# AN EXPERIMENTAL STUDY ON TRAFFIC FLOW FOR EVALUATION OF GEOMETRIC ASPECTS OF HIGHWAYS

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**ABSTRACT**

The development of Intelligent Transportation Systems (ITS) requires high quality traffic information in real-time. For several years, under growing pressure for improving traffic management, collecting traffic data methods have been evolving considerably and the access to real-time traffic information is becoming routine worldwide. The use of traditional on-road sensors (e.g. inductive loops) for collecting data is necessary but not sufficient because of their limited coverage and expensive costs of implementation and maintenance. In the last years we have been witnessing the emergence of alternative data sources.

This study aims to analyse the current road traffic data collection methods - both fixed and mobile - in terms of capabilities and limitations. The development of Intelligent Transportation Systems (ITS) highly depends on the quality and quantity of road traffic data. Usually, traffic information such as vehicle speed or traffic flow is collected through fixed detectors placed along the road network at strategic points. Currently, collecting traffic data through mobile phones and In-Vehicle GPS has become an alternative source of data gathering that can provide accurate real-time information over a large road network and overcoming some problems related to fixed detectors. Even if further developments are still needed, both types of sources - fixed and mobile - are now widely used by several service providers worldwide to provide the users with high quality real-time traffic information. Economic issues related to the emergence of this new market based on real-time information from these technologies are also discussed.

## I. INTRODUCTION

With the rapid development of urbanization, collecting and analyzing traffic flow data are of great significance to build intelligent cities. The paper proposes a novel traffic data collection method based on wireless sensor network (WSN), which cannot only collect traffic flow data, but also record the speed and position of vehicles. On this basis, the paper proposes a data analysis method based on incremental noise addition for traffic flow data, which provides a criterion for chaotic identification. The method adds noise of different intensities to the signal incrementally by an improved surrogate data method and uses the delayed mutual information to measure the complexity of signals. Based on these steps, the trend of complexity change of mixed signal can be used to identify signal characteristics. The numerical experiments show that, based on incremental noise addition, the complexity trends of periodic data, random data, and chaotic data are different. The application of the method opens a new way for traffic flow data collection and analysis. Traffic congestion is a daily phenomenon in large- and medium-sized cities all over the world. With limited urban facilities and resources, it is an effective way to control traffic congestion by analyzing and predicting traffic flow. This involves two issues, collecting and analyzing traffic data. There are many methods to collect traffic data, such as pneumatic road tubes, induction loop, and piezoelectric sensors. These methods can collect traffic flow, but cannot record the speed and location of vehicles, which cannot meet the needs of traffic flow analysis algorithm. The paper proposes a novel traffic data collection scheme based on wireless sensor network (WSN). The scheme measures vehicle flow and speed based on vehicle disturbances to geomagnetism and uses the slotted ALOHA protocol to communicate between data nodes. Based on the scheme, vehicle speed and location are record every specific time slot. Chaos algorithm is widely used in traffic flow data processing, and chaotic identification is the premise of chaotic analysis. However, because of the complexity of chaos, its intrinsic mechanism has not been fully revealed, so the academic community has not yet proposed a unified definition of chaos. Aiming at the chaotic identification, scholars have proposed many criterions, such as Poincare section, bifurcation diagram, power spectrum, Kolmogorov entropy, and topological entropy. The most commonly used criteria are the largest Lyapunov exponent and the fractal dimension, but these two parameters are based on phase space reconstruction. Only in real phase space or near-real phase space that the two parameters can accurately analyze and identify the signal. The time delay method based on the Takens embedding theorem is a main way for phase space reconstruction. However, this method has been influenced by many causes in practice, so the real phase space model of the object is often difficult to get, which leads to the unreliability of the identification results. According to the idea of indirect method, the noise of different intensities is incrementally added to the signal, and it is found that the complexity trend of the mixed signal is an important feature for identifying signal characteristics.

**SCOPE OF THE WORK**

This experimental technology can collect travel time data by discretely tracking cellular telephone call transmissions. Cellular telephones are also useful to collect travel time data. Two techniques have been applied using cellular technology: cellular telephone reporting and cellular geolocating.

Cellular Telephone Reporting: An operator at the central control facility records each drivers identification, location, and time, by monitoring the time between successive telephone calls, travel time or travel speed between reporting locations are determined. It is useful for assessment of current traffic conditions and for collecting travel time data during delays or accidents. The cellular telephone reporting method is recommended for short-term studies with low accuracy requirements.

## II LITERATURE REVIEW

The lower level problem involved determining the optimal information strategy given the optimal locations of the DMS (found by solving the current iteration of the upper level problem). The lower level problem was solved using a simulation-based dynamic network assignment model (DYNASMART). The DMS is assumed to provide route guidance to users along paths to their destinations under a single incident scenario. The travel times on all paths connecting the DMS location to a particular destination are assumed to be equal and minimal.

Valdez-Diaz et. al. (1999) provides a methodology to determine optimal time-dependent percentages of vehicles to be diverted under incident conditions such that the system travel time is reduced. Two classes of users are considered to be present in the system: Class 1 users have no information and class 2 users receive information through Dynamic Message Signs. Class 1 users follow pre-specified paths obtained for a no incident scenario. Class 2 users accessing the DMS follow time dependent System Optimal paths from the DMS location to the various destinations. Optimal time–dependent diversion rates, determined using a MUC model, resulted in a consistently better system performance (up to 15 %) under various incident scenarios.

The essential point of the investigation is to give an unmistakable and useful technique for the life cycle sway evaluation of street developments and for the correlation of option auxiliary arrangements. The evaluation methodology should assess the unique highlights of street developments. It was trusted that the evaluation technique would be so basic and simple to utilize that in future it could likewise be utilized by organizers and planners. Be that as it may, the appraisal should cover the primary life cycle periods of the developments just as the most significant natural effects, and it should likewise meet the other fundamental necessities set forever cycle examination. The examination concentrated particularly on the correlation of mechanical side-effects and traditional materials in the circle of street development, however there was likewise a craving to apply the methodology to the ecological effect evaluation of different developments too. A similar methodology dependent on impact scoring that would supplement the stock procedure for street developments was set as one point of the investigation, since it was wanted to that in future the evaluation technique would likewise be appropriate for use regarding other arranging frameworks, for example the existence cycle cost investigation being produced for street developments. These frameworks necessitate that the outcomes can be exhibited as basic, commonly practically identical numerical qualities. What's more, there was a longing to improve the appraisal in situations where the client isn't completely familiar with ecological effects. Another point was to get a more extensive perspective on the criticalness of the ecological stacking information being managed, and along these lines to make it simpler to set framework limits.

## III METHODOLOGY

The investigation was completed in two phases so that in the primary stage a proposition was made for a methodology appropriate for the existence cycle sway appraisal of street development. So as to assess the relevance of the technique, the utilization of coal fiery debris, squashed solid waste and impact heater slag in street development was assessed on the off chance that reviews. The utilization of these modern side-effects and waste materials was contrasted and the utilization of characteristic materials in comparing applications. The important information was additionally gathered during the investigations. Exceed expectations based formulae for each work stage were utilized as the stock method.

The point of the investigation's subsequent stage was to move the collected information for utilisation as a reasonable model by making a stock examination program to figure and think about the existence cycle effects of the most widely recognized street developments. The information got in the primary phase of the examination was increased to the degree important for this reason. Four phases of performing a LCA

1. Goal and Scope
2. Life Cycle Inventory Analysis
3. Life Cycle Impact Assessment
4. Interpretation

**TRAFFIC VOLUME STUDIES**

Intersection Counts Intersection counts are used for timing traffic signals, designing channelization, planning turn prohibitions, computing capacity, analyzing high crash intersections, and evaluating congestion (Hamburger et al. 1996). The manual count method is usually used to conduct an intersection count. A single observer can complete an intersection count only in very light traffic conditions. The intersection count classification scheme must be understood by all observers before the count can begin. Each intersection has 12 possible movements. The intersection movements are through, left turn, and right turn. The observer records the intersection movement for each vehicle that enters the intersection. Intersection Movements

**CONTRACTING FOR A TRAFFIC VOLUME COUNT STUDY:**

Information Gathering Before a jurisdiction contacts an engineering consulting firm to perform a traffic volume count study, a variety of information may need to be collected. Any information may aid the consulting firm in adequately completing the study. The following is a list of possible information that an engineering consulting firm may request:

· issue at hand

· historic volume counts

· existing zoning

· proposed future land use changes

· traffic impact statements if available

· citizen input · location map

· appropriate contact persons

· any other relevant information the following project work order may assist local governments in contracting to an engineering firm.

As a result, it is appropriate to use automatic traffic counters with either: - Inductive loops only where traffic flow data is required or - Inductive loops and WIM sensors where both traffic flow data and axle or speed measurements are required. Notwithstanding the above, where only inductive loops are used it is possible to count 5 classes using the following axle spacing classification:

1L Light vehicles, Cars, Taxis, Vans and Pick-Ups .............(length 0 - 5.5 m)

2L Unarticulated trucks, 2 - 3 axle Trucks, Buses ............(length 5.6 - 7.5 m)

3L Unarticulated bus, Buses and Trucks ...........................(length 7.6-12.4 m)

4L Heavy trucks and very long Buses .......................... (length 12.5 - 15.9 m)

5L Heavy trucks ..........................................................(length 16.0 – 22.0 m)

With inductive loops and WIM censors installed it is possible to count 7 classes as follows: 1W Car, Taxi and Vans........................(2 axle, length 0-5.5 m)

2W 4W-drive Pick-Ups........................(same as 1W, but with higher chassis)

3W 2-axle Trucks and Buses................(length 5.6 – 7.5 m, weight - 2 tons )

4W 3-axle Trucks and Buses...............(length 5.6 - 7 m, weight 2 - 20ton)

5W 2-3 -axle Buses and Trucks...........(length 7.6 - 12.4 m)

6W 4-5-axle Trucks.............................(length from 12.5 m)

7W 6 or more axle Trucks ....................(length from 16.0 m)

Where counts have been done with both WIM and inductive loops it is often difficult to specify the classification of aggregated data.

A better solution is to store the following measured data for each vehicle type:

● Date and time.

● Speed.

● Total length .

● All axle spacing.

● All axle weights.

When data has been stored for each vehicle, various options can be selected and the computer can be programed to perform various calculations as may be required. With the use of inductive loops in each lane it is possible to measure the vehicle speed very accurately. Most counting equipments have speed registration which then group vehicles into speed categories, again these can be used to group the different vehicles by their axle spacing. Some counting equipment has the facilities to register the average speed and variation of the speed.

For each direction the following vehicle speed data should be collected hourly:

● Average speed of all vehicles

● Speed variation of all vehicles

● 85 % faster than

● 15 % faster than

● Vehicles > 60 km/h

● Vehicles > 80 km/h

● Vehicles > 100 km/h

● Vehicles > 120 km/h

● Vehicles > 140 km/h

● Number of vehicles < 2 sec behind vehicles ahead

● Average speed length for group 1L

● Average speed length for group 2L

● Average speed length for group 3L

● Average speed length for group 4L

● Average speed length for group 5L In recent years substantial efforts have been made by various traffic authorities all over the world to develop/use suitable Weigh-in-Motion (WIM) equipment, in some cases these efforts have not been fully successful.

## IV EXPERIMENTAL I ANALYSIS AND RESULTS

### ESTIMATION OF ANNUAL TRAFFIC FLOW AND TRAFFIC VOLUME

Two very important types of traffic data delivered by transport centres around the world concern the Average Annual Daily Traffic (AADT) and the Vehicle Kilometres Travelled (VKT). These two raw traffic variables, mainly derived from fixed sensors measurements, play a key role in traffic engineering analysis (e.g. model calibration, determination of traffic exposure functions, etc.) and policy decisions.

**Traffic flow – Average Annual Daily Traffic (AADT)**

AADT is the average calculated over a year of the number of vehicles passing a point in a given counting section each day (usually expressed in vehicles per day). It simply represents the vehicle flow over a road section (e.g. highway link) on an average day of the year.

AADT is considered as one of the most important raw traffic dataset where it provides essential inputs for traffic model developments and calibration exercises that can be used for the planning of new road construction, determination of roadway geometry, congestion management, pavement design, and many others. AADT is generally available for most of the European road networks. The data is collected by traffic control centres, refined and disseminated to users by traffic information centres in most of the EU countries.

### STUDY AREA

The Report was prepared for Traffic survey Sampling studies on SH-01 (Hyderabad – Karimnagar – Ramagundam Road (SH-1) from Km 28+200 to Km 235+058) which is also known as

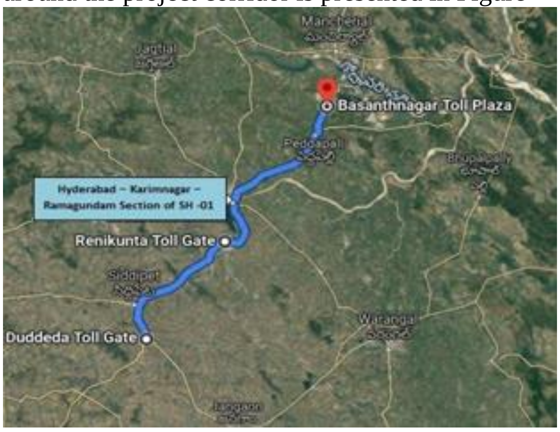
Rajeev Rahadari under Chief Engineer R&B. The Project stretch commences at km 28.200 beyond the Hyderabad Outer Ring Road near Thumukunta Village and passes through Karimnagar and Ramagundam towns before ending at km 235.058 by joining NH-63 near Mancheriyal in Adilabad District, now the Traffic Sampling pertaining to three toll plazas (TollPlaza-1 Duddeda, TollPlaza-2 Renikunta, TollPlaza-3 Basanth Nagar). The details pertaining to the Traffic sampling and its analysis are presented in the following sections.

THE PROJECT HIGHWAY

State Highway 01 also knows as Rajiv Rahadri, starts from Hyderabad near Parade grounds and ends at junction with NH 16 near Ramagundam. Enroute it passes through the districts of Hyderabad, Rangareddy, Medak, Karimnagar and Adilabad.

The Present Project corridor starts at km 28.200 and ends near Ramagundam at km 235.058.The stretch lies in Medak, Karimnagar and Adilabad districts of Andhra Pradesh (Currently in Telangana state) and passes through or abutting towns and major settlements like Gajwel, Siddipet, Karimanagar, Peddapalli, Ramagundam and Godavarikhani.

The terrain is generally plain and the alignment crosses or abuts water bodies, including major dam maneru Karimnagar. The major activities around the corridor are agricultural and industrial establishments are located. The alignment of the project corridor along with major road network around the project corridor is presented in Figure




**Schedule of Traffic Surveys**

| Sl. No. | Type of Survey | Duration | Location | Date(s) of Survey |
|---|---|---|---|---|
| 1 | Classified Volume Count Survey | 24 Hrs | Duddeda (TP1) at km 91+450 | 23.10.2021 - 29.10.2021 |
| 2 | | | Renikunta (TP2) at km 140+050 | |
| 3 | | | Basanthnagar (TP3) at km 208+100 | |

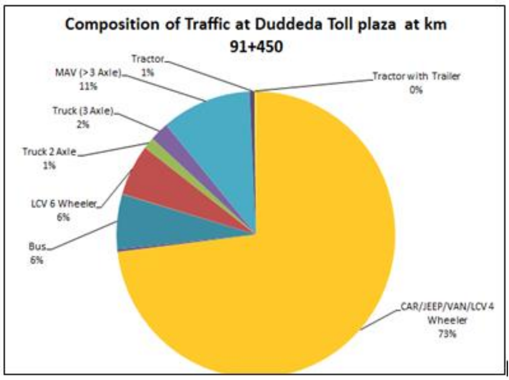
| S. No | Mode of Vehicle | Duddeda (TP1) at km 91+450 | Renikunta (TP2) at km 140+050 | Basanthnagar (TP3) at km 208+100 |
|---|---|---|---|---|
| 7 | Truck (3 axle) | 385 | 384 | 502 |
| 8 | MAV (> 3 axle) | 1832 | 1782 | 1817 |
| 9 | Tractor | 102 | 33 | 120 |
| 10 | Tractor with trailer | 24 | 16 | 7 |
| 11 | Passenger vehicles | 14009 | 7959 | 5990 |
| 12 | Freight vehicles | 3589 | 3058 | 3078 |
| Total Vehicles | | 17598 | 11017 | 9068 |
| Total PCU | | 28346 | 20137 | 18790 |

**Average Daily Traffic at Toll Plaza locations on SH-01 by ATCC Survey**

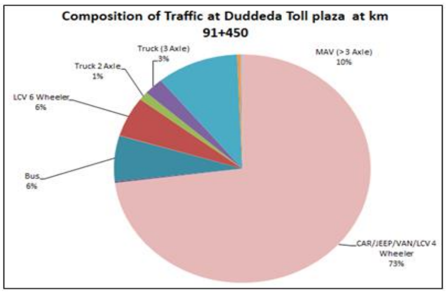
| S.No | Mode of Vehicle | Duddeda (TP1) at km 91+450 | Renikunta (TP2) at km 140+050 | Basanthnagar (TP3) at km 208+100 |
|---|---|---|---|---|
| 1 | Car/Jeep/van/LCV 4-wheeler | 12716 | 7323 | 5433 |
| 2 | Minibus | 34 | 19 | 9 |
| 3 | Bus | 1122 | 662 | 641 |
| 4 | School bus | 12 | 16 | 17 |
| 5 | LCV 6-wheeler | 985 | 686 | 404 |
| 6 | Truck 2 axle | 210 | 144 | 202 |
| 7 | Truck (3 axle) | 428 | 424 | 557 |
| 8 | MAV (> 3 axle) | 1799 | 1796 | 1779 |
| 9 | Tractor | 78 | 35 | 122 |
| 10 | Tractor with trailer | 33 | 17 | 8 |
| 11 | Passenger vehicles | 13884 | 8021 | 6100 |
| 12 | Freight vehicles | 3532 | 3102 | 3072 |
| Total Vehicles | | 17416 | 11123 | 9172 |

**Composition of Traffic**

**Composition of Total traffic observed at three toll plazas on SH -01 by Manual survey and ATCC method is given in the following Figures from Figure**

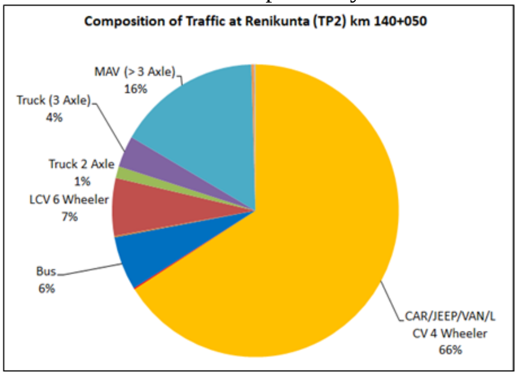



**Traffic Composition at Duddeda Toll plaza at km 91+450 by Manual CVC count**

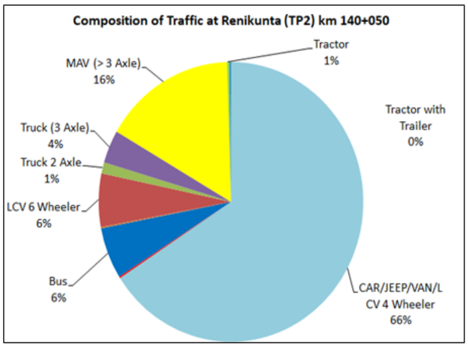



**Traffic Composition at Duddeda Toll plaza at km 91+450 by ATCC count method**

The composition of traffic for Duddeda Toll plaza is shown in Figuresby Manual count method and ATCC method. Cars shares 73% & Truck traffic is 20% and buses are 6% respectively.



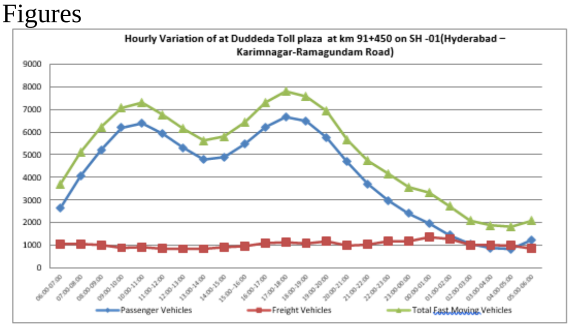

**Traffic Composition at Renikunta Toll plaza at km 140+050 by Manual CVC count**



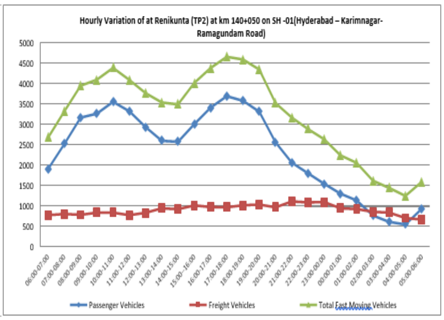

**Traffic Composition at Renikunta Toll plaza at km 140+050 by ATCC count method**

Hourly Variation of Traffic

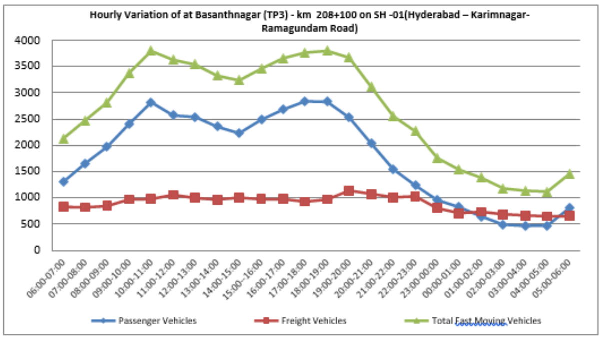
The analysis of hourly traffic variation is helpful in identifying the percentage of peak hour traffic flow to the total ADT. The hourly variation of traffic and category-wise are presented in the following Figures




**Hourly Variation of Traffic in terms of Total Traffic at Duddeda Toll plaza at km 91+450**




**Hourly Variation of Traffic in terms of Total Traffic at Renikunta (TP2) at km 140+050**




**Hourly Variation of Traffic in terms of Total Traffic at Basanthnagar (TP3) - km 208+100**

Daily Variation of Traffic Volume Daily variation of traffic for three toll plazas is given in the following

Table

Table : Daily Variation of Traffic at Three Toll plazas on SH-01 by Manual Count Method

| Daily Variation of Traffic by ATCC Counting | | | Total Vehicles at Duddeda (91+450) | | Total Vehicles at Renikunta (140+050) | | Total Vehicles at Basanthnagar 208+100 | |
|---|---|---|---|---|---|---|---|---|
| S. No | Date | Day | Total Vehicles | Total PCU | Total Vehicles | Total PCU | Total Vehicles | Total PCU |
| 1 | 23-10-2021 | Saturday | 18651 | 29363 | 12041 | 21539 | 9716 | 19965 |
| 2 | 24-10-2021 | Sunday | 20216 | 30568 | 12664 | 21629 | 9845 | 18645 |
| 3 | 25-10-2021 | Monday | 18061 | 27709 | 11281 | 20102 | 9240 | 18313 |
| 4 | 26-10-2021 | Tuesday | 15922 | 27095 | 10092 | 19521 | 8316 | 17936 |
| 5 | 27-10-2021 | Wednesday | 17724 | 29029 | 11220 | 20753 | 9627 | 19572 |
| 6 | 28-10-2021 | Thursday | 15891 | 26535 | 10137 | 19316 | 8922 | 19175 |
| 7 | 29-10-2021 | Friday | 15449 | 26071 | 10427 | 19850 | 8538 | 18477 |
| | **Average daily Traffic (ADT)** | | **17416** | **28053** | **11123** | **20387** | **9172** | **18869** |

## V CONCLUSION

A projected annual traffic growth is expected that the total number of vehicles using the Public Highway Network will increase substantially. This indicates a potential demand for investment in transport infrastructure. Proper utilization of such huge investments necessitates systematic planning for need-based development. Such need based developments include determination of the required capacity expansion, provision of additional road infrastructure, improvement of existing roads, prioritization of different development phases and forecasting of which is possible upon collection of traffic data. This is done in order to eliminate bottlenecks in both international and local inter-urban road transport towards providing an efficient and effective road transport system.

The concept of forecasting the future use of the road network in terms of traffic loading and flow, is generally an accepted approach world-wide. The techniques used have become almost standard in both developing and developed countries. The accuracy of traffic data collection and the subsequent predictions are of paramount importance in the fulfillment of an appropriate planning, design, maintenance monitoring and management of the road network.

In the past, routine collection of traffic data in any country was not considered important for the development and management of the road network. In the early 1970's it was realized that a wide variety of information is required in respect of traffic characteristics for proper planning, design, maintenance and management of the national road network. This realization emanated from concerns raised with regard to the amount of traffic (volume), the composition of the different types of vehicles, their speed, total gross weight, number of axles, axle loads and origin and destination of the journeys. Most of this information result in assessment of progressive or rapid deterioration of the road network towards estimating additional cost required to sustain it.

As a result, attempts are now being made to adopt suitable road traffic methodologies for conducting road traffic surveys, which are both technically and scientifically sound, and operationally convenient to execute under the country's prevailing conditions. This includes the use of both manual and automatic traffic counters, together with computer analysis of the collected traffic data. During the planning, design, construction and maintenance period of the road network, traffic data becomes an essential element in decision-making, and therefore the format and the accuracy of data collection and analysis is critical. It is with this view that this post the concept of traffic data collection and analysis has been authored

Finally conclusion drawn is

The rapid vehicular growth partned with ever increasing population, rural to urban migration ever economic upsurge has put immense amount of pressure and transportation infrastructure and especially on traffic management practices in cities and towns of urban India. Based on the international experiences and best practices observed in the countries like USA, Dubai, Canada, European nations, United Kingdom etc., the application of ITS seems a promising solution for advanced traffic control and management. There are many physical, social, economic and administrative challenges in front of ITS to flourish in India. India has just begun the journey in the field of ITS, still there is an urgent need of implementation the ITS application more comprehensive, primarily by formulating an ITS based transportation policy and secondary by making it mandatory for urban areas.

**REFERENCES**


1. 1] World Bank India; Development dialogue: spending an Infrastructure Drives Growth. World bank India Newsletter. New Delhi, India 2009
2. [2] J Levine, S.E. underwood; Amultiatribute analysis of Goals for Intelligent Transportation system Planning, Transpn Res.-C, Vol.4(2), pp.97-111-1996.
3. [3] Chowdhury, mashrur A. and Adel Sudek; Fundamental of Intelligent Transportation Systems Planning. Boston, MA: Artech House, 2003.190 pages. ISBN 1580531601.
4. [4] Yokota, Toshiguki et al; ITS Technical Notes for Developing countries. World Bank Washington DC. 2004, retrieved 9 May 2015.