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# Innovative Tools and Techniques in Identifying Highway Safety Improvement Projects

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***Abstract*: Road safety management may be a major concern in India. Now a day's roads are the highly hazardous environment in India. Road safety management reduces the injuries fatalities and major accidents. For every road the accidents are reported and collect the relevant data about the accidents are reported and review the collected data about the accident should be recorded. Based on the small print and reports the implementation of remedial measures also impossible due to less available data. The analysis are made depends upon the record to seek out out the high risk location, vulnerable road users. The reasons for accident is "Unsafe Conditions or Unsafe Acts" either by the road or by the drivers. This study highlighting the shortage of road safety awareness for the general public, drivers and therefore the basic concepts for improving the road safety management in India. we chose a road section between Wakad and Hinjewadi intersection of about 950meter.We tried to survey the geometric and operational condition of the road way. It includes measuring effective road width, shoulder condition, skid resistance condition, control device, street location and a few other parameters. To check the necessity (warrant) control devices., to work out the sort of improvement measure got to be taken, to live the effectiveness of a control measure we need this study. For this study a case study analysis is performed at waked bridge, Pune.**

***Keywords*: Traffic, Road, Management, National highways, Signals.**

## 1. Introduction

There is a growing public demand for safer streets and highways. In response to the present demand, state and national transportation agencies have developed safety programs that emphasize public education, accelerated highway renewal, community-sensitive street systems, and innovative technology to facilitate safe highway design. Historically, information about the security effect of a design component has been supported anecdotal evidence, laws of physics, before-after studies, or comparisons of site safety (i.e., sites with and without the design component). However, the accuracy of this information is suspect due to inherent random nature of crash data and therefore the many factors (some of which pertain more to the driving force and the vehicle than the roadway) that can lead to a crash at a specific location. As a result of this uncertainty, engineers have traditionally come to rely on design standards and policies to guide them in the design process, with the underlying premise that compliance with warrants and controls will yield a "safe" roadway.

## 2. Research Problem

The level of safety provided by a roadway is directly linked to the extent to which safety was explicitly considered throughout the design, design, and construction stages. Although one design exception for a selected highway element or the utilization of a minimum design value may end in an acceptably small reduction in safety, the net effect of several exceptions or the utilization of several minimum values can create an unsafe design condition. The goal is to build a traffic and road safety management system for intelligent route planning, road usage and maintenance that fulfills the constraints imposed by the Indian scenario. This system should work under varied road conditions, chaotic, dense and unstructured traffic and an outsized sort of vehicles. It should be cost effect, easy to deploy (no got to dig or build overhead structures) and need minimal maintenance. We should avoid the need for specialized equipment. In order to satisfy these somewhat conflicting requirements, we are willing to be content with system that does an approximate, aggregate traffic analysis and near real time reporting. We don't need an explicit count or classification of vehicles but rather some information through which we will deduce the state of traffic on a road segment. Hence, we are willing to tradeoff accuracy of reporting with ease of deployment. We want to create a road monitoring system that's ready to better quantify a road anomaly. Thus, our efforts are going to be to undertake determine ways to report severity, intensity or dimensions of a pothole or a damaged road segment.

## 3. AIM

The main aim of this study is to conduct a traffic survey and present a brief overview of road safety in Pune in terms of its factors, characteristics and priority safety improvement options

## 4. Research Objectives

- To conduct traffic survey at Intersections on road.
- To study all the safety systems for application on highway safety.

- To identify the safety issues at the survey site.
- Develop a prototype model showing the highway management system designed at the study site.

## 5. Methodology

This research is aimed to provide a model with safety systems and innovations for highway safety. The survey will be conducted in Residential, commercial and construction companies in Pune. The case study has been conducted on the site at wakad Location, Pune for analysis

This part of the chapter describes the data collection activities undertaken to assemble a database suitable for developing frontage-road safety evaluation tools. The first section outlines the criteria used in the segment selection process. The second section describes the characteristics of the crash data. The last section describes the process used to collect traffic flow and geometry data.

In the proposed model, we are not using a machine and operating it automatically by fixing sensors rather operating by manual efforts. In this research we place the ultrasonic sensor to one side of the road to detect whether there is any traffic congestion or not, if there is a congestion then the safety system will get activated, and when there is no congestion the system will operate normally. And if there is a congestion then a message is sent to the nearby traffic control police stating that traffic congestion has occurred. So this is a simple and can replace the heavy machines.

## 6. Present Scenario of Traffic Problem in India

Total networks of roads in India are 47lakh KM. The roads are classified under four categories 1) National highways, 2) state highways;3) PWD roads; 4) Rural and other roads. The distance of national highways is 70934KM, State highways 1,63,896KM, the space of PWD Roads is 10,05,327KM Rural and other roads are 27,49,805KM. For every 1min 1 major accident occurs, a minimum of 1 accident death for each 1 min. (Road Accidents in India,2010) Ministry of Road Transport and Highways. The road accidents in India nearly 4 to five lakhs the accident rate is gradually increasing per annum.

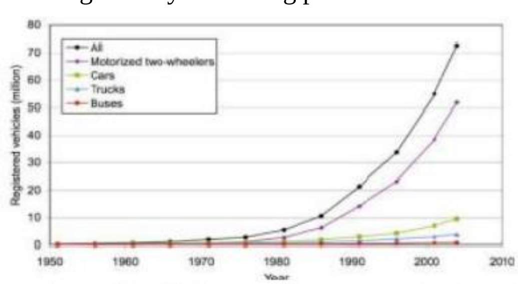


Fig. 1. Registered vehicles 1951 through 2005 (Department of Road and Transport)

## 7. Road Safety

The approach for road safety management is suggest some measures to reduce the accidents and to be implemented in the different classification of road networks for minimize the accidents, injuries, fatalities and damage to the properties result of road accidents table 1. Shows the brief work for good road safety development. The road traffic is also one of the most important issues in the road safety management. The accident factor in the behavior of human is very high. The basic concept of safety is the road safety audits, inspections and black spot managements was developed and promoted by (Perandones and Ramos, 2008). The efforts which are al completely eliminated in the transportation risk and it’s contribute a reduction of risk and to minimize the crashes level and consequences.

## 8. Experimental Study

*A. Data Collection*

*1) Vehicle/Traffic information*

Perhaps the foremost important traffic data is that the class-wise traffic volume, i.e. how many vehicles of each class (car, bus, truck etc.) pass through a specific point. This gives valuable information to road designers and traffic planners to make and keep the road corridors safe. Other traffic data which is collected is headway, gap, occupancy, speed and vehicle weight. The traffic volume data along a corridor gives the level of service of traffic operations, which is an indication pf traffic density. If the flow rate drops in a section of the corridor, and it shows significant unexplained difference between two points, it would mean traffic congestion due to a specific incident, like accident or vehicle breakdown, and appropriate corrective measures shall be adopted for the corridor

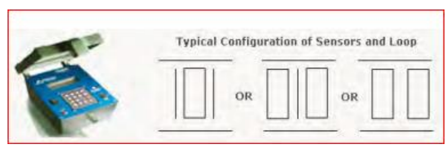


Fig. 2.

- Traffic data collection with intrusive sensors
- Intrusive sensors are those which are embedded in the road and their maintenance and installation requires lane closure or traffic diversion. For traffic flow monitoring, the only system consists of sensors embedded within the road connected to a roadside electronic unit called the “data logger” which records the sensor readings. The back-end software analyses theses readings and notifies aberrations. The sensors commonly used are electromagnetic loop, piezo-sensor, and pneumatic road tubes. A loop sensor consists of a wire with multiple turns embedded within the paved surface, generally concrete

A high frequency current is passed through this to generate an electromagnetic field and any metal body (the vehicle, in this case) passing over the loop disrupts this field and causes a change in current which is recorded by the loop detector in the data logger. As this loop behaves like an inductance, it is sometimes called and “inductive loop”. The “piezo-sensor” is made of material which exhibits piezoelectric properties, i.e. it generates electric charge when subjected to pressure. The sensor generates a charge (or voltage) proportional to the speed and weight of the vehicle passing over it. Such sensors can be used not only for axle detection but also axle weight. A combination of loops and piezo-sensor can detect vehicle's magnetic signature, vehicle presence, axle presence, and approximate weight, and a software algorithm then generates information on vehicle count, class, weight, speed, headway, gap and occupancy (traffic density).

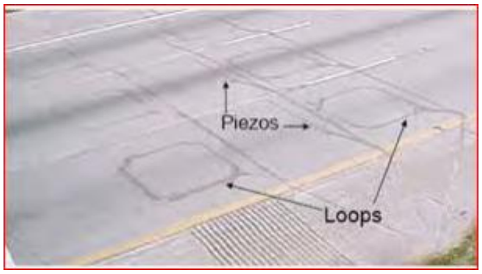


Fig. 3.

- Traffic data collection with non-intrusive sensors.

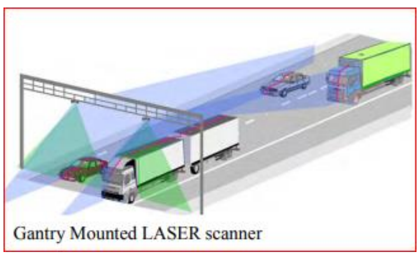


Fig. 4.

Intrusive sensors require lane closure for installation also as maintenance and to scale back this point, non-intrusive methods of knowledge collection are superior. The commonly deployed non-intrusive technologies are based on (a) light beam: infra-red (IR) and LASER (Light Amplification by Stimulated Emission of Radiation), (b) camera: image and video capture and (c) radio beam: RADAR (Radio Detection and Ranging). Infra-red (IR) sensors typically consist of infra-red transmitters and receivers installed on either side of the carriageway. As the vehicle passes between these sensors, it cuts the IR beam, which is named an "event". The number of times the beam is disrupted generates a pattern which provides information on number of wheels; inter wheel spacing, vehicle profile and therefore the tyre cord length. Each beam-cut event is time stamped and the data is then processed to calculate vehicle volume, class, speed and direction Laser sensors are generally mounted overhead and consist of a laser scanner which emits highly focused light on the traffic and records the reflected light. This provides a 3 dimensional profile of the vehicle which is then used for count and classification. Cameras also can provide information on detection and classification of vehicles. The video feed from the sector cameras is fed to video analytic software which detects vehicle presence, analyses the vehicle shape in video frames and filters each vehicle according to its class.

*2) Survey and Data Collection*

In many west and concrete cities like Pune, road traffic mix is characterized by high volumes of two wheeler motorcycles which traverse the roadway without lane discipline.

Two out of the four signalised intersections on the two lane dual carriageway Mumbai-wakad road were studied, namely the "Barclays bank" intersection located on the "Hospital road" link and the "Agric" intersection.

The objective covered in this chapter is to estimate toll traffic through Video based ATCC and estimate daily transport and commoner's vehicles passing at the Wakad Junction at Pune. National Highway (NH) starts at and ends at and is km long. The following map presents the alignment of NH:

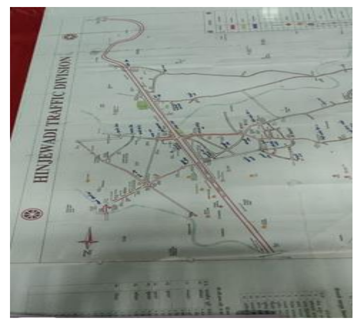


Fig. 5.


Fig. 6.

Categories of vehicles for survey and density calculation that are being calculated as per the notification are as given below:

For counting classified traffic through Video-based ATCC, videography has been administered near the signal location.

## 9. System Design and Information

### *A. Sensor Technology*

Over the last decade, sensor technology has become ubiquitous and has attracted plenty of attention. Sensors are deployed in many areas like healthcare agriculture and forest, vehicle and marine monitoring. In transportation, sensor technology supports the design and development of an honest range of applications for traffic control, safety, and entertainment. In recent years, sensors, and actuators like tire pressure sensor and rear-view visibility systems became mandatory within the manufacturing of vehicles and thus the implementation of intelligent transportation systems, aimed toward providing services to increase drivers' and passengers' satisfaction, improve road safety and reduce traffic congestion. Other sensors are optionally installed by manufacturers to observe the performance and standing of the vehicle, provide higher efficiency and assistance for drivers. Currently, the quality number of sensors during a vehicle is around 60–100, but as vehicles become "smarter", the number of sensors might reach as many as 200 sensors per vehicle, the author presents a classification of three categories of sensors supported the place of deployment within the vehicle: powertrain, chassis, and body. Another work classifies sensors during a vehicle supported the type of application the sensor is supposed to support, and 4 categories of sensors are identified: sensors for safety, sensors for diagnostics, sensors for convenience and sensors for environment monitoring. We extend the classification (four categories) proposed into include two additional categories of sensors, namely sensors for driving monitoring and traffic monitoring, as shown in Table below.

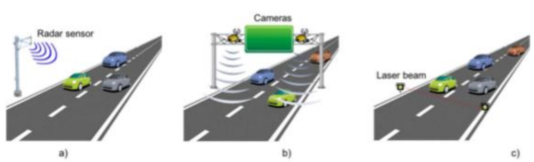


Fig. 7. Non-intrusive sensor groups, (a) roadside mast-mounted, (b) bridge mounted and (c) across roadside

## B. Taxonomy of ITS Applications

Figure 8, presents a taxonomy for ITS applications. The taxonomy defines six categories based on the type of application for ITS.

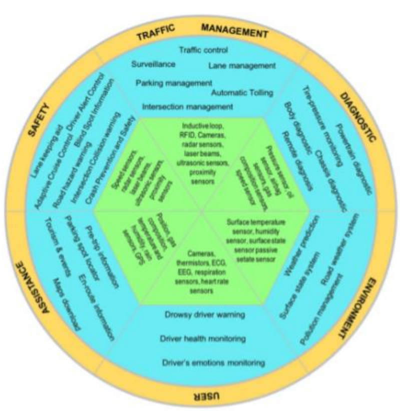


Fig. 8. Taxonomy for its applications

## 10. Site Investigation and Analysis

This project evaluation analysis is completed by the subsequent methods:

- Observational before/after studies: Observational before and after studies are a standard and preferred method for evaluating the security effectiveness of a project. This study use crash and traffic data for the amount before and after the countermeasure implementation. Since the treatment sites are typically selected supported high crash frequency, applying this method can have some drawbacks because of the selection bias. Daily observations are done on the chosen site as mentioned previously in chapter 3 for a period of 1 week.
- The study should also include some unusual roadside activities which may cause overall detrimental effect on the extent of service and road-user safety.

## 11. Investigation/Survey Observation Overviews

Data has been taken keeping mind about two parameters.

- Geometric
- Operational Geometric condition analysis:

*General Purposes:*

- Scientifically study and observe pavement surface condition.
- Determining the geometric layout of the roadway and point out any drawbacks of the following general protocol
- Pedestrian crossings, presence of non-motorized vehicles, disabled traffic signals, accessibility problems.
- To observe whether the infrastructures and space provided for usage are being properly utilized.
- To observe the level of illumination in the road during night and determine its sufficiency.
- To determine the current conditions of road markings, signs and whether they are being helpful for pedestrians and road users

*Design Purposes:*

- Geometry: Inclinometers measure the forward or back tilt of the vehicle for gradient and the side-to-side tilt of the axles for cross fall.
- Texture: Accelerometers remove most of the vehicle motion relative to the road to provide a stable inertial
- To examine the existing operating/service condition of a roadway section.
- To check the need (warrant) traffic control devices.
- To determine the type of improvement measure, need to be taken.
- To survey new Access Road.
- Monitor highway performance
- Measurement of current demand of a facility
- Location and width of side roads in goggle map
- Roadside land use pattern (residential, commercial)
- To show various control devices like Road sign, Marking, Signal, Speed breaker.
- Finding out the faults of that intersection and making proposals to remove them.
- Planning for reducing congestion and minimize delay in intersection.
- Layout of street lightening.

## 12. Conclusion and Recommendation

### A. Conclusion

- In average a width of 9 m has been maintained.
- Shoulder height and width in average is 1 feet & 1.7m
- Median height and width in average is 1.5 feet and 1.7 meter
- An important parameter is that along our chain age we did not find pedestrian crossing. But later measurement shows for pedestrian facility height of median is about 1'. that is less than average height
- confinement of buildings has reduced shoulder with about .5 meter
- average interval for pedestrian rod passing is 25 m
- Along our whole section only one u turn facility is provided
- Presence of many side roads along arterial road is enough a cause to reduce safety, efficiency and capacity
- Main vehicles emerge from side road is NMV and CNG auto rickshaws
- The orientation of some of them are even opposite to the lane direction
- Reduction in shoulder is on average .4m
- Major factor for disturbing road capacity is side road
- All types signal are present here. But they are not operative. Again manual control is dominant
- Some signal has not power connected. Several are obstructed by objects. Thus the are totally ineffective
- In several places marking has worn out
- Road texture was rough

### B. Future scope

- Before surveying a clear view can be achieved from google map. This will help to understand in what place more specific data is required.
- The above mentioned work can be established at highly accident prone zones with accurate data collection.

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