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Queue length and delay estimation at signalized intersections using detector data

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QUEUE LENGTH AND DELAY ESTIMATION AT SIGNALIZED INTERSECTIONS USING DETECTOR DATA

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INTRODUCTION

- Measures of Performance for Signalized intersections
  - v/c ratio
  - Control delay
  - Max. queue length
  - Level of service
  - Fuel consumption
  - Number of stops

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- Measures of Performance for Signalized Intersections
  - v/c ratio
  - **Control delay**
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METHODOLOGY

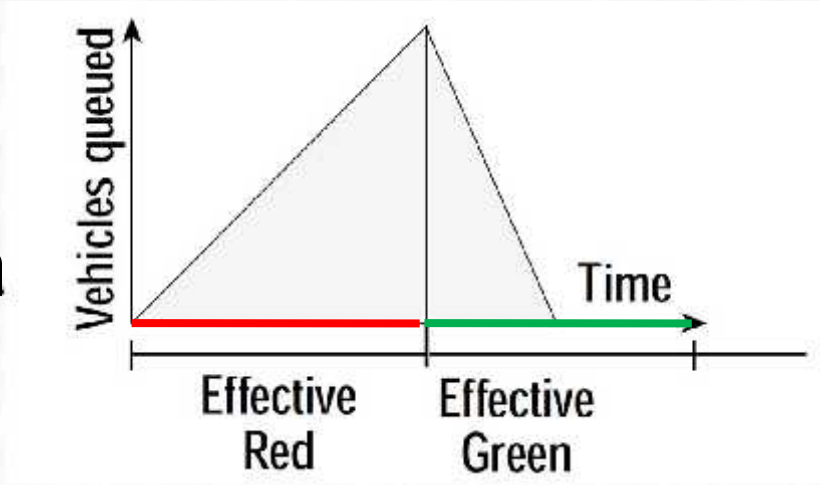
- INPUT

  Stop bar detections

  Signal timing information

- Development of Queue polygon

- Meas h and delay for ea



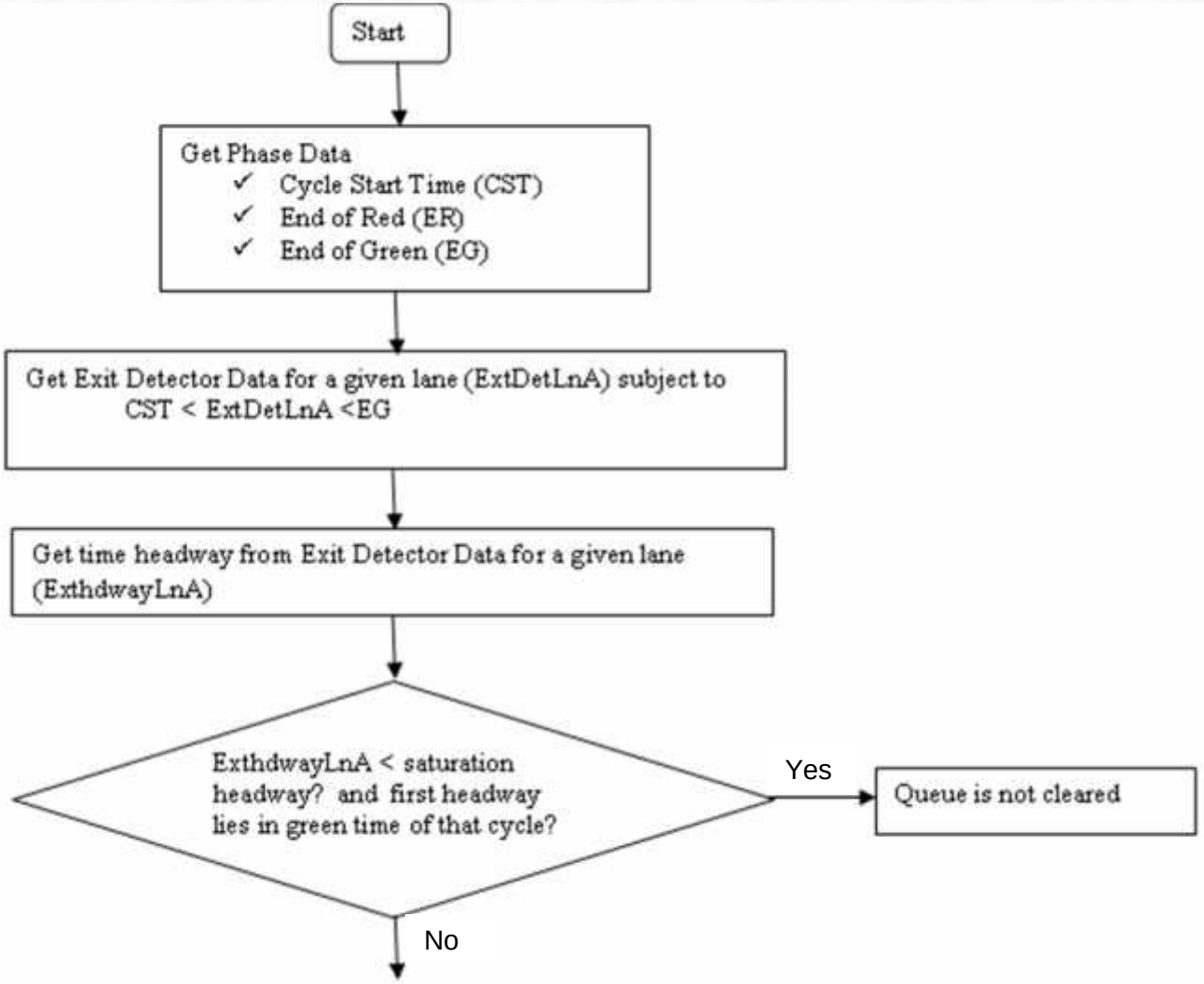
STUDY SITE

- This method requires signal timing information- difficult to get in India
- Study sites selected are 17 G and 27G Cornhusker in Lincoln, Nebraska, USA

DATA COLLECTION

- Micro loop detectors placed just after stop line
- Digitalized data generated as vehicles arrive and leave
- Signal timing information obtained
- Actual values extracted manually from video
- One hour each from 17G intersection and 27G Cornhusker in peak and off-peak hour

QUEUE POLYGON DEVELOPMENT



QUEUE POLYGON DEVELOPMENT (contd.)

Queue clearance time = Time stamp of start of green - time stamp of the first headway greater than saturation headway

↓

Numqueue= Count of number of vehicles leaving before queue clearance time

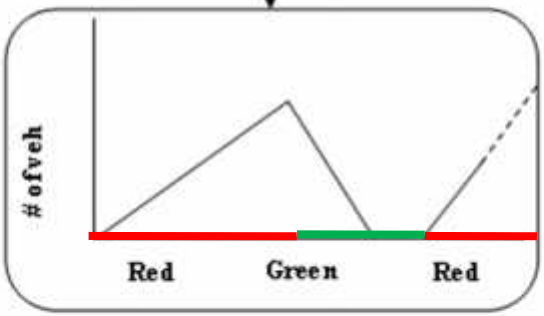
↓

Generate queue polygon with
Arrival rate = Numqueue / Red duration
Departure rate = Numqueue/ queue clearance time

↓

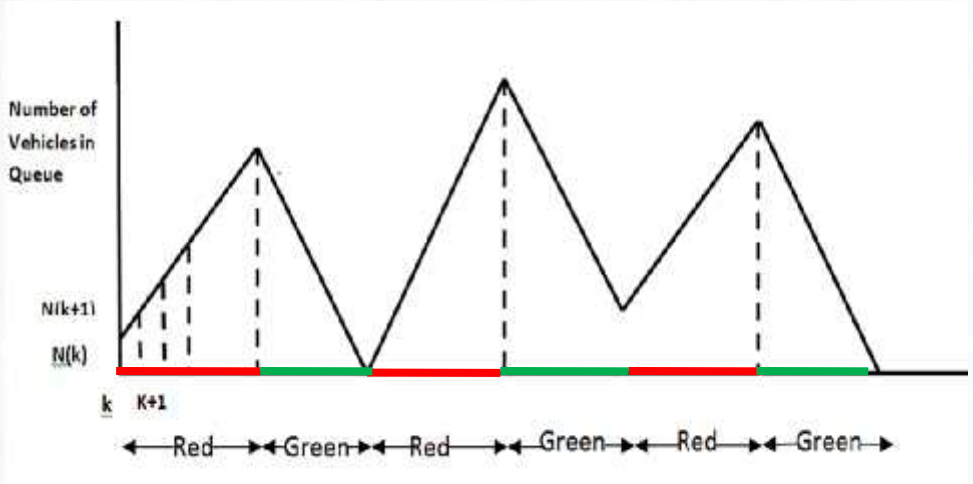
Vehicles coming after queue clearance time in that cycle departs in green and so no queue

↓



CALCULATION OF PERFORMANCE MEASURES

Delay t_d at a time instant *k+1* is given as

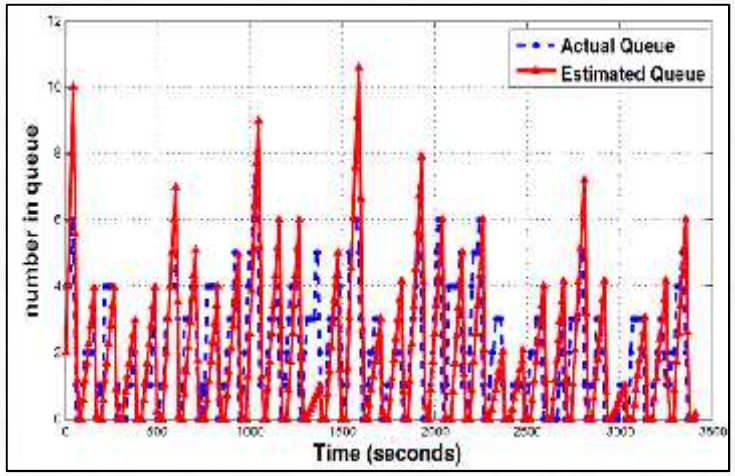


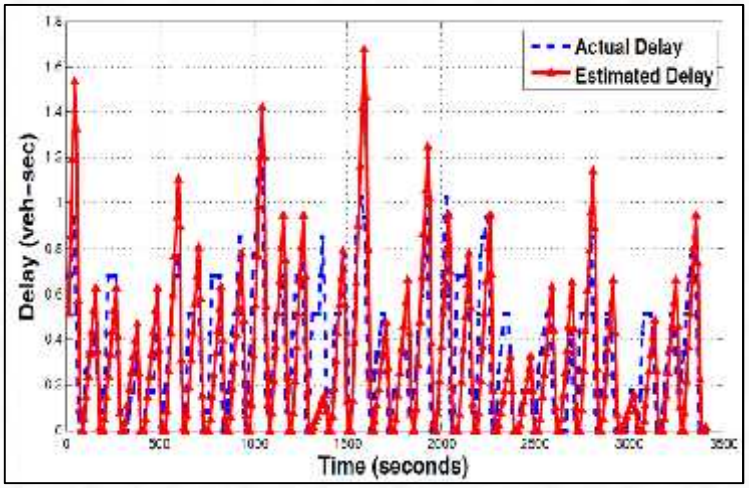
$$t_d(k+1) = \int_k^{k+1} N dt = \left(\frac{N(k) + N(k+1)}{2} \right) \times h$$

where *N(k)* is the number in queue at k^{th} instant of time, *h* is the duration of analysis period from *k* to *k+1*

RESULTS

Intersection	RMSE	
	Queue (veh)	Delay (veh-sec)
17G off-peak	1.2	0.12
17G peak	1.3	0.18
27 G off-peak	1.5	0.32
27 G peak	1.3	0.2





CONCLUSION

- Simple and effective scheme to determine performance measures at signalized intersections
- Developed for under-saturated conditions
- Uses minimal data - stop bar detection and signal timing

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THANK YOU