Adoption of Aerial Survey Methods for Traffic Operations

JOSEPH F. RICE, Department of Highways and Traffic, Washington, D. C.

• EFFICIENT OPERATION of a modern highway transportation system requires continuing attention to the current and foreseeable traffic trouble spots, the necessity for development and use of new traffic control methods, and continuing research on traffic characteristics to assure the safest possible operation. To accomplish these functions the traffic operations engineer must use his resources in the most profitable way possible. This usually means spreading himself very thin, since problems affecting most highway users occur between the hours of 6:30 to 9:30 AM and 4 to 7 PM. These two

Figure 1.

Figure 2.

Figure 3.

Figure 4. Dense outbound traffic on Key Bridge further congested by a traffic accident.

Figure 5.

Paper sponsored by Committee on Photogrammetry and Aerial Surveys.

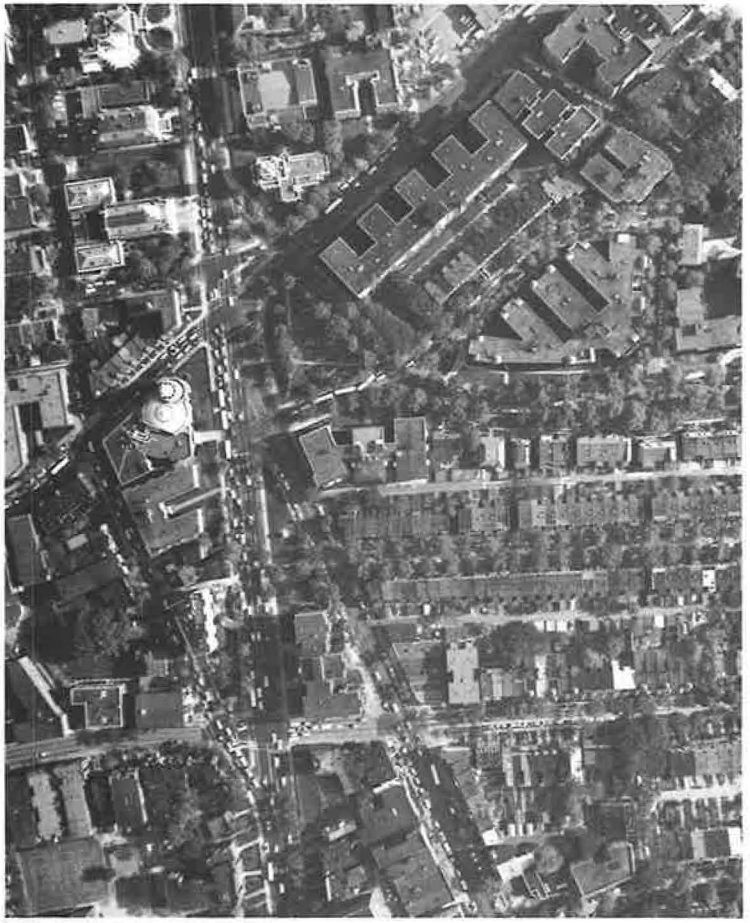

Figure 6.

Figure 7.

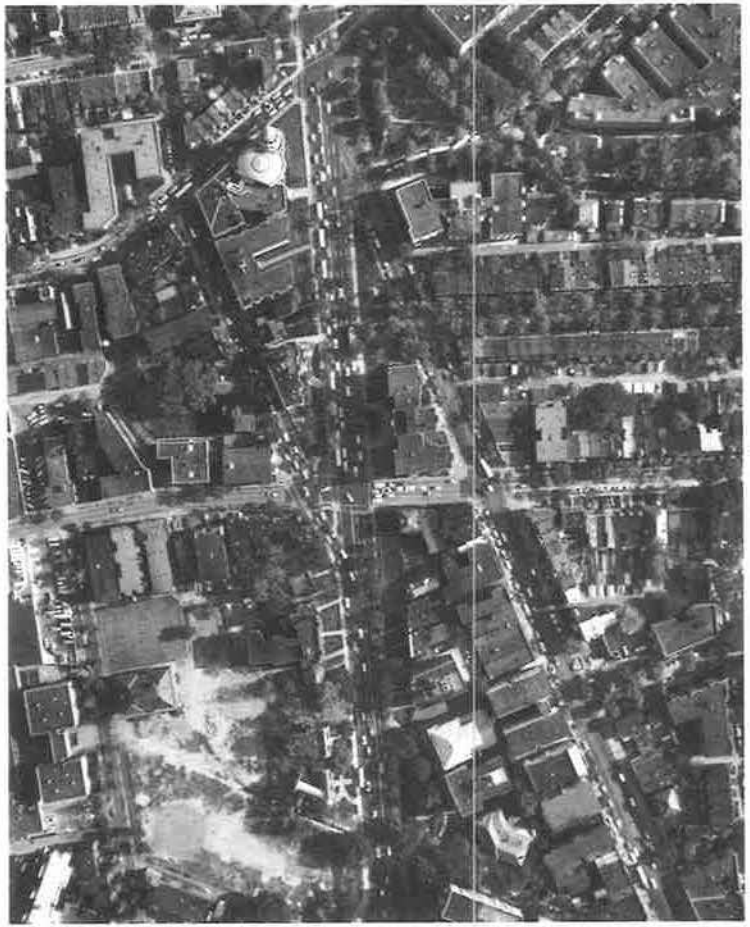

Figure 8.

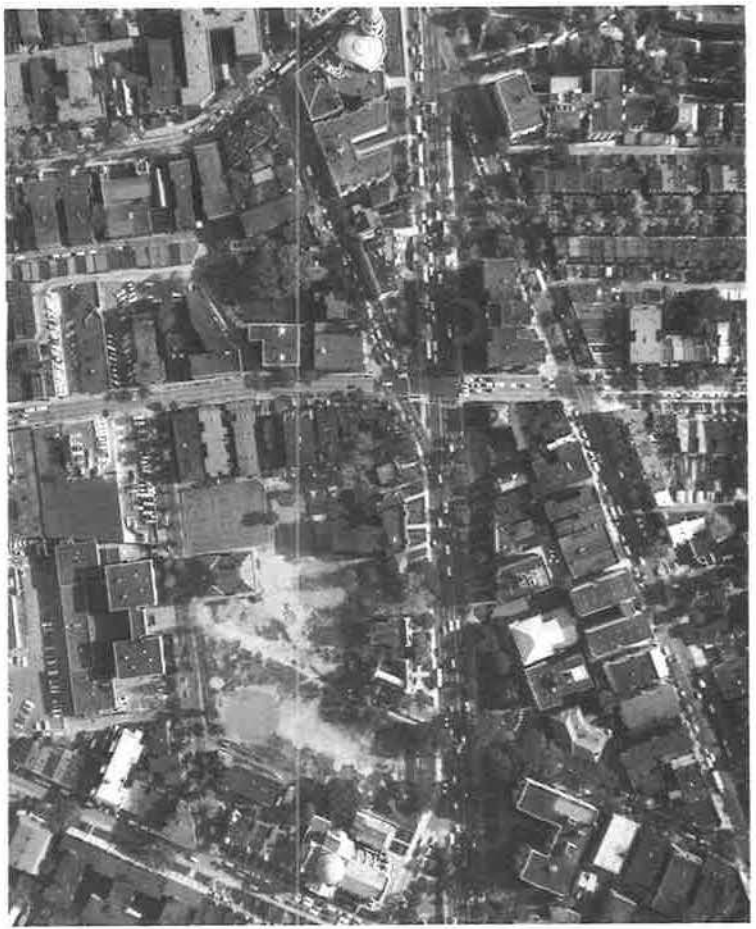

Figure 9.

periods, when traffic movement problems are the most acute, usually occur before and after what are considered normal working hours. This is significant in that methods of getting traffic data from widely-dispersed areas in short periods of time become increasingly important.

Aerial survey techniques offer an unusual opportunity to meet these demands in scope and detail during the critical traffic hours. Airborne photographers can be dispatched to problem locations and capture an event on film for study or reference. Further, since most traffic events have both cause and effect relationships, the extent of the effect can often be recorded and used as a check on office analysis of a problem.

A recurring demand of vehicle operators for more efficient service from the highway systems (that their gasoline taxes pay for) is the improvement of safety and the reduction of bottlenecks on commuter routes. Several cities have airborne traffic surveillance on a continuing, scheduled basis. Various means of identifying traffic-movement trouble spots have been attempted in the Washington Metropolitan Area. The examples used in this paper combine experience obtained through cooperation with the Metropolitan Police Department of the District of Columbia and through the courtesy of the U. S. Army in making available training flight time.

In 1960, aerial observation of several bottleneck points during periods of peak traffic was used by helicopter-borne traffic engineers on several successive days. In late 1961, personnel of the Traffic Division of the Metropolitan Police Department, in cooperation with a local radio station, began broadcasting traffic information from a small helicopter during peak traffic periods. In November 1962, a larger aircraft was obtained and an invitation was extended to engineers of the Department of Highways and Traffic to use the third seat for traffic operations work. This offer was accepted to obtain information on the efficiency of arterial highway systems and operation of detours. The advantage of such joint usage of aircraft is that the recurring problem areas, well known to police personnel, can be subjected to joint enforcement and engineering inspection, and in some instances a course of action may be decided while viewing the problem.

All aerial photographs were taken from a helicopter at flight heights ranging from 200 to 2,000 ft. The operational photographs were obtained using photographic film of A.S.A. speed rating 200 in either a Kodak Signet or an Argus C-3 camera held in the engineer's hand. The time lapse photography was obtained with a K-24 aerial camera equipped with a 7-in. focal length lens, mounted on a Bell G-2 helicopter. "Elevated" photographs were taken from flight heights ranging between about 30 ft and 110 ft above ground level.

The operational uses and advantages of aerial survey techniques fall into two general categories:

The problem category is illustrated in Figures 1 through 3. Complaints received indicated traffic congestion so severe that cars could not exit from off-street parking lots. Spot study of the problem seemed to confirm this. Upon receipt of the "elevated" photographs, however, it was evident the location of bus loading operations was the major factor. A call to the transit company and shifting of bus loading areas resulted in substantial improvement.

Another illustration of the problem category is shown in Figure 4. While airborne on routine evening rush-hour surveillance, notice was received of an accident on a bridge which was operating very close to practical capacity. Any interruption of traffic on this structure during rush hours produces a wave of congestion extending down a freeway and a major arterial street within one cycle of a traffic-control signal. Within two minutes an engineer was over the scene and obtained photographic evidence of the influence exerted, furnishing visual support that operating conditions are so critical as to create very adverse traffic conditions when subjected to the slightest inferference.

Figure 5 shows a third problem area. Here a complex intersection tends to become a bottleneck under rush-hour operation. The only way to obtain a perspective of the problem is to view it from the air. Study of the problem must also be based on data showing the overall problem.

In the research category, both precise survey type photography and non-survey photography are used. Figures 6, 7, 8, and 9 show two intersection complexes on a major

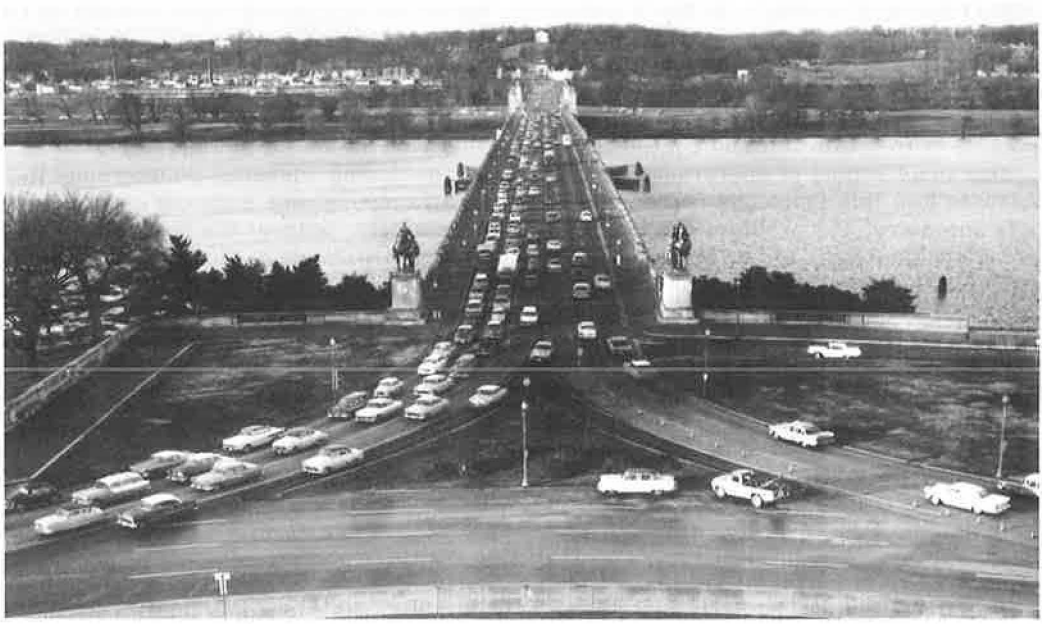

Figure 10. Intense morning traffic in two of four inbound lanes, Memorial Bridge.

Figure 11. More uniform distribution of morning traffic in the four inbound lanes, Memorial Bridge.

arterial street. These photographs were taken at 5-sec intervals for operational research on signal control systems. They are to be used for operational research on traffic movement, particularly bus lanes (when available) and for research into pedestrian crossing problems. In many instances, aerial survey photography already on file can be extremely valuable to the traffic operations engineer if made available to him. This "bonus" value is often overlooked.

Figures 10 and 11 show a non-survey research problem in lane distribution. The fourth lane from the left reverses direction during the evening rush hours, but the problem is to obtain full and continuous use of this lane as shown in Figure 11.

This brief report of operational uses of aerial, including elevated photographs illustrates how this technique can be used by the traffic operations engineer.

In summary, the problem can be viewed in its entirety, without the engineer being a part of the problem, either at the source or in the resulting congestion. Aerial photography is the effective means of getting to the trouble spot rapidly while the condition exists. It also provides a powerful tool for operational research and study of problems not otherwise approachable. There is no necessity for high-priced equipment, or even aircraft, in many instances. The bonus value of on-the-shelf survey photography provides in many instances a convenient library of photographs available on request. Potential future uses for both categories of photography include detour review and operation, and analysis of traffic movement and traffic intensity.

Finally, the traffic operations engineer should be aware that aerial photographs will not solve his traffic problems, but their use will identify new problems he did not realize existed. Consequently, although aerial photographs are an invaluable aid in making traffic surveys, and in identifying and analyzing traffic problems, engineers should remember there is no substitute for getting all pertinent facts, clear thinking, and complete analysis before the problems can be solved. With the preceding qualifications the engineer will find aerial survey methods are very valuable aids to use in his attack on traffic problems.