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MICROSIMULATION OF URBAN TRAFFIC FLOW- A CASE STUDY OF UNIVERSITY ROAD PESHAWAR, PAKISTAN

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ABSTRACT
Traffic cramming is a serious problem in urban areas of Pakistan particularly in Peshawar. A pilot scale survey was performed regarding traffic volume and travel time data, vehicle specifications and geometry of the study area and analysis were performed that can be applied to the remaining section of the University road. Calibration and validation of model was done by comparing the field results of traffic volume and travel time with results obtained from the micro simulation. After analysis for queue delays, travel time and traffic flow versus travel time data for different traffic scenarios, maximum queue lengths and queue stops were observed near U-turning and Right-turning locations. At selected section, the average speed was found considerably lower than the design. An option of roundabout and a flyover were used in analysis. Queue delays travel time reduce near U-turns and all the right turning locations of study area with provision of roundabout or flyover. With provision of flyover, results for traffic flow and delay were improved.

INTRODUCTION
Transport and communication play a key role in the economic and social development. Traffic cramming has now become a serious problem in Peshawar city. Immense problem that people are facing in Peshawar today is irregular transport problem. Due to large mix of vehicles, traffic on every small or large road remains block especially during the morning peaks resulting in large queues especially near U- turns and intersections.

Statistical approaches to estimate the delay and capacity of U-turning movements of vehicles at the median openings and intersections reveal that u-turning vehicles have to adopt low speed, will need large gap and have to face high speed traffic. Median openings at different locations were selected in cities of Jordan. First regression equation of model shows that capacity depends upon conflicting traffic flow and total average delays while second equation shows that critical gap depends on average total delay and conflicting traffic speed. [1,2]. U-turn studies were performed at directional median openings in Florida. Statistical analysis on U-turn movements for capacity, delays and travel time reveal that U-turning operational effects of large vehicles could not be evaluated. [3]. For a model of congested network in VISSIM in city of Pasadena California calibration parameters used were traffic data for HOV (High Occupancy Vehicles) lanes, 20 metered on-ramps with and without bypass lanes and three interacting bottlenecks. But driving behavior parameter set needed more modification in this study [4]. VISSim model was used for analysis of traffic congestion in North America and Europe [5]. Micro simulation modeling in VISSim used, to identify changes in capacities over time of freeway in Australia [6].

There is no work done in Pakistan on use of VISSIM for micro-simulation therefore tool was selected. The purpose of this research is to simulate effect of u-turning and right turning movements on traffic operation at the University road.

METHODOLOGY
For the microsimulation of traffic, data was collected which consists of the following components.

Traffic volume survey:
Traffic volume data is basic for planning and management of the road development and this data forms an integral part for drawing up a rational transport policy. We classified the vehicles into different categories like Motorcycle, Car/jeep, Mazda bus, Wagon(flying coach), Large bus, Suzuki pickup(carry dabba), Datsun, Taxi,

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Trucks and Oil tanker/tractor. Traffic volume data were collected at U-turns and T-junctions of selected section (Figure 1). The daily traffic plot at university road is shown in Figure 1a.

Travel time survey:

Sound methodology was adopted for the travel time study that will provide the required data to validate the model. Parameters used while doing travel time survey are Geographic areas, facility types and time elements. Functional classification**:** According to function classification, University road is a Principal Arterial (Divided). Routes designation**:** Routes for travel time survey were: Ph-3 to Iqra chowk & Iqra chowk to Ph-3, Ph-3 up to university & university to Ph-3 chowk, University to Iqra chowk, Iqra chowk to university, U-turn maneuver near board, U-turn maneuver near BISE, U-turn near Niamat mahal, U-turn near KCD and Spin jumat U-turn. Test vehicle technique was adopted during travel time survey. The travel time at designated points was recorded for calibration/validation of the model in VISSIM.

Geometric survey:

Geometric data was collected including number of lanes, width of lanes, and width of median. In case of U-Turns, length and width of U-turn gap was measured.

Vehicle specification survey:

In addition to traffic volume, travel time and other geometric data VISSIM also needs data on vehicle characteristics i.e. identification of all vehicles types which flow in study area. Vehicle dimensions (i.e. length and width of vehicles) are measured as per requirement in software in the field vehicle specification survey.

Base data and model preparation:

After completion of field data collection, modeling was done in VISSIM software. Elements of the Base Data includes using 2D/3D Models, functions of maximum acceleration, desired acceleration, maximum deceleration, desired decelerations, desired speed distributions and defining driving behavior parameter etc. Model preparation inputs consists of background file, traffic compositions, priority rules, links, vehicle inputs, conflict areas, connectors, routing decisions, data collection points, vehicle types, reduced speed areas, queue counters, vehicle classes, desired speed decisions and evaluations (file) settings

Figure: 1 Study Area at University Road Peshawar

MODEL CALIBRATION AND VALIDATION

Model was calibrated using parameters of desired speed distribution, acceleration/deceleration of vehicle, mechanical characteristics of the vehicle, minimum safety distance, minimum lateral distance and driving behavior characteristics were adjusted. Model was validated by comparing calibrated results obtained against field measurements. Vehicle types selected for this study are shown in Figure 2. Driving behavior parameter set has key importance in VISSIM. Some of the parameters of this set measured in the field are illustrated in Figure 3. After traffic volume input, total volume was distributed in respective directions through routing decisions and relative flow according to field measurement. The turning vehicle percentage is shown in Figure 3a. Model was validated by comparing traffic volume, avg. travel time and by physical assessment (comparing original traffic with VISSIM generated traffic). Our results were within the limits of 5%, it means that model was validated.

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SIMULATION

After running the simulation model, resulting reduced speed areas and conflict areas in a road network are shown. in Figure 4: the yellow highlighted are reduced speed areas detected at t-junction near niamat mahat and islamia college gate while in Figure 5: red and green are resulting priority rules in terms of conflict areas at Iqra chowk for U-turning and other turning movements of vehicles.

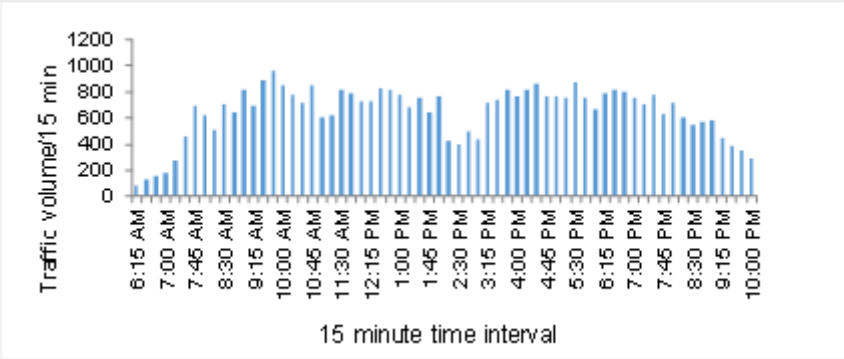

Figure 1a. Daily traffic at university road Peshawar

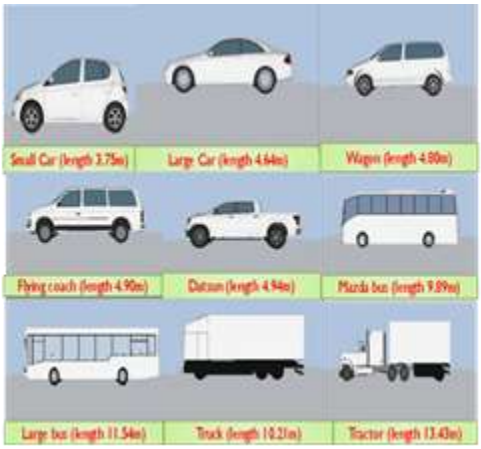

Figure 2: Vehicle models

Figure 3: Driver behaviour

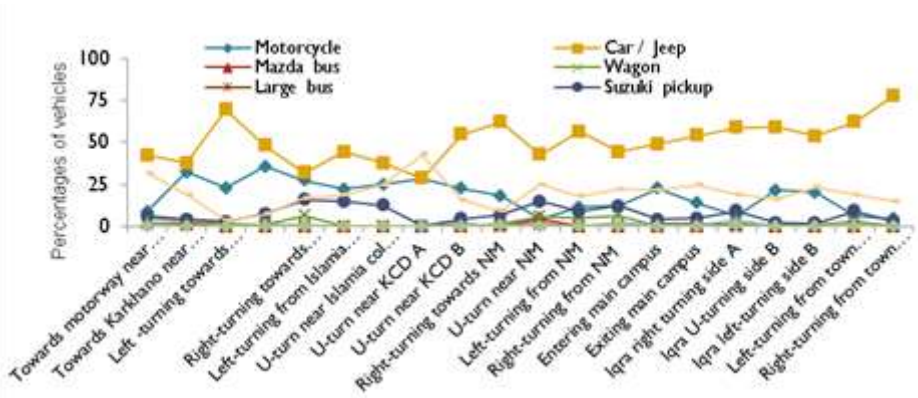

Figure 3a. Turning Vehicles in the selected area

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Figure 4: Simulation results

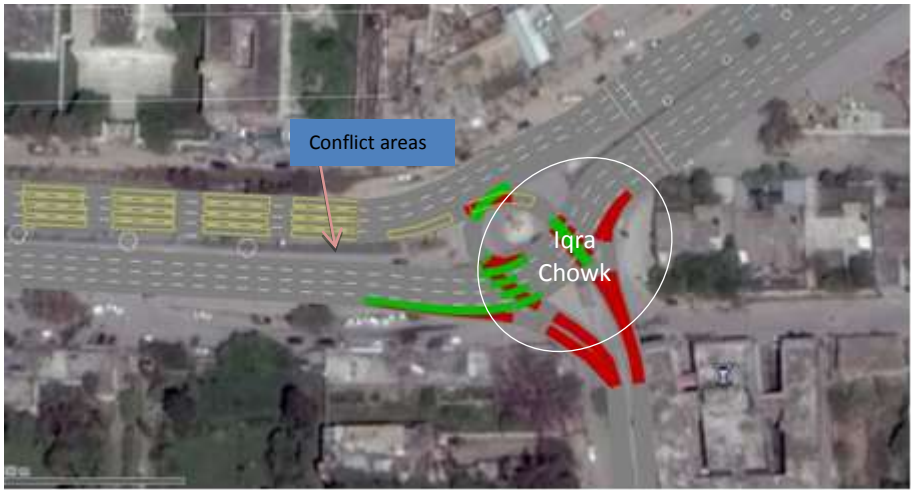

Figure 5: Simulation results

RESULTS AND ANALYSIS

Three scenarios made to analyze the results were existing peak hour, existing peak hour with Roundabout and existing peak hour with flyover (Figures 6-8). A three-leg with three lane roundabout near Islamia college gate 01 was proposed. Or A flyover of 0.4km span length and 8 percent gradient was proposed at Iqra intersection with ramp roads while going in westward direction. Comparison was made between the parameters of queue delays, travel time and flow vs travel time for three scenarios at university road.

Results show the decrease in queue delay of all vehicle types for two scenarios after the proposed roundabout or the proposed flyover at Iqra chowk in comparison to normal case for existing peak hour. Similarly comparing the results of travel time for normal case with other two traffic scenarios i.e. after provision of roundabout near islamia college gate or provision of flyover at iqra intersection, travel time decreases for later two cases as clear from graphical form below: If we analyze and the results and compare flow (in volume per hour) versus travel time, we can see that travel time reduces after provision of roundabout and provision of flyover compare to the normal case. We observed that for reduced/less travel time flow was going to increase after roundabout and flyover provision.

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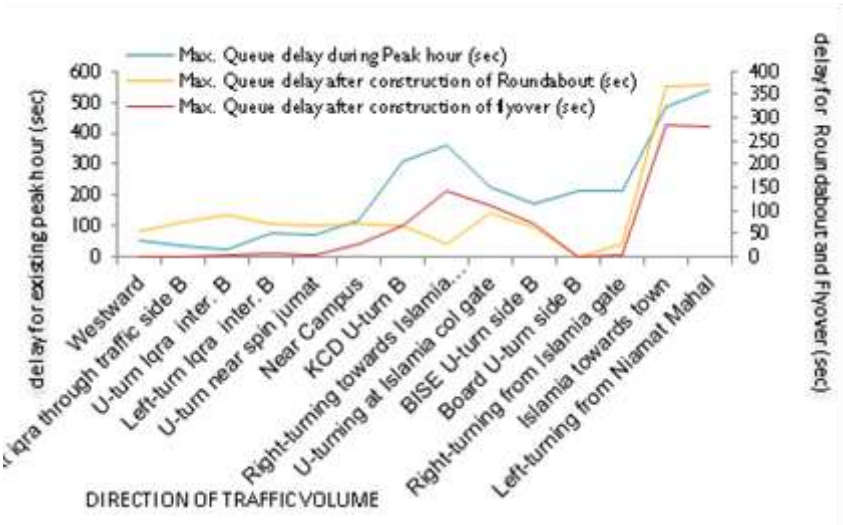

Figure 6: delay for three scenarios in Westward direction

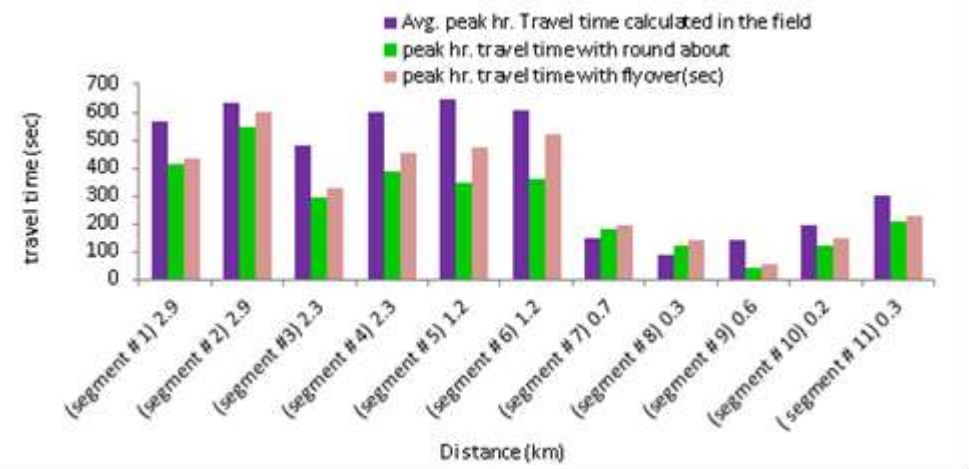

Figure 7: Travel time (all vehicle types) for three scenarios

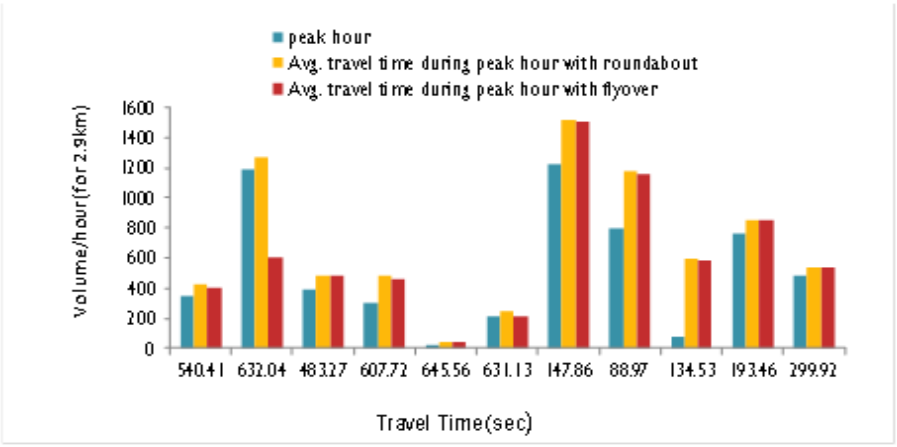

Figure 8: Travel time (all vehicle types) for three scenarios

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CONCLUSIONS

From analysis of the data, it was found that:

- The traffic framework at university road can be modeled in VISSIM, the traffic simulation software.
- Conflict points (U-turns and T-junctions) at the selected road section mainly contribute to the queuing and delays.
- Increased delays at the conflict points have resulted an increased travel time.
- Driving behavior was also found a reason for delay and increased travel time.
- A reduced number of conflict points was found increasing the capacity, hence suitable for traffic flow.
- Queuing and travel time was found decreasing with provision of a roundabout near Islamia college Gate or a flyover at Iqra chowk or a flyover at Iqra chowk increase the traffic flow capacity.

REFERENCES

1. Kpk development statistics 2010, bureau of statistics planning and development govt. Of khyber pakhtunkhwa.
2. Capacity of u-turn at median opening by hashem r. Al-masaeid, ite journal/1999
3. Liu, pan, "evaluation of the operational effects of u-turn movement" (2006). University of south florida
4. A micro simulation model of congested freeway using vissim presented at annual meeting of transportation research board by gabriel gomes 2014.
5. Tony woody, 2006, calibrating freeway simulation models in vissim. Cee 600 final research report university of washington seattle, wa
6. Freeway capacity, saturation flow and car following behavioral algorithm of vissim micro simulation software by julian laufer maunsell australia, 2007
7. Travel time data collection handbook,report no. Fhwa-pl-98-035, office of highway texas transportation institute information management texas a&m university system federal highway administration u.s. Department of transportation, march 1998
8. Topic no. 750-020-007 “travel time and delay study” manual on uniform traffic studies)
9. Highway engineering, martin rogers, department of civil and structural engineering dublin institute of technology ireland