A METHOD OF MEASURING RELATIVE EFFICIENCY OF TRAFFIC FLOW THROUGH STREET INTERSECTIONS

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The flow of traffice through street intersections is a fundamental consideration from the standpoint both of safety and of expediting traffic

The following discussion has to do only with a method for measuring the relative efficiency of traffic flow through street intersections, under various conditions that control traffic, as for example, without control, officer control, automatic signal lights, or other means of control.

The method consists in counting the traffic moving through an intersection, for which purpose there is required not less than 4 observers, each counting a stream of traffic in a given direction. The data presented are compiled from observations made by senior class students in civil engineering at the University of Maryland in 1927 Each observer counts, for pre-determined periods, the total number of vehicles that pass through the intersection, at the same time noting the number of vehicles that come to a stop, which are classed as delayed Thus, the vehicle that moves through the intersection without stopping is considered to have suffered no inconvenience The percentage of delayed to the total number of vehicles passing through an intersection for a given period of time is taken as the measure of the flow of vehicle traffic through the intersection

The observations that are here presented are not intended as any conclusive study as to conditions at particular intersections observed, but to afford limited data for the purpose of illustration The interval that has been used in these observations was of 5 minutes duration It may well be that in studying a given situation this interval should be less, perhaps 2 minutes

It was the endeavor in the observations here reported to select that time during the day when it was expected that traffic would reach a peak load.

The following charts, to which reference is made by number, show, by location of the dots, the total number of vehicles passing through the intersection during a 5-minute interval, expressed in rate per hour. Thus for a 5-minute interval, if 100 vehicles were counted, it would be shown on the charts as a rate of 1200 per hour The location

of the dots shows also for that particular 5 minute interval the percentage of the number of vehicles passing through the intersection which were delayed Thus, in chart Number 1, Figure 1, which is from observations taken in Washington at 15th and I Streets (I Street is a one-way street under free control, that is without lights or officers to guide traffic) the rate of traffic flows during the period observed varied from about 750 per hour to 1650 per hour. For the latter, the percentage of vehicles delayed is 20 In general, the average is seen to be 10 to 12 per cent.

Chart Number 2, Figure 1, shows a similar group of observations taken at 6th and F Streets, where there is 2-way traffic under conditions of free control It is noted that the range in amount of traffic is not so large as that noted in chart Number 1, but the percentage of delays is about the same, 10 to 20 per cent.

Chart Number 3, Figure 1, is for observations made at 15th and I Streets, 1-way traffic on I Street under officer control, traffic varying from a rate of 500 to 1600 per hour, the percentage of delays being over 50 per cent, averaging 35 per cent

Chart Number 4, Figure 1, is for observations taken at 15th and H Streets, 2-way traffic on both streets under officer control Here was a considerable density of traffic, reaching a rate of 2400 per hour with a very large percentage of delays, in some cases for the 5-minute intervals nearly every vehicle being delayed This was undoubtedly caused by the necessity to provide for the pedestrian traffic.

A similar case of high percentage of delays is shown on Chart Number 5, Figure 1, which gives the results of observations taken at Liberty and Lexington Streets, Baltimore, under officer control, 2-way traffic on Liberty Street, 1-way traffic on Lexington Street. While the amount of traffic for the period observed is not great, reaching a maxi- of 1200 per hour, it is noted that the delays are around 70 per cent Here, too, the delays were caused by the large amount of pedestrian traffic at this intersection. The observations at this point were made between the hours of 11.30 and 1 o'clock, when vehicle traffic was not at its height, whereas pedestrian traffic was heavy.

It is interesting to compare the charts so far presented with Chart Number 6, Figure 2, which is for observations taken between 3 30 and 6 o'clock at Mt. Royal Avenue and St. Paul Street, Baltimore, 2-way traffic controlled by automatic lights While the traffic was heavy, varying from 1200 to 2400 per hour, it is to be noted that delays are relatively small, averaging about 30 per cent. At this intersection, the pedestrian traffic is comparatively light.

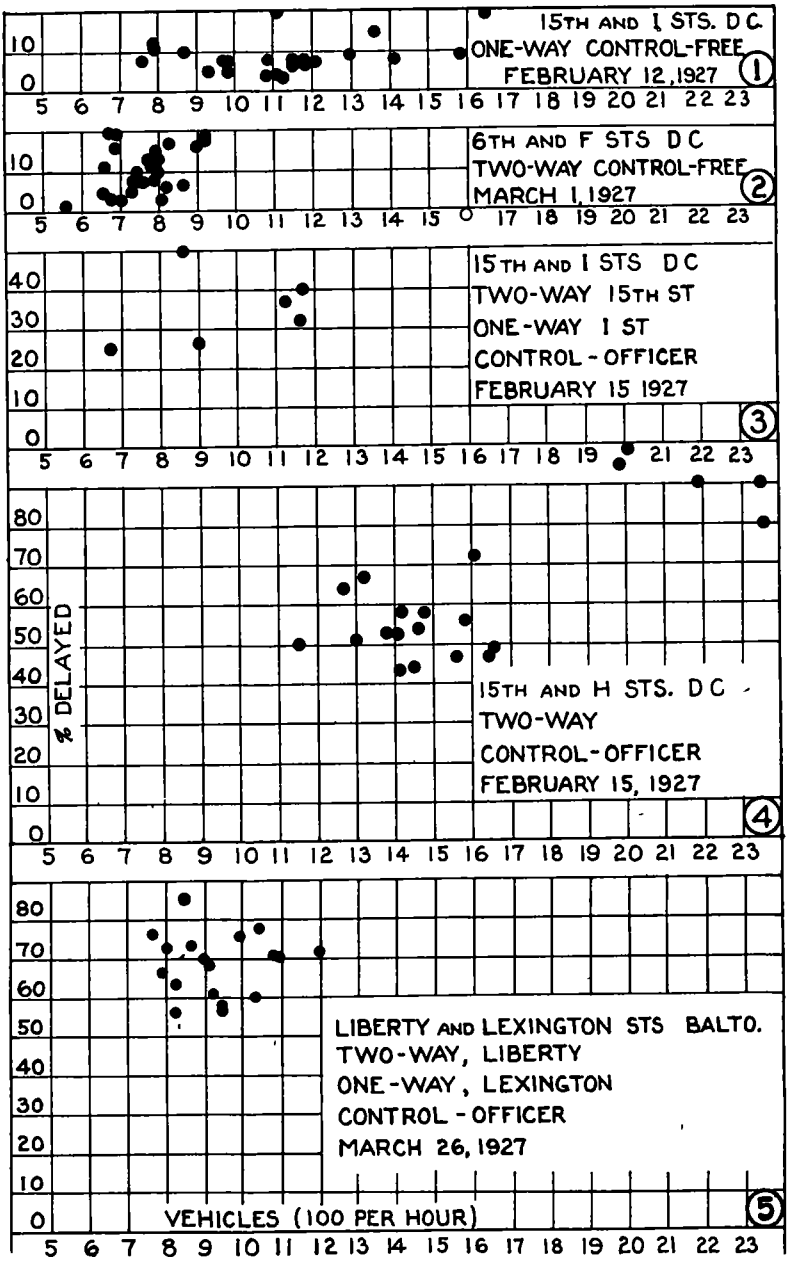
15TH AND I STS. D.C.
ONE-WAY CONTROL-FREE
FEBRUARY 12, 1927
1
6TH AND F STS D C
TWO-WAY CONTROL-FREE
MARCH 1, 1927
2
15TH AND I STS D C
TWO-WAY 15TH ST
ONE-WAY I ST
CONTROL - OFFICER
FEBRUARY 15 1927
3
% DELAYED
15TH AND H STS. D C
TWO-WAY
CONTROL-OFFICER
FEBRUARY 15, 1927
4
LIBERTY AND LEXINGTON STS BALTO.
TWO-WAY, LIBERTY
ONE-WAY, LEXINGTON
CONTROL - OFFICER
MARCH 26, 1927
5
VEHICLES (100 PER HOUR)

Figure 1

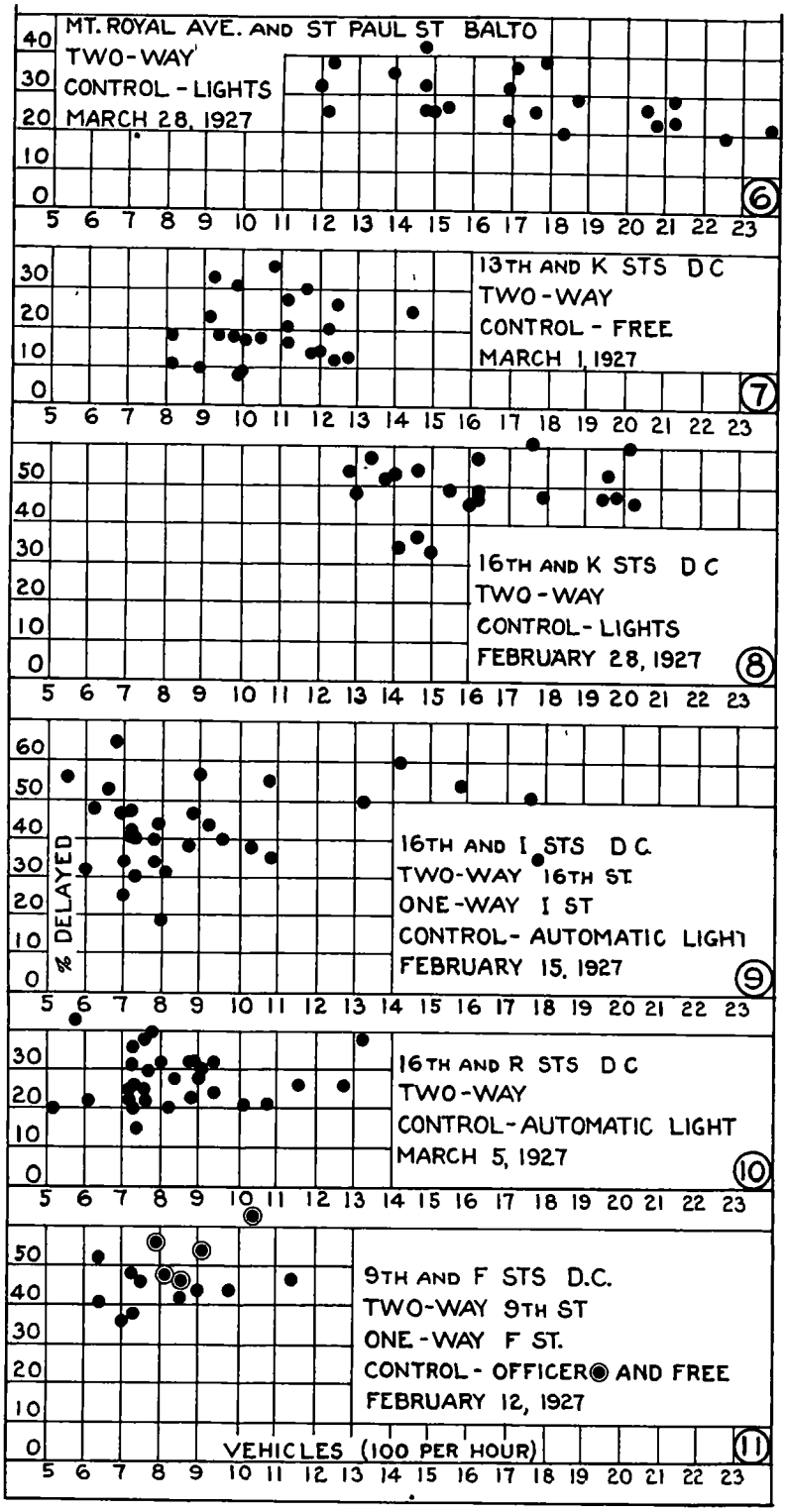
MT. ROYAL AVE. AND ST PAUL ST BALTO
TWO-WAY
CONTROL - LIGHTS
MARCH 28, 1927
⑥
13TH AND K STS D C
TWO-WAY
CONTROL - FREE
MARCH 1, 1927
⑦
16TH AND K STS D C
TWO-WAY
CONTROL- LIGHTS
FEBRUARY 28, 1927
⑧
% DELAYED
16TH AND I STS D C.
TWO-WAY 16TH ST.
ONE-WAY I ST
CONTROL- AUTOMATIC LIGHT
FEBRUARY 15, 1927
⑨
16TH AND R STS D C
TWO-WAY
CONTROL-AUTOMATIC LIGHT
MARCH 5, 1927
⑩
9TH AND F STS D.C.
TWO-WAY 9TH ST
ONE-WAY F ST.
CONTROL - OFFICER◉ AND FREE
FEBRUARY 12, 1927
VEHICLES (100 PER HOUR)
⑪

Figure 2

Chart Number 7, Figure 2, is for observations taken at 13th and K Streets, Washington, 2-way traffic under free control during the hours of 10 to 12 o'clock It is noted that the amount of traffic varies from 800 to a little over 1400 per hour, but that the percentage of delays is comparatively low, averaging about 20 per cent.

Sixteenth Street, Washington, is under the progressive light control system, so that it is possible for a vehicle, properly timed, to proceed without stopping for a considerable distance on 16th Street Charts Numbers 8, 9 and 10, Figure 2, are from observations taken at 16th and K Streets, 16th and I Streets, and 16th and R Streets respectively, taken from 3 to 5 o'clock P M for Chart Number 8, and from 9 to 11 o'clock A M. for Charts Numbers 9 and 10 The traffic, it is to be noted, is not extraordinary, reaching something over 2000 per hour, averaging perhaps 1000 per hour The percentage of delay is somewhat less at 16th and R Streets, Chart Number 10, than at the other two intersections, 16th and K Streets and 16th and I Streets, where the delays are about 50 per cent

Chart Number 11, Figure 2, taken at 9th and F Streets, where F Street has one-way traffic, has some points of special interest. The officer in control took charge of traffic at 10-minute intervals, being on duty 10 minutes and off duty 10 minutes The double circles indicate the observations that were made with the traffic officer on duty The percentage of delays with traffic averaging 700 to 1000 per hour was 55 per cent Under free control, with traffic ranging from 600 to 1150 per hour, the delays were about 45 per cent, the difference being due undoubtedly to the fact that the officer held up the traffic for the accommodation of pedestrians. In general, it would seem to be observed that for traffic of not exceeding a rate of 1000 per hour, it moves much more readily through the intersections without control, but undoubtedly it increases the hazard of the pedestrians

As stated at the opening of this discussion, these observations are not submitted as forming any conclusive evidence from which exact deductions are to be drawn, but rather as illustrating a very practical method for examination of traffic conditions through intersections Complete data, it is obvious, would include the number of vehicles making right and left turns, the pedestrian traffic handled through the intersection, as well as the vehicular traffic

It is probable that where pedestrian traffic is considerable, the best we may hope for is that not more than 60 to 70 per cent of the vehicular traffic will be delayed—that is, come to a stop—before passing through an intersection