THE EFFECT OF CONTROL METHODS ON TRAFFIC FLOW—TRAFFIC MOVEMENTS AT SEVENTEENTH STREET AND CONSTITUTION AVENUE IN WASHINGTON, D C

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[In Abstract*]

The study was made to compare the time of vehicle passage through an intersection with variable control methods for traffic of nearly constant volume Data were taken between morning and evening rush hours when the traffic was nearly constant at 2,000 vehicles per hour Movement of traffic was studied under no-control, officer control, vehicle-actuated control, and seventeen different fixed-time controls All vehicles that entered and left the zone of influence of the intersection were noted by means of a graphic time recorder From this record the average time per vehicle was determined Over 100,000 vehicles were timed The results are summarized in Table I

From the average time per vehicle tabulated, the following expression was derived to show the result of lengthening the intervals on either or both streets

$$T = 26\,4 + 0\,04x + 0\,28y$$

in which T is the time for the average vehicle to travel 600 feet, including the intersection, x is the green light interval on Constitution Avenue, including three second amber overlap, and y is the green interval on Seventeenth Street, including three second amber overlap

SUMMARY OF CONCLUSIONS

1 For the traffic volume encountered in this analysis (about 2,000 vehicles per hour) operation of the intersection without control incurred the least delay to traffic Of all the control methods, officer control permitted the fastest movement of traffic, closely followed by the shortest fixed-time control, and traffic-actuated control

2 Under fixed-time control, a very marked increase in delay followed lengthening of the cycle In fact, for certain of the short cycles completely reversing the proportioning of the cycle had less effect on the time of the average vehicle than did retaining the same proportioning but doubling the cycle length

3 The flexible control methods showed efficiency equal to or better

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than the most efficient fixed-time control, but it is believed that both the officer control and traffic-actuated control could be more efficient than indicated here

4 During the course of a 10-hour day from 8·00 A M to 6:00 P M. as much delay was incurred during two hours of peak traffic as during the remaining eight hours

TABLE I

AVERAGE TIME PER VEHICLE (SECONDS)

Timing		Constitution Avenue			17th Street			Both Streets
Constitution Avenue	17th Street	West	East	Both directions	North	South	Both directions	
No-control		23 8	25 9	24 9	30 1	28 2	29 1	26 3
Officer control		26 8	29 1	28 0	34 6	33 2	33 9	29 9
15 sec	15 sec	29 3	32 2	30 9	32 6	32 9	32 8	31 5
Traffic actuated		28 9	30 6	29 8	35 3	35 3	35 3	31 6
20 sec	20 sec	31 4	32 4	31 9	33 5	32 0	32 7	32 2
40 sec	20 sec	27 6	28 9	28 3	42 0	41 2	41 6	32 7
30 sec	15 sec	29 5	30 7	30 2	41 1	39 7	40 4	33 5
30 sec	20 sec	30 4	31 3	30 9	41 0	38 3	39 6	33 8
15 sec	30 sec	35 8	38 0	37 0	30 9	29 1	30 0	34 9
30 sec	30 sec	33 7	34 8	34 3	37 2	35 5	36 2	34 9
40 sec	30 sec	31 3	33 3	32 4	41 5	41 7	41 6	35 3
20 sec	30 sec	37 0	36 6	36 8	36 0	34 3	35 1	36 2
60 sec	30 sec	29 9	30 9	30 5	51 4	50 8	51 1	37 1
40 sec	40 sec	36 9	38 0	37 3	38 9	38 9	38 9	37 8
70 sec	30 sec	28 4	29 0	28 7	61 1	55 7	58 3	39 0
50 sec	50 sec	41 7	40 9	41 3	40 6	40 2	40 4	41 0
60 sec	45 sec	35 9	38 4	37 3	51 1	49 5	50 3	41 4
30 sec	50 sec	46 0	46 8	46 4	32 9	32 0	32 5	41 6
60 sec	60 sec	44 1	45 1	44 6	48 6	45 3	47 0	45 4
30 sec	70 sec	56 1	57 3	56 7	32 6	31 7	32 1	48 6
Average traffic (vehicles per hour)								
		625	740	1,365	320	350	670	2,035

In discussion MR J ROWLAND BIBBINS said

I hope further studies will be made under heavy traffic because, from the results shown, it is quite apparent that the rush hour problem is an exceedingly large and difficult one I was impressed with the possibility of the analysis of the individual trip-records by short intervals—15 minutes or even shorter Would not that show what happens in those short intervals with respect to the maximum variations about the day average In that way might be deduced from these trip records some of these essential points of heavy traffic periods

I was gratified to see what a good officer can do when he is properly

trained In the fixed-timing tests I noticed that the Constitution Avenue time required was quite low when the proportion of traffic moving in the two streets was passably reflected in the time-split of the cycle Perhaps analysis would show that the officer more nearly apportioned the time-splits between the two movements than the signals

Both stragglers and speeders must be regimented and the movement made more nearly uniform which is, of course, one of the inherent purposes of the progressive signal

One more point Most of us in carrying out investigations like this have no opportunity to use as elaborate mechanism as here available I wonder if a simple notation of "cars delayed,"—what I call a "pile-up"—will not give a rough measure, through a very wide range of operating conditions, of the practical effectiveness of the signal control or any type of control used

I remember on one location in Washington, the Connecticut Avenue Bridge with a 2000 feet clear approach, after 5:25 P M the motor pile-up occurred sometimes one-half or two-thirds way across the bridge, which meant that those end cars would not get through until the third cycle What I want to emphasize is, can we not roughly study traffic control efficiency or adequacy through the determination of pile-ups or percentage of stopped cars?

It will be worthwhile to follow the new Michigan Avenue (Chicago) installation of flexible progressive equipment. The first installation of signals is from 22nd Street north to Oak Street, 3½ miles It will have an expedited rush hour feature, widening the "wave-band" inbound in the morning and outbound in the evening, with automatic reset It is to be hoped that Chicago may be able to experiment with that signal system through a wide range of variable timings and splits as in the Washington tests This paper has shown the necessity of putting such a flexible system through the necessary range of observations