Data Requirements for Lahore Traffic Management System

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At present there are at least seven government agencies responsible for Lahore's road and traffic data. These multiple planning agencies collect data for their own purposes and sometimes the surveys are repeated on the same road within a year by different agencies and consultants. This is an indication of poor coordination and communication between agencies and the citizens. There is a lack of a single agency or department responsible for maintaining transport and traffic data and an adequate system to keep updated data like vehicle ownership, driving licenses which is also a major issue. Urban transport problems in Lahore are mostly managed by widening or building larger, better roads and flyovers. This bureaucratic and project centric approach is inadequate to meet transportation challenges. Lahore has a history of incomplete and poorly envisioned projects as the city suffers from ad-hoc planning with little strategy and coordination. Budget constraints, limited funding and unclear status of committed projects further add to the dilemma.

Road and Traffic Management

Encroachments are a serious traffic hazard. Yet streets are filled with retail encroachments and street vendors. The parking spaces are limited for commercial shops and many street vendors earn their daily income from street activities. There is poor management of space available as Lahore suffers from a chaotic mix of pedestrians, carts, bikes, motorbikes, rickshaws, cars; widespread encroachments can be seen in most places. Poor management of physical infrastructure, road maintenance, pavement failures, and chaotic rainy season makes commuting extremely difficult. Enforcement of traffic rules is increasingly becoming a challenge.

Roadway design and Parking Management

No roadway geometric design standards exist in Punjab and major design firms follow American standards (AASHTO) for designing rural or urban streets. These standards are designed for homogenous traffic and do not consider the impact of rickshaws, qingqis, and carts, etc. There is absence of dedicated parking facilities hence vehicles are illegally parked on streets. Land in Lahore has been continuously encroached by illegal parking along roads; it reduces operational capacity of road due to friction of parked vehicles and occupancy of road space. No parking design standards or guidelines exist. Moreover there is no parking policy existing for Lahore or Punjab for overall managing parking and providing such facilities. Traffic laws are not applied on cyclists; animal drawn carts push carts and pedestrians while they make 70% of total road users. Traffic police do not have adequate authority to remove encroachments. Work zone, school area signage is also nonexistent; as these fall under the jurisdiction of District Administration.

Establishment of Central Data Repository & Official Websites

Establishment of central data repository for traffic, accidents, zoning, land use and GIS would help develop planning, monitoring and evaluation mechanisms for infrastructure and service delivery. Such an establishment would facilitate transport institutions and agencies in conducting further transport studies, access relevant data and ensure pragmatic implementation of projects.7 All data, project information, traffic counts and relevant statistics should be on official websites of the departments for sharing with general public and relevant authorities. The electronic forms and downloadable documents should be made available on official websites with anonymous complaint and suggestion system as well. Many departments have no official websites (See Annex V) considering the work they have been doing, TEPA has no official website, while it should have a

proper website displaying upcoming projects, project budget details, completed projects and upcoming planned projects.

Transport Demand Management

We need to accept that in the future, it would become difficult to provide enough road capacity to satisfy the future demand and so it becomes necessary to find ways to make sure that demand is restrained to match the capacity that can be provided. Transport demand management policies aim to: traffic calming in residential areas, auto-restrict zone in the city centre, area licensing schemes (ALS), vehicle ownership restraint, road pricing, congestion pricing and peak period dispersion.

Key Findings from First International Conference on Sustainable Transportation & Traffic Management, July 1-3, 2010, Karachi

1. The design and location of manmade structures should be regularized since they pose a threat to human lives during a natural calamity such as an earthquake.
2. Proper manuals and codes should be “adapted” and not “adopted” keeping public safety and our own infrastructure needs in mind.
3. Future hazard predictions through appropriate research models should be discussed with the concerned authorities so that precautions can be implemented.
4. Urban planning, transportation and infrastructure professionals should be made part of the concerned decision-making process at every government level to formulate appropriate policies and programs.
5. Public safety laws should be enforced and made as a regular feature of all transportation and driver’s education manuals.
6. Public awareness campaigns should be held to promote the various dimensions of travel safety. 7. Confidence building measures and mechanism should be introduced to encourage data sharing between government agencies, universities and other stakeholders.
8. Mechanism for increased coordination between law enforcement agencies and emergency response units should be designed.
9. Traffic law enforcement agencies and city authorities should work together properly to enforce the laws relevant to reducing vehicle crashes and road user fatalities.
10. The use of GIS should be promoted through curriculum, workshops and training courses for all stakeholders.
11. Road user safety would be enhanced by expanding the ITS video surveillance network throughout major cities of Pakistan (including efficient traffic and incident management, crime prevention surveillance, and other benefits realized by Karachi City’s Command & Control Centre).
12. Calibrate traffic flow and assignment models using ITS video surveillance data in cooperation with the city authorities.
13. Sustainable transportation and development requires mixed landuse and increased transit mode share. Pakistani cities mostly have mixed landuse which should be a priority in future development in combination with clean transit modes, such as compressed natural gas (CNG) buses.
14. Women professionals should be involved in transport planning, policy making, operation, and maintenance of all modes of transportation so that women’s points of view are incorporated appropriately.
15. A special section of the traffic police should be established to record accident data and share it with other stakeholders.
16. Traffic police, city authorities and provincial authorities should work together to establish and implement vehicle inspection and emission testing programs to reduce air pollution in cities and remove faulty and unsafe vehicles from roads.

17. Investment in transportation infrastructure should be given high priority by government agencies at all levels considering ‘clean’ public transit, women preferences, and pedestrian friendly strategies.

THEORETICAL FRAMEWORK

According to a report in December 2005 more than 500 people have lost their lives on roads of Pakistan just because of increased frustration resulted because of traffic congestion (Humayun, 2006). Congestion holds different meaning to different commuters. For a traveler congestion is a loss of time, missing opportunities and something that leads to frustration. Whereas, to an employer, congestion means loss of productivity, loss of workers, delivery delays, increased costs, trade opportunities etc. All such factors results into exasperation which is one major cause of fatal road accidents. If we add up all the disabilities or deaths in an accident, they’ll amount to billions of dollars annually in the world. As far as Pakistan is concerned the solution to most of the problems related to traffic management and safety lie in implementation of intelligent transportation system. There are at least nine components of ITS i.e.:

1. Smart Traffic Signal Control
2. Freeway Management System
3. Transit Management System
4. Incident Management System
5. Electronic Toll Collection System
6. Electronic Fare Payment System
7. Emergency Response System
8. Traveler Information System
9. Route Guidance System

1. Smart Traffic Control System

This system senses heavy traffic flows at intersections using various number of devices like video cameras, inductive loop detectors, automatic vehicle counters etc. Using the data provided by the above mentioned devices the signal timing is adjusted automatically giving maximum possible green time to the most congested leg of the intersection making sure that the intersection gets clear quickly. This system saves a lot of time and also reduces the cost of fuel burned wasted during long wait for the signal to become green. Cacogenic emissions from the automobiles are also thus reduced and hence help protecting the environment. Installation of this system is expensive but once it is installed it will effective in the long run. This system can be installed on Sharah-e-Faisal, Karachi and Ferozepur Road of Lahore. The following images will show you various devices which aid in the working of this system.

2. Freeway Management System

It is a system to effectively manage control and monitor freeway traffic by combining system components and technologies. The system components may include ramp metering, freeway mainline metering, reversible roadway control etc. This system counts the vehicles entering the freeway with signals on the ramps. This system has been in use for some time but has not been used upto its full capacity. A new phenomenon may be introduced in its work such as linking it with other detection systems such as accident surveillance systems etc.

3. Transit Management System

This system has a bright future specifically for Pakistan. This system can be used by factories/logistics managers to manage their goods in transit well and take new orders. There are a large number of companies who are doing business in supply chain and logistics and for them this system is a blessing in disguise. They can know the status of their shipment/order 24/7 anywhere, anytime. This helps their quick and efficient service and earns them good profits. Using this system

the manager can also warn a particular driver of taking the goods to their destination about any congestion present on any intersection and allows them to take a detour. This system is expensive and is being used by only top leading logistics companies of Pakistan. If it is applied over every transporter's vehicle then it'll help to save a lot of time and money.

4. Incident Management System

This system detects and manages non recurrent traffic congestion caused by random unpredictable incidents such as accident, lane blockages, and hazardous spillages resulting in major traffic congestion. Lack of awareness about the situation at the upcoming intersection is a major problem in Pakistan. People travelling on a highway have no idea of the traffic condition of the upcoming intersection. If an accident has occurred it is usually seen that many people stop by, not for helping but only for looking at the scene. This causes congestion on the main carriageway, congestion of which the upcoming traffic is unaware of. If we have proper Incident management system then at least 2 km before the message regarding the accident have been displayed using the VMS (Variable Message Sign) and it would advise travelers to take detour due to the congestion on the upcoming intersection. This will help in reducing the congestion and we can clear the intersection quickly. If we take the example of Ferozepur road Lahore which is about 22 km in length, then we could require a 11 Variable Message Signs and this would completely change the entire condition of the road.

5. Electronic Toll Collection

This technology is being used in Pakistan especially by National Highway Authority. E-Tag sensors as they name it are widely being used at entry and exit points of motorways/freeways under National Highway Authority Pakistan. It saves time and doesn't make long queues of vehicle at toll plazas.

6. Electronic Fare Payment System

This concept is yet to take place in Pakistan. Many efforts for its implementation are being done in this regard. The proposed Metro Bus of Lahore is said to have electronic fare collection system. Using E-Cards passengers would be easily able to make their journey without waiting in long queues just to buy tickets. This facility is available for several airlines but this technology is relatively new in road transportation industry and will have its impacts if applied seriously. The following image will show you an electronic fare collecting machine.

7. Emergency Response System

This system is specifically designed for emergency vehicles like ambulances, fire brigades, police, bomb disposal squads etc. It allows the interaction of the emergency vehicle with the intersection signal control system. The green time can be controlled by the drivers of one of these emergency vehicles and he can keep it green until the vehicle has cleared the intersection. Pakistan specifically Punjab province has its emergency service by the title of Rescue 1122; if this system is applied then they can do their job even more effectively and help people in every possible way. This could save a large number of lives and will also result in helping the economy.

8. Traveler Information System

Traveler Information System is one of the most important systems of ITS. Its main aim is to provide the road user with necessary information related to driving on a particular road. For example maximum speed for cars and trucks, information related to any construction work been done, information related to congestion, road geometry changes, necessary precautions etc. This information could be conveyed either by variable message signs (VMS) or via radio control. This system helps the drivers greatly and helps in reducing congestion etc. In Pakistan this system is

slowly being deployed e.g. in Lahore there is a proper radio channel of traffic police which gives information about traffic on roads of Lahore 24 hours a day. This helps greatly in reducing traffic problems of Lahore.

9. Route Guidance System

These systems are based on global positioning system (Satellite) technology and assists motorist with distance and direction information to selected destination. This technology is quite expensive so its implementation will take some time in Pakistan.

Sensor Technology

Over the last decade, sensor technology has become ubiquitous and has attracted a lot of attention. Sensors have been deployed in many areas such as healthcare, agriculture, and forest, vehicle and marine monitoring. In transportation, sensor technology supports the design and development of a wide range of applications for traffic control, safety, and entertainment. In recent years, sensors, and actuators such as tire pressure sensor and rear-view visibility systems have become mandatory (due to federal regulation in the United States) in the manufacturing of vehicles and the implementation of intelligent transportation systems, aimed at providing services to increase drivers' and passengers' satisfaction, improve road safety and reduce traffic congestion. Other sensors are optionally installed by manufacturers to monitor the performance and status of the vehicle, provide higher efficiency and assistance for drivers. Currently, the average number of sensors in a vehicle is around 60–100, but as vehicles become "smarter", the number of sensors might reach as many as 200 sensors per vehicle. LIDAR (LIght Detection And Ranging) has become in a key component for the evolution of autonomous vehicles. LIDAR enables a self-driving car (or any robot) to observe the world with a few special characteristics such as continuous 360-degree visibility and highly accurate depth information. LIDAR sensors continually fire off beams of laser light, and then measure how long it takes for the light to return to the sensor. Although more sensors are in each vehicle, their integration with other components and the lack of widely accepted standards among different brands is a huge drawback in their adoption. In contrast, current automated systems are limited in their capacities. For example, Volvo's city safety speed limit is 50 km/h or less to avoid collisions with other vehicles or hitting motorcycles or cyclists. A city safety system is based on a laser unit, so in darkness conditions, the it can only detect a vehicle if its headlights and taillights are on and are clearly visible. Pneumatic road tube sensors use one or several tubes placed across traffic lanes allowing for number of vehicles counting and vehicle's classification. When a vehicle's tire passes over the tube, the sensor sends a burst of air pressure which produces an electrical signal. The electrical signal is transmitted to the processing unit. The Inductive Loop Detector (ILD) sensor is one of the most common sensors in traffic management. It is used for collecting traffic flow, vehicle's occupancy, length, and speed. It consists of a long wire coiled to form a loop which is installed into or under the surface of the road and measures the change in the electrical properties of the circuit when a vehicle passes over the sensor, producing an electrical current that is sent to the processing unit. Magnetic sensors are used to detect vehicles when a change in the earth's magnetic field is produced. Magnetic sensors are used to collect flow, occupancy, vehicle length and speed and are suitable for deployment on bridges. Piezoelectric sensors detect vehicles passing over (at high speed ranges around 112 km/h) a sensor though a change in the sensor's voltage and can

monitor up to four lanes. Piezoelectric systems are commonly formed by piezoelectric sensors and ILDs sensors. A Video Image Processor (VIP) system includes several video cameras, a computer for processing the images and a sophisticated algorithm-based software for interpreting the images and translating them into traffic data. Video cameras placed at the roadside collect and analyze video images from a traffic scene to determine the changes among successive frames using traffic parameters such as flow volume and occupancy. The main disadvantage of VIP systems is that they are susceptible to reduced performance caused by bad weather conditions.

CCTV Control – CCTV Control will operate as a receiving and recording point for CCTV images that are available to the CCTV matrix for IC3 Centre. Images can be displayed and, where appropriate, passed into the SOMS and CMC at that centre for viewing at work-stations and/or for display on the video-wall. CCTV Control will also monitor all police facilities including police premises. • Crisis Management Centre (CMC) – CMC will plan and manage all the pre-planned and spontaneous major events through a defined escalation process to contain and manage a situation or an event through a clearly defined command structure. It will contain integrated tools that merge information in an environment that provides leadership quick and accurate data to evaluate situations.

CONCLUSION

Sensors will play a vital role for ITS in the future. Their usage enables the development of a wide variety of applications for traffic safety, traffic control entertainment and driver assistance. Sensors provide the mechanism to data acquisition related to the vehicular context (such as road conditions, traffic conditions, vehicle conditions) that can be integrated with the current transportation systems to mitigate some of the problems that past and current transportation systems have been facing. The use of analytical and statistical techniques demonstrates the real potential of integrating sensors with ITS. This integration is a promising research area that will broaden the development of a wide range of next-generation smart applications aimed at improving the safety and traffic control of existing and future transportation systems.It is concluded from the above discussion that the population of Pakistan especially of urban areas is increasing rapidly as a result of which vehicle ownership is also increasing. More the number of vehicles more will be the congestion and more chances will be there of an occurrence of an accident. Car financing programs should be abandoned and must not allow loans for buying vehicles that would lessen the vehicle ownership that causes a burden on our transportation system. Rural Urban migration is another problem which should be seriously looked upon. The government should provide equal earning opportunities to people living in rural areas so that they may not migrate to urban areas which would otherwise result into increased population and enhanced load on or transportation system. Deployment of Intelligent Transportation System is the need of the time especially for Pakistan. Since we are living in the decade of road safety, so we need to make sure that we actually make our roads safer and ITS can play an important role in this regard.

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