

Research Article

# Application of Moving Car Observer Method for Measuring Travel Time, Delay & Vehicle Flow under Heterogeneous Traffic Condition of C.B.D. Area: Case Study of Surat-Rajmarg (Chowk to Delhi Gate)

Mrugesh J. Solanki<sup>\*\*</sup>, F.S. Umrigar<sup>#</sup>, L.B. Zala<sup>#</sup> and Amit A. Amin<sup>#</sup>

<sup>#</sup>Department of Civil Engineering (Transportation Engineering), Birla Vishvakarma Mahavidyalay Engineering College, Vallabh Vidyanagar, Gujarat, India

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## Abstract

An analytical study among vehicular Travel Time, Vehicle Flow & Delay from Moving Car Observer Method in field are presented in this paper. Chowk to Delhi Gate C.B.D. area of Surat city was surveyed for traffic data collection using test vehicle. Moving Car Observer data were collected from six test vehicle runs for both Morning & Evening peak hours and two test vehicle runs for Afternoon peak hours for three days (i.e. Monday, Saturday, Sunday). Vehicle counts with and against the test vehicle, Vehicle overtaken and overtaking the test vehicle, Travel time and delay time were recorded. Parameters like Flow, Average journey speed, Average running speed were calculated from the collected data. Then Graphical representation of Average journey time, Average running time & Average delay time for each session each day were presented along with the traffic flow comparison for all three days.

**Keywords:** Moving Car Observer Method, Travel Time, Delay, Vehicle Flow, Test Vehicle.

## 1. Introduction

Poor road traffic management is the primary reason for extended periods of traffic congestion throughout the world (Vipin Jain *et al*, 2011). Congestion results when the traffic infrastructure lags behind the growth in an area and increase the time it takes to complete a trip by car, the travel time index and the annual delay per commuter measure the effect of congestion on the amount of time it takes us to travel through the city. Congestion results in excess fuel consumption and increased costs both in the value of the driver's time and fuel. (David Schrank *et al*, 2012)

In this paper, Moving Car Observer data for six trips for each Morning and Evening peak hours and two trips for Afternoon each three days were collected from Central Business District of Surat city (Chowk to Delhi Gate).

Travel time and delay were obtained by the data collection and Average journey speed, Average running speed, Average delay time were calculated from obtain data. Same is to be presented as graphical format for better understanding of the situation.

## 2. The Moving Car Observer Method

Moving car observer method is a procedure commonly used to estimate the average flow and journey time of

traffic on a road link through collected data of moving vehicle. The method was first described in a paper by Wardrop and Charlesworth (1954) and developed by the road research laboratory in U.K.

In this method, a series of runs of a test vehicle made traveling "with" and "against" traffic. The enumerators in the test vehicle record the number of opposing vehicle met, number of vehicles to which test vehicle overtook, number of vehicles overtaking the test vehicle while it was traveling, average speed of the test vehicle and journey time of the observer in each run. (M. Ann-Marie *et al*, 2002)

Using relevant equations, traffic flow are calculated from the collected data. The main advantage of Moving Car Observer Method is that flow, Average journey speed, Average running speed and Average delay can be obtain from the calculation. It has the advantage of obtaining the complete state with just three observers and a vehicle. Moving Car Observer technique is one in which both speed and traffic flow data are obtained by a single experiment.

## 3. Method of Field Data Collection and Calculation

The field survey was carried out to collect the data on the selected major road (Chowk to Delhi Gate) has 2.4 km length. To count the Traffic flow, Moving Car Observer Method has been used. Our selected particular section of this road was covered with traffic

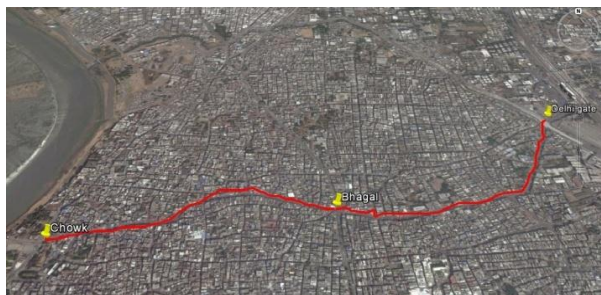
\*Corresponding author: Mrugesh J. Solanki

by all type of vehicles including Bus, Jeep, Car, Auto rickshaw, Hand Cart etc. vehicle enters in the road section from Chowk for Eastward trip and from Delhi Gate for Westward trip.

$$t_{avg} = t_w - \frac{m_w}{q}$$

$$q = \frac{m_w + m_a}{t_w + t_a}$$

Where,  $t_{avg}$  = Average journey time,  $t_w$  = Average journey time when vehicle is travelling in the stream,  $m_w$  = Overtaking vehicle minus Overtaken vehicle,  $m_a$  = Average number of vehicle in opposite direction,  $t_a$  = Average journey time when vehicle is travelling in opposite stream. (Tom V. Mathew, 2014)



Courtesy: Google Earth

Figure 1 Study Area Road Stretch



Figure 2 Vehicles Counting Through Test Vehicle



Figure 3 Vehicles Passing on a Road

A Number of test runs are made along the study stretch and a group of observer records various parameters. One is having two stop watches in which one stop watch is used to find the total journey time and the another watch s used to measure the various delay occurred on the stretch. These details are recorded by the observers in a suitable tabular form. The number of vehicles overtaken, Number of vehicle overtaking and the Number of vehicles coming from the opposite side are noted down by the other two observers during the study.

The average journey time (min.) for all vehicles in a traffic stream in the direction of flow ( $q$ ) is given by following equation.

#### 4. Data Collection & Calculation

Table 1 Moving Car Observer Data Collection Sample

Morning peak hour						
Location	Direction	Journey time	Stopped time	Number of vehicles		
				Over Taking	Over Taken	In opposite direction
Chowk to station	E-w	8.01	0.51	22	31	651
		9.70	0.53	55	29	713
		9.02	1.08	51	40	852
		11.18	1.30	77	26	1092
		10.24	1.01	31	25	1007
		14.03	4.38	73	31	1019
<b>Total</b>		<b>62.18</b>	<b>8.81</b>	<b>309.00</b>	<b>182.00</b>	<b>5334.00</b>
<b>Mean</b>		<b>10.36</b>	<b>1.47</b>	<b>51.50</b>	<b>30.33</b>	<b>889.00</b>

Table 2 Sample Calculation of Moving Observer Survey

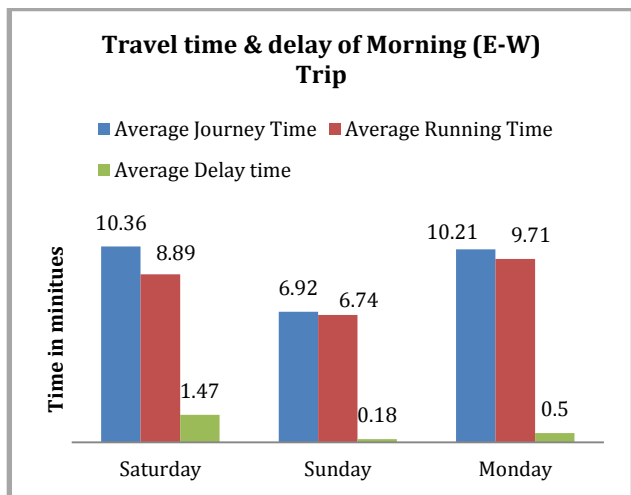
Calculation	
$m_w$ = Overtaking vehicle minus overtaken vehicle	21.17
$m_a$ = Average number of vehicle in opposite direction.	988.83
$t_w$ = Avg. journey time when vehicle is travelling in the stream	10.36
$t_a$ = Avg. journey time when vehicle is travelling in opposite stream	11.58
(Flow) $q$ veh./hr=	2762.08 veh./hr
Avg. Journey time	10.36 min.
Avg. journey speed = $(2.4*60) / 10.36$	13.91 Kmph
Avg. Running time = Avg. journey time - Avg. Stopped Delay	8.89 min.
Avg. Running Speed = $(2.4 * 60)/8.89$	16.20 Kmph

As shown in table 1 & 2 data collection sample and Sample calculation of Moving Car Observer Survey are carried out. Same procedure carried out for each session each day (i.e. Monday, Saturday, Sunday and

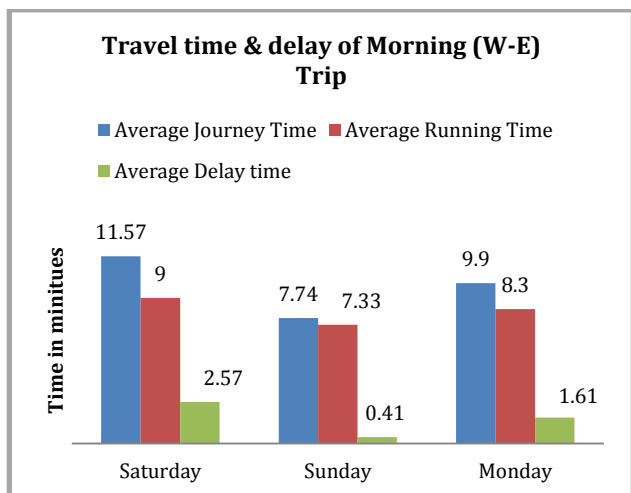
each contains three Morning, Afternoon, Evening Sessions).

### 5. Data Analysis

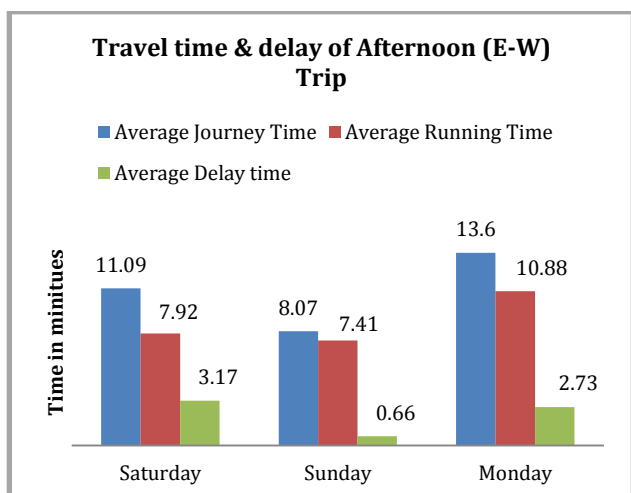
#### 5.1 Travel time & delay Analysis



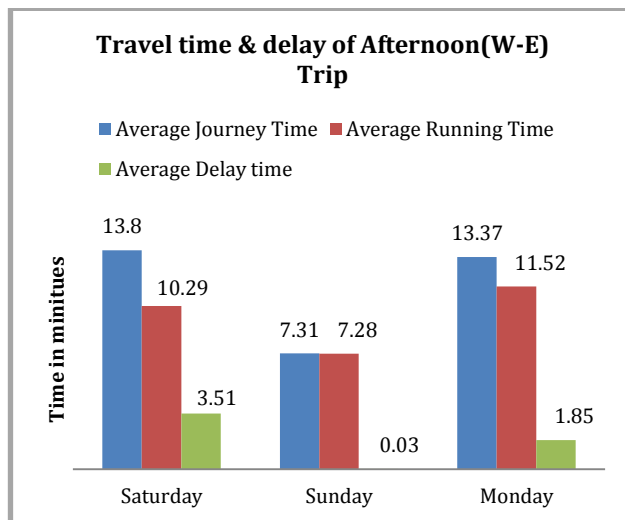
**Graph 1** Travel time & Delay of Morning (E-W) Trip



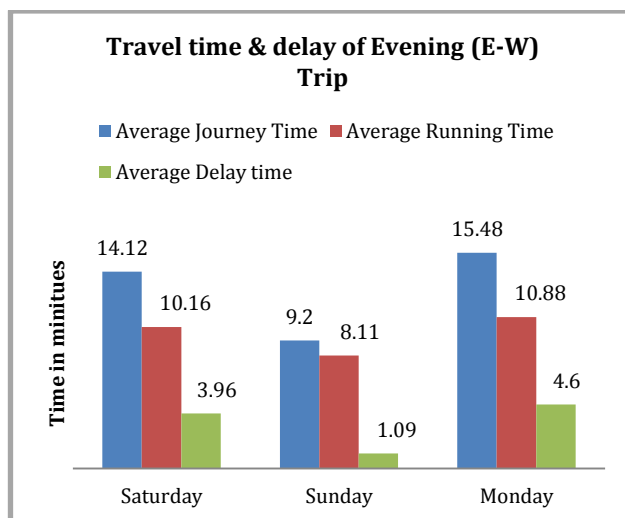
**Graph 2** Travel time & delay of Morning (W-E) Trip



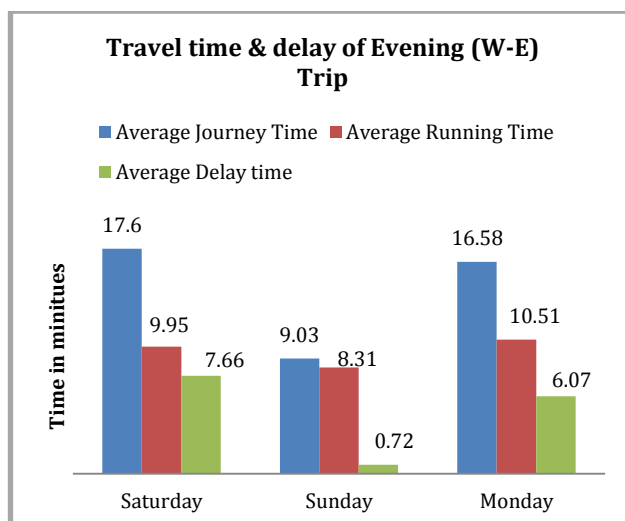
**Graph 3** Travel time & delay Afternoon (E-W) trip



**Graph 4** Travel time & delay of Afternoon (W-E) Trip

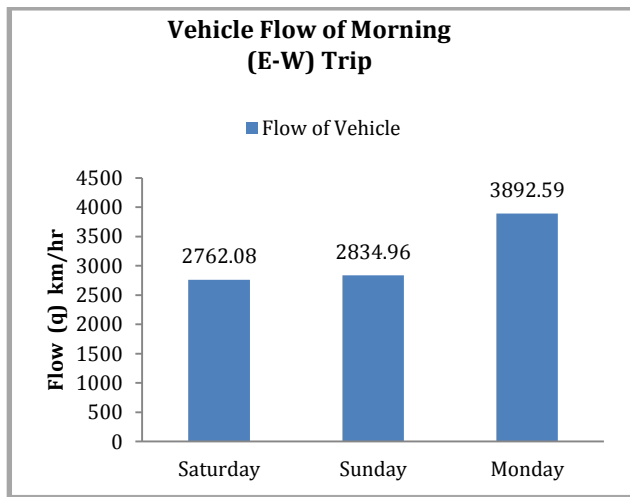


**Graph 5** Travel time & delay of Evening (E-W) Trip

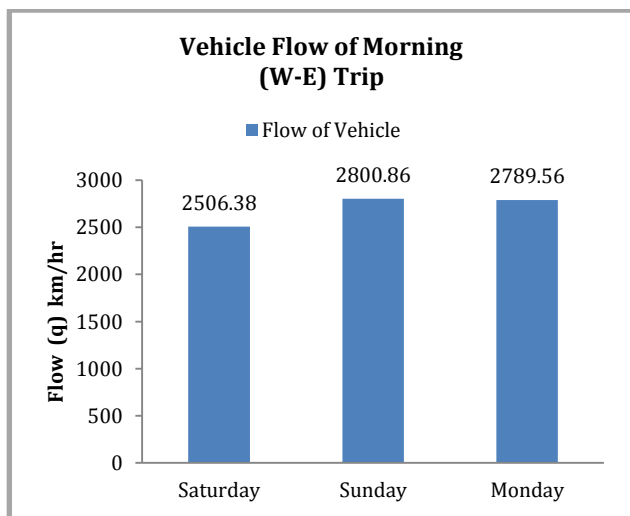


**Graph 6** Travel time & delay of Evening (W-E) Trip

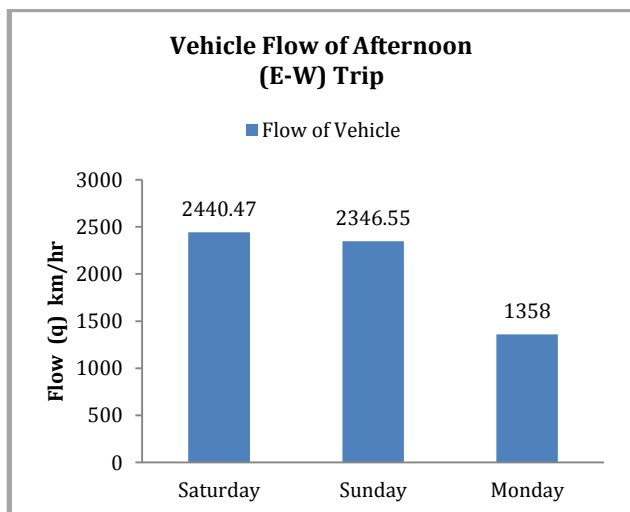
5.2 Vehicle Flow Comparison



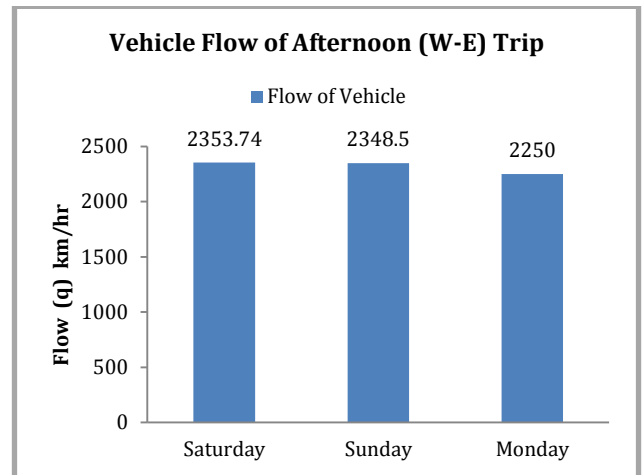
Graph 7 Vehicle Flow of Morning (E-W) Trip



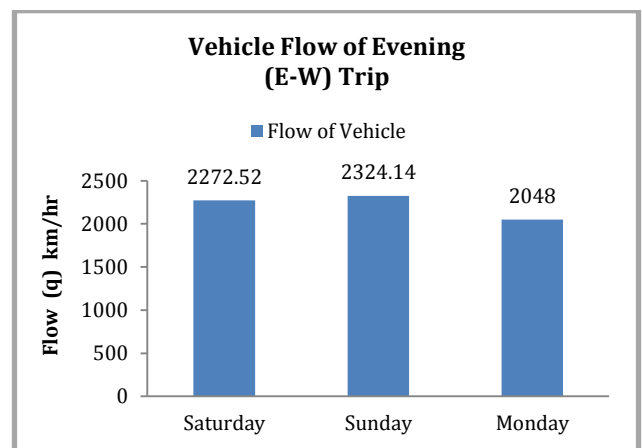
Graph 8 Vehicle Flow of Morning (W-E) Trip



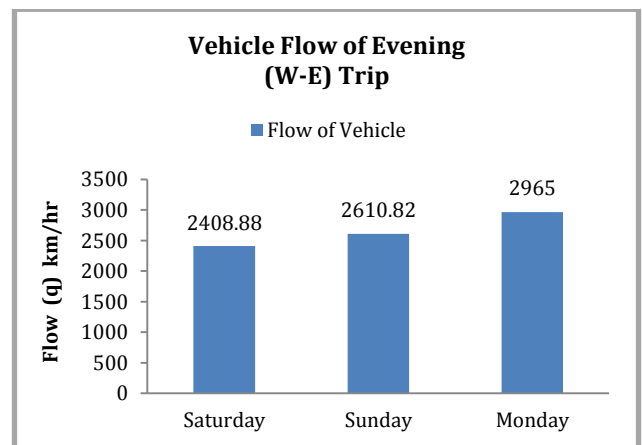
Graph 9 Vehicle Flow of Afternoon (E-W) Trip



Graph 10 Vehicle Flow of Afternoon (W-E) Trip



Graph 11 Vehicle Flow of Evening (E-W) Trip



Graph 12 Vehicle Flow of Evening (W-E) Trip

6. Result & Discussion

As shown in Graph 1 Travel time & delay of Morning (E-W) trip Saturday has the highest Travel time & delay among the all three days, same for the return trip (W-E) Saturday has the highest Travel time & delay as shown in graph 2, for Travel time & delay of Afternoon

(E-W) Trip Monday has the highest Travel time & delay is shown in Graph 3, Graph 4 shows the return Afternoon Trip (W-E) and again Saturday has the highest Travel time & delay, Travel time & delay of Evening (E-W) trip Monday contains the highest Travel time & delay as shown in Graph 5 and for return Evening trip (W-E) Saturday has the highest Travel time & delay as shown in Graph 6.

For Vehicle flow comparison Graph 7 to 12 are shown above, Graph 7 indicates Monday has highest Vehicle flow of Morning (E-W) trip, Graph 8 shows Sunday has the highest Vehicle flow of Morning Return Trip (W-E) among all three days, Graph 9 indicates Saturday as highest Vehicle flow of Afternoon (E-W) Trip, same for the return trip of Afternoon (W-E) Saturday contains highest vehicle flow as shown in Graph 10, Vehicle flow of Evening (E-W) Trip Sunday has the highest flow as shown in Graph 11, for Return trip of Evening (W-E) Monday has the highest Vehicle flow as shown in Graph 12.

### Conclusion

From the result and analysis conclusion has been made that the all three days contains heavy vehicle flow but Saturday and Monday has the comparatively high Travel time & delay to the rest of the weekday.

Because of the heavy vehicle flow congestion and delay in Travel time occurring simultaneously. Study shows the relation between traffic flow and travel time delay as the traffic flow increases the travel time delay also will increase, on the other hand smaller the delay time higher the speed of the vehicle and smaller the travel time of vehicle.

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