensive studies shows the basic classification of injuries; namely minor, serious (major) and fatal injuries. By definition the serious and fatal injuries play vital role for the improvement of any arterial of a city. Crash reporting standard criteria designates the combination of various identities in a single crash like the number of injuries and fatalities on a specific road w.r.t several spots, road users involved in identified spots, vehicles involved, involvement of pedestrians and passenger crashes, number of reported accidents in major arterials, comparison of different years of accident data record, percentage of different contributory factors of accidents etc. The noise in the data also demonstrates the set black spots and black roads of city. By looking the collected data in several ways, generalized or specified recommendation may be drawn for future interventions.

One of the most important parts in crash reporting is the set out aims and objectives of road safety project. The buffer zone of collected data covering the number of arterials and type of hospital records should be identified in preliminary phases of the project. This will ensure the credibility of entire work.

IV. Significance of Road Safety Audits and Accident Investigation Procedures

Audits and investigation techniques are very useful for road safety management processes. Implementation of audits and investigation must be applied in standard formalized manner. Road safety audits are meant as preventive measure and may be useful for construction work zones, application during planning, design and construction phases etc [4], while accident investigation is done for a particular incident in order to avoid future accidents. In both, investigations and audits, proposed engineering interventions and remedies are identified. The investigation is being carried out by detailed designed formal questionnaire covering severity measures while it may vary from country to country as per the need and requirement.

In order to make preference of black spots, severity indices may be calculated for different arterials. The audits and investigations are helpful in proposing effective calming measures, traffic control devices and features related to geometry and road furniture. Even in several cases, accidents causing friction effect is controlled with strategic safe pavement design procedures.

V. Situational Context of Road Accidents for Metropolitan City – Karachi, Pakistan

Karachi is in fact a metropolitan and big city in terms of population and vehicle ownership. Karachi is covered with number of arteries, collectors and local roads which need lot of concentration in terms of traffic management issues. The importance of road safety agenda is enhanced in Karachi city when look around the nature of single road network. Each arterial has its own characteristics in terms of road user, route mapping and vehicle involvement.

There are number of roads and arterials in Karachi on which severity index of road crashes is too high. The reported accidents are of fatal and serious by nature. The black spots of Karachi involved Shahrah-e-Usman Ramz, Shahrah-e-Faisal, MA Jinnah road, National Highway, Chaudary Fazal Ellahi road etc. The identified vulnerable road user groups in most of the dictated studies are Pedestrians and Passengers. The idea will be more emphasized with an analytical study presented in respective paper. The main contributory causes associated with the crashes of this city include improper traffic management, absence of traffic control devices, illegal cuts, wrong way movements, violation of law and rules, dilapidated roads, weak enforcement actions taken by concerned authorities etc [5]. For the sake of reason, this metropolitan city is taken as an example for this research study. The nature of accidents is illustrated in pictorial views below.

Fig. 1. Examples of Traffic accidents in Metropolitan City Karachi

VI. Traffic Injury Data Surveillance System in Karachi City – Role Model

Due to the increase in number of road traffic accidents and less signified police reports, the concerned stake holders had joined hands in order to inaugurate a data injury surveillance system for the benefit, safety and prosperity of mankind. The centre Road Traffic Injury Research and Prevention Centre (RTIR & PC) was being developed with the coordination of Public and Private sectors including Ministry of health, Education sector, Medico legal departments and Enforcing agencies as well. The focused objectives of the centre were [6]:

- Collection of accident data from major trauma centers of Karachi
- Proper organization of data or organization of data base management
- Detailed analytical studies from the collected data ensuring the type of roads, severity rate, vehicle involvement, severity in terms of road users and black spots. The data is to be analyzed using modern tools and techniques or software applications.
- Comparative analysis of different months/ years data record with continuous collection of data and recorded interventions on respective roads
- In addition to that, road safety audits and accident investigations on certain roads and major accidents respectively
- Preparation of impact studies with the help of collected data
- Formulation of justifications, proposals, reports and coordinated meetings for important stakeholders of the group

The entire data is to be collected from FIVE major hospitals of Karachi including Jinnah Post Graduate Medical Center (JPMC), Civil Hospital (CHK), Abbasi Shaheed Hospital (ASH), Liaqat National Hospital (LNH) and Agha Hospital (AKU). The department is synchronized in following sub divisions:

- Interviewing department
- Data Punching department
- Data operators and analytical department
- Engineering department
- Stakeholder's group

The members are deputed in emergency centers of identified hospitals for the interview from the victims arrived or either from the attendants. The data is to be collected in a prescribed format designed on standard guidelines or by the coordination of panels involving Experts, Engineers and supporting staff. The collected data is then now reached in the hands of data punching department which is refined from all errors and mistakes and presented on soft form rather than collected hard forms for further processing. The data operators and analysts perform vital role for valuable outputs. At this point, the transformation of data is done in various ways; the practice is to be done for observing a single traffic crash in different angles which may be helpful in future safety actions. The recommended measures on the basis of observations and analysis are produced by engineering department. The association of engineers is responsible for any proposed safety work ensuring standard operating procedures and guidelines. The implemented safety measures are proposed on the basis of analysis, practical exposure, availability of resources and material, involvement of agencies, field experience and knowledge and interest of concern stake holder. Audits, investigations and impact studies are also carried out by Engineering department.

VII. Analytical Studies of Road Traffic Injury Research & Prevention Center

RTIR & PC has a variety of data or analytical works in order to present accordingly. Some analytical studies related to important aspects are discussed below with descriptions [6]. As discussed earlier that data sets are categorized into Minor, Serious and Fatal injuries. The table below represents the severity rate of victims for tenure from Jan 2009 to Dec 2010. It is clearly shown in the table that approximately 25% of data is related to serious and fatal injuries require much attention for stakeholders.

TABLE I. Severity Rate of Traffic Accidents

Severity	Number	Percentage
Minor	48314	76%
Serious	12821	20%
Fatal	2409	4%

Another study is related to identify the black spots and black roads of Karachi city ensuring the classification of road users in particular crashes.

TABLE II. Road user Severity on Major Corridors

Roads	Rider/Pillion Rider	Pedestrians	Passengers	Drivers
MA Jinnah Road	1032	418	140	58
Shahrah-e-Faisal	1005	407	129	50
Korangi Road	775	313	95	28
Shahrah-e-Shah Suri	471	154	43	16
National Highway	363	198	178	26
Nawab Sadiq Ali Khan Road	555	117	57	21
Ch Fazal Ellahi Road	444	214	48	19
Main	262	88	50	12

Korangi Road				
Nishter Road	378	130	28	9
Site Avenue	268	97	62	15
Mauripur Road	229	216	49	15
University Road	306	233	44	22

As per the above data of year 2009 related to involvement of road users on major corridors, MA Jinnah road is highly affected with the injuries of each class of road user. MA Jinnah road is one of the busiest and mobilized arterial of city including number of spots. Several safety measures were taken after the complete formulation and presentation by centre to respective stake holder group on this road. These include enforcement actions, proper traffic planning works, installation of road furniture and calming devices etc. Afterwards impact studies are also produced to create balance.

While considering the multiple year analysis of traffic crashes for 2011 and 2012 below, it can be stated that vulnerable road user groups are Rider, Pillion riders and Pedestrians by all means of injury type. Most of the time safety measures are identified and highlighted by RTIR & PC keeping in the consideration of in injuries of this road user group. Unfortunately, the transportation system lacks behind the working of design road user group as per standard likewise the design controls and criteria and cross sectional elements.

TABLE III. PERCENTAGE OF INJURIES & FATALITIES OF DIFFERENT TYPES OF ROAD USERS

Road users	Minor	%age	Serious	%age	Fatal	%age
Rider/Pillion rider	29682	63%	6051	52%	853	37%
Drivers	1322	3%	412	4%	94	4%
Passengers	5623	12%	1527	13%	349	15%
Pedestrians	10352	22%	3466	30%	971	42%
Others	131	0%	105	1%	33	1%
Total	47110	100%	11561	100%	2300	100%

VIII. PROPOSED AND IMPROVED MODEL – CONCLUSION

The discussed and functional model of RTIR & PC is performing effectively for the benefit of road users and mankind but there is always a room of chance in every project. In the conclusion part of this research another improved and proposed model is presented and briefly explained below.

Following operational model components should be kept in mind while formulating a channelized solution in road safety project [7].

- Sustainable Funding source/ Generation: The funding agencies should be clearly identified with the scope and objectives of project ensuring their sustainability.
- Strong institutional framework: Leadership should not be promoted. Framework will be designed with less dependency.
- Skilled staff: Range of expertise should be present in order to cover all project heads.
- Positive relationship: Improved and strong coordination should be maintained among the stakeholders of project and market partners related to road safety.
- Qualitative and Quantitative work: Aspects of road safety should be covered in all terms including indigenous research, data collection and analysis.
- Media coverage: Media group should be introduced and promoted in identifying various types of crashes and intervention strategies on major roads for users.
- Organogram: The program should be well designed with conceptual hierarchy of managers, engineers and supporting staff in the context of designation. Over look committee should be present for monitoring actions.
- Individual Involvement: Public should have the access to take part in providing the solutions of road safety. This will ensure their priorities on certain roads with respect to strategy applied.

This is quite evident that traffic crash problem in our country is a debatable question and requires much more attention of related stakeholder group. Road safety measures and solutions are no doubt present for the implementation but on the base line management actions are also required which is only possible by integrating the above discussed steps. The stated research is also an example of blend of management and analytical perspective of road crashes.

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