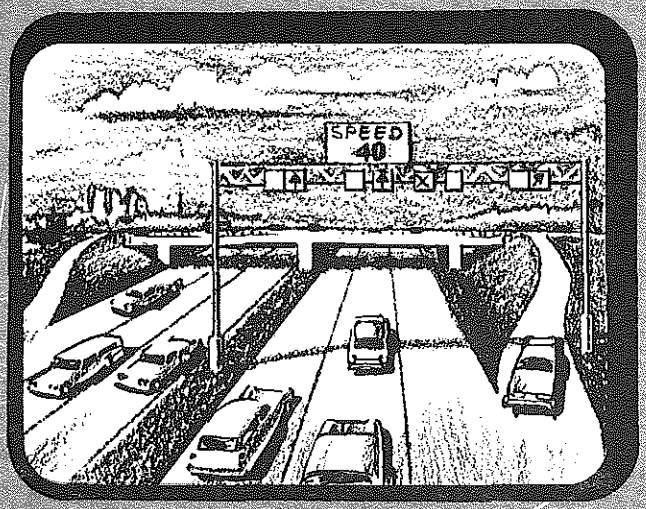
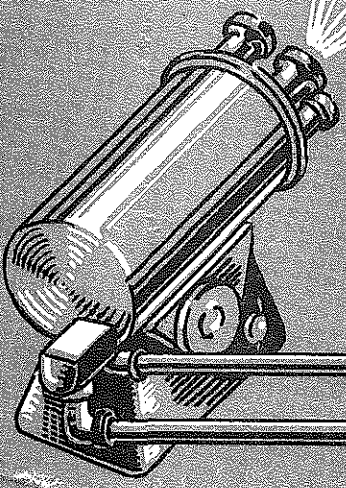
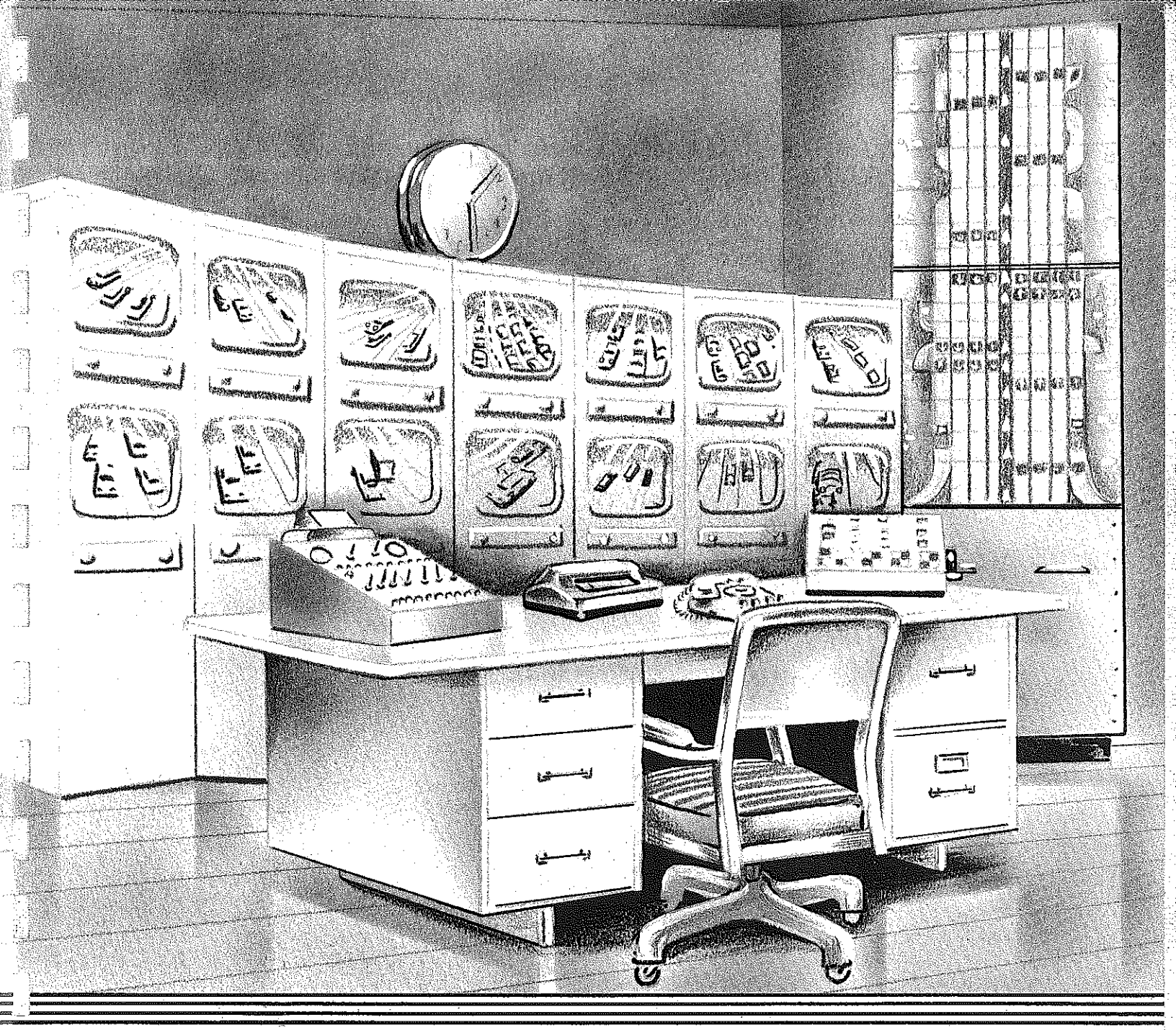
JOHN C. LODGE
FREEWAY TRAFFIC SURVEILLANCE
and
CONTROL RESEARCH PROJECT





EFFECT OF INCIDENTS ON FREEWAY TRAFFIC



FREEWAY SURVEILLANCE CONTROL CENTER

FREEWAY TRAFFIC SURVEILLANCE AND CONTROL RESEARCH PROJECT

A Project of the
Michigan State Highway Department
Jointly with the
Wayne County Road Commission
City of Detroit, Department of Streets and Traffic
In Cooperation with the
U.S. Bureau of Public Roads

STUDY 424
EFFECT OF INCIDENTS ON FREEWAY TRAFFIC

I. LANE CLOSURE FOR MAINTENANCE

II. EFFECT OF ACCIDENT ON FREEWAY TRAFFIC FLOW

A Report of the
Project Technical Committee

By

Conrad L. Dudek
Traffic Division
Michigan State Highway Department

FREEWAY TRAFFIC SURVEILLANCE AND CONTROL RESEARCH PROJECT

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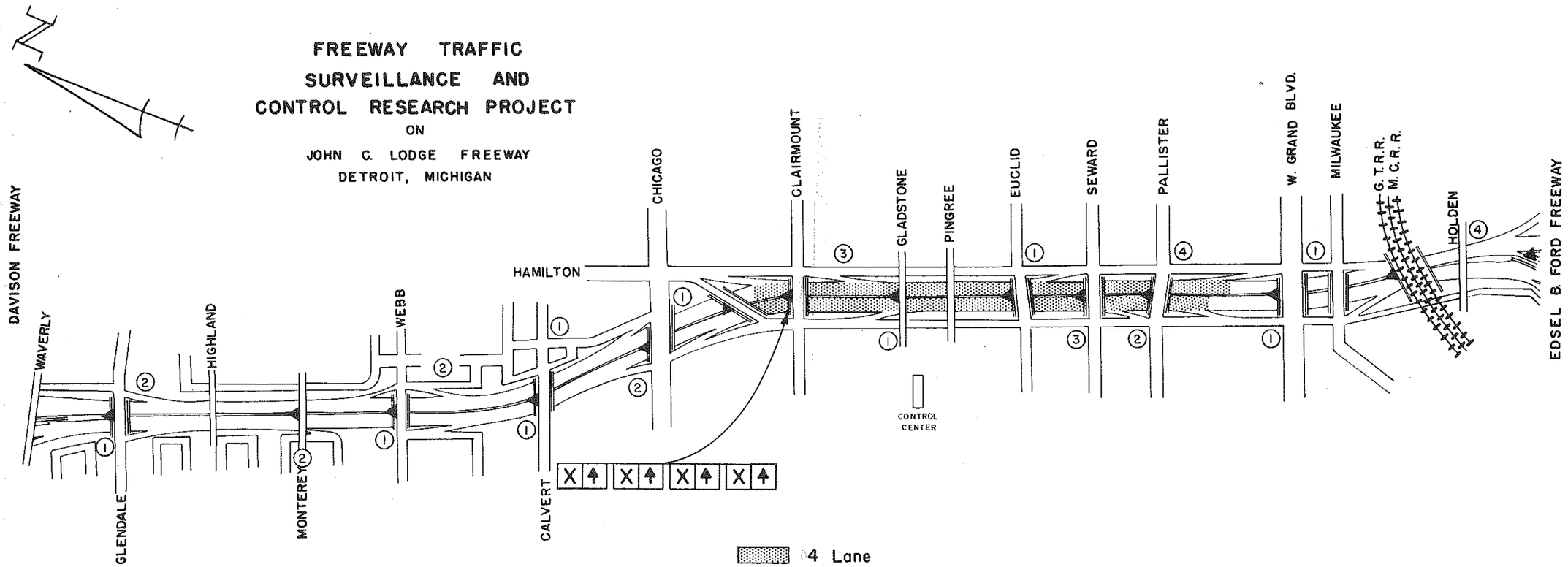
FREEWAY TRAFFIC SURVEILLANCE AND CONTROL RESEARCH PROJECT

ON

JOHN C. LODGE FREEWAY

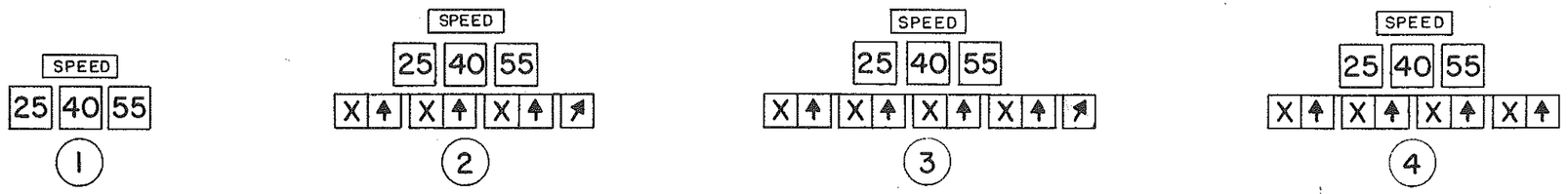
DETROIT, MICHIGAN



◀ T.V. CAMERA

FIGURE I

FREEWAY STUDY AREA PLAN



SIGNAL LOCATION

SPEED MESSAGES COMBINED IN SINGLE MATRIX

12-18-61 B.R.

One of the prime objectives of the John C. Lodge Freeway Surveillance and Control Research Project is to observe freeway traffic when an incident has occurred, such as an accident, vehicle breakdown, or maintenance vehicle operation, and to study the effects of such incidents on traffic flow which may assist in determining improved procedures for handling such incidents. The method utilized here for studying such incidents involves the taking of photographs of the television monitors which gives a permanent record of such incidents. Added to this is traffic information which includes volumes, speed and density of traffic surrounding the incidents. Comparions of this traffic information without incident as compared to during and after the incident can show the effects on traffic behavior. The photographs can provide visual evidence of these effects and can be easily taken off the TV monitors. Motion pictures, as well as still pictures taken in sequence, can present these effects in greater detail but require more sophisticated camera equipment.

This report is an initial attempt to present the effects of two incidents by still pictures taken in sequence. The presentation here provides visual evidence of the effects of these incidents.

The still pictures provide this evidence within their limitations. However, future plans call for recording such incidents on motion pictures, which will provide a more complete, active and realistic presentation for study.

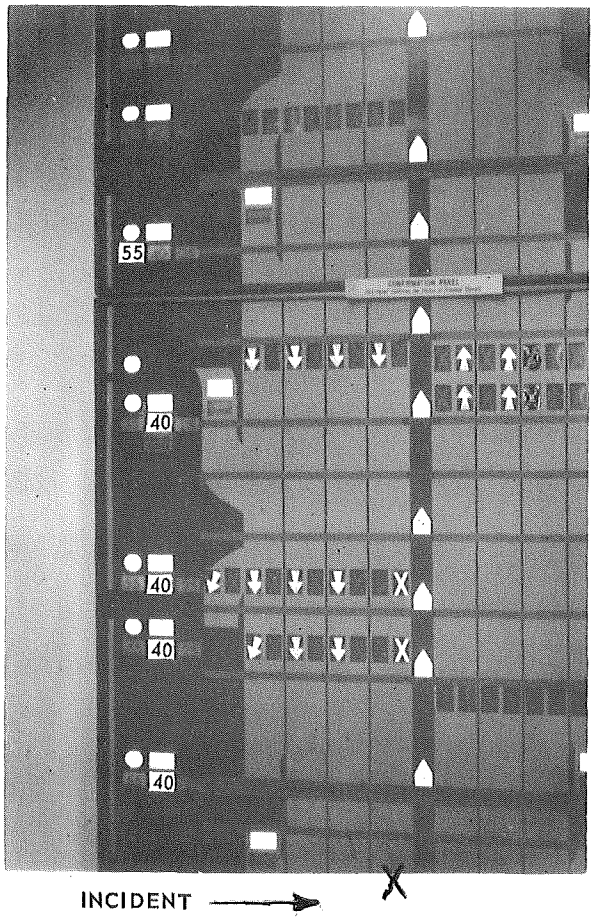
This study shows the effects upon freeway traffic of two types of incidents often observed from television surveillance as recorded by prints from 35 mm films.

I. LANE CLOSURE FOR MAINTENANCE

The pictures here record the traffic flow n the John C. Lodge Freeway during a maintenance operation on the median guard rail. These photos were taken in sequence directly off the TV monitors at the project Control Center. The incident recorded occurred on May 15, 1962, during the second week of the control system operation. The maintenance operation required that the median lane be closed to traffic. This was physically accomplished by setting out traffic cones approximately 250' in advance of the location of maintenance work to channelize traffic into the two open lanes. In addition, a flasher trailer was attached to the rear of the maintenance vehicle for advance notification. This practice is the normal operating procedure for this work. Figure 1 presents an incident which took place just south of the Milwaukee Bridge in the southbound direction.

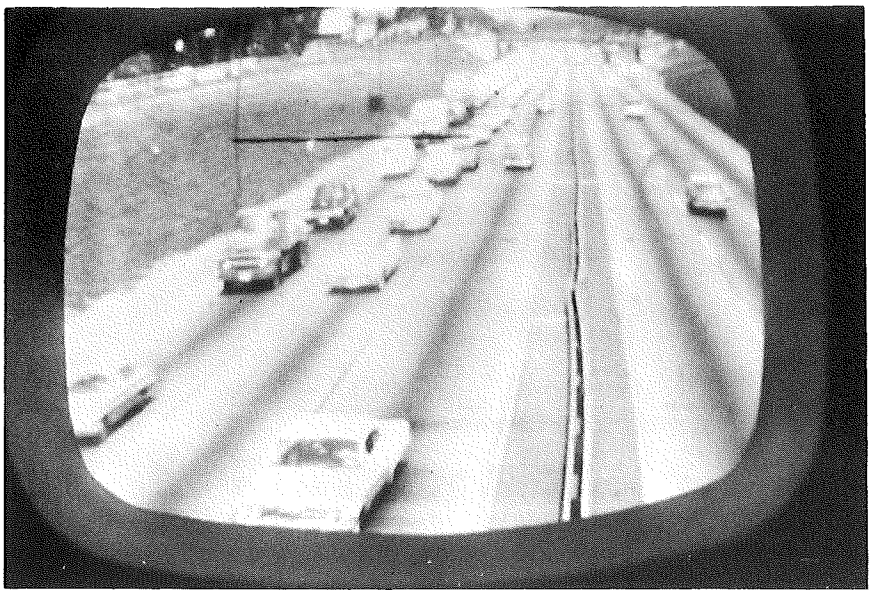
This incident occurred during the off-peak traffic period. The control system was activated to display a red "X" over the median lane.

The operational procedure for the control system during this week was that of part system operation. That is, only that portion of the control system was used where needed in the vicinity of the incident. As a result, only three spans of lane control signals were illuminated in the direction effected. Figure 2 illustrates the Confirmation Panel displaying the location of activated signals



Note two spans in advance of the incident have "X's" displayed on the median lane in the southbound direction. The location of the incident is identified in the picture. The incident is viewed from the Grand Trunk Railroad camera location. Green arrows are displayed over the shoulder and center lanes.

The following is a series of photos at adjacent camera locations in advance of the maintenance operations. Figure 3 presents the traffic flow from the West Grand Boulevard camera which views a field from 400 feet to 1640 feet in advance of the maintenance operation.



This traffic has passed under the two spans of signals displaying the red "X" over the median lane. Note the heavy traffic in the center and shoulder lane as traffic has moved from the median lane because of lane closure by the signals.

Figure 4 presents traffic as viewed from the Pallister camera location covering the area from 1640 feet to 2345 feet in advance of the incident. Traffic here has passed under one span displaying the red "X" in the median lane and is approaching the second span of signals on the truss visible in the picture. Note the median lane is clear of traffic in the near field of the photo.

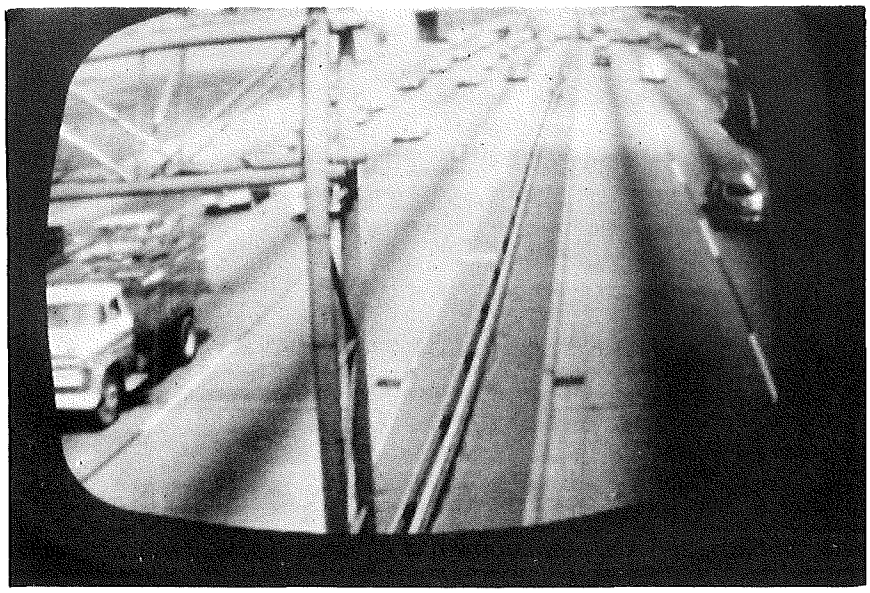


Figure 5 presents traffic flow approaching the first signal span displaying the red "X" from the Seward camera location. This span is located approximately 2400 feet in advance of the incident and the camera field in this photo covers from 2345 feet to 3170 feet in advance of the incident. Even this distance in advance of the incident, it is apparent that motorists have responded to the red "X" in an efficient manner, as indicated by the heavy traffic in the shoulder and center lane.

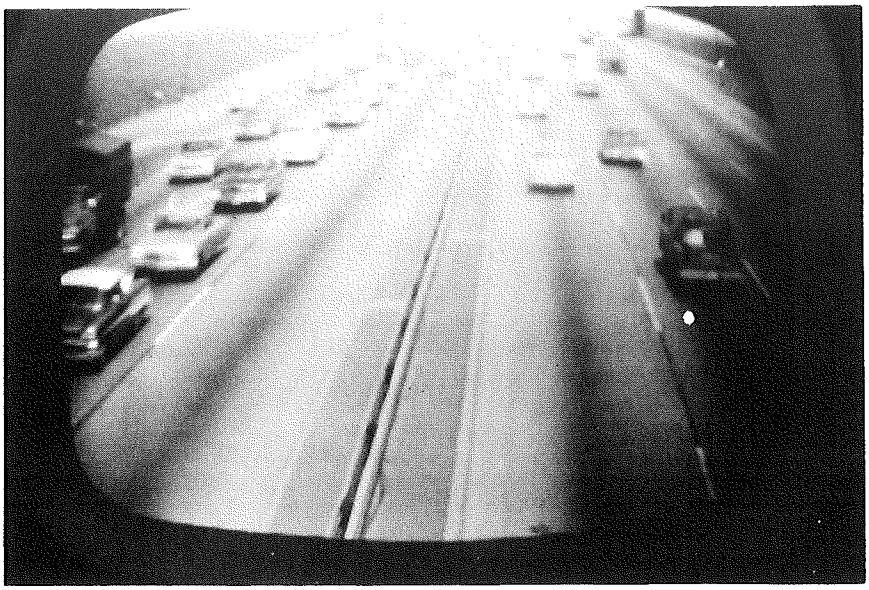


Figure 6 presents traffic flow as viewed from the Euclid camera location. The field covered by this camera is from 3170 feet to 4425 feet in advance of the incident. Traffic can easily view the first span of signals displaying the red "X". Here motorists are moving from the median lane into the center lane.

Figures 7 through 11 present corresponding photos as figure 1 and figures 3 through 6, but taken at a later time. Traffic in these later photos is still responding to the control system and particularly the red "X".

Figure 8

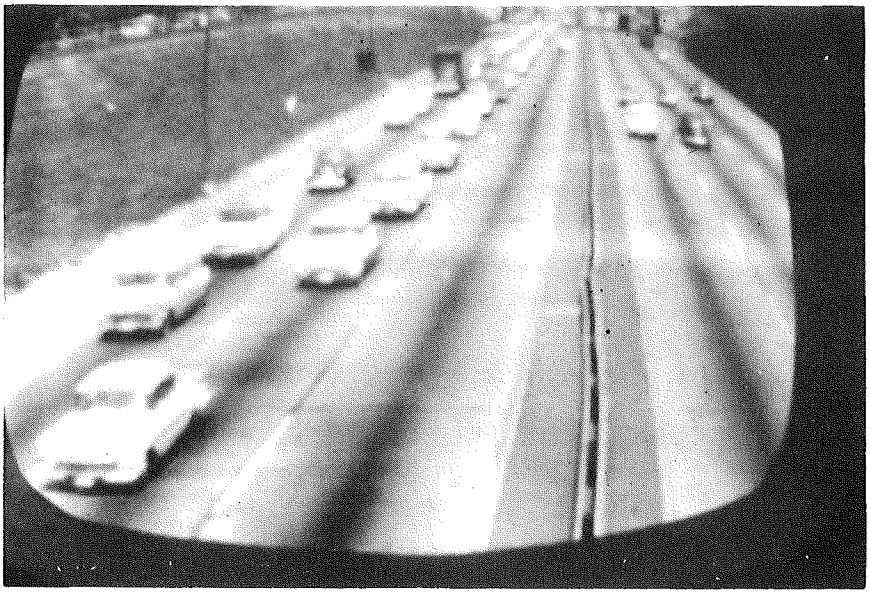


Figure 9

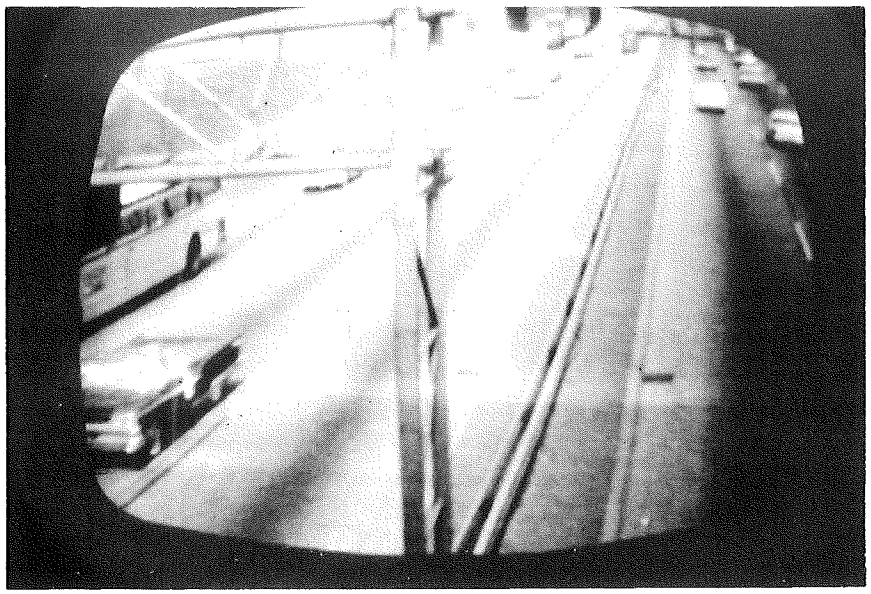
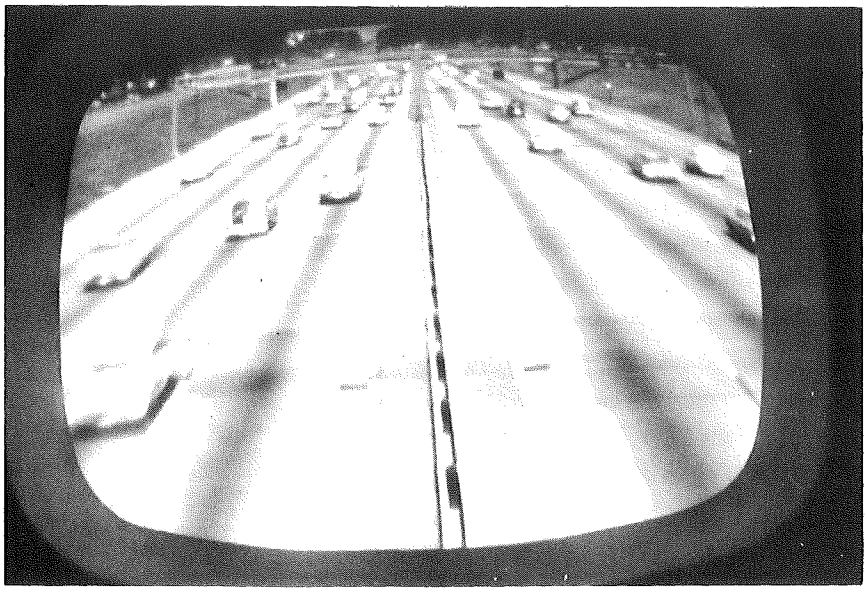


Figure 10.

Figure 11.



The foregoing photographs have presented motorists reaction to a lane closure required by a maintenance operation. The lane closure presented was successful as indicated by the motorists response to the red "X". This incident occurred during the second week of the operation of the control system. Some motorists did disregard the red "X" because of certain conditions. When traffic became very heavy in the shoulder and center lane, this left little opportunity for the median lane traffic to merge readily into the open lanes. Also, a few motorists upon seeing the median lane vacant of traffic, disregarded the red "X" when they could see no obstruction ahead in the hopes of getting ahead of fellow motorists. To their disappointment, they became trapped at the incident in the median lane and were able to leave the median lane only when a courteous motorist in the center lane allowed them to do so. This condition is now getting less common with the motorists exposure to the control system. The use of the red "X" will inform these motorists not to proceed in a closed lane unless he wants to be trapped at the obstruction point. This situation will be eliminated through self eduction and judicious use of the red "X" restricted to actual lane blockages.

When traffic began to congest some minutes after the maintenance vehicle started work, motorists did experience difficulty in merging into the center lane as openings were not available to them. Thus, with the center and shoulder lanes filled and traffic continuing to enter the freeway area, the motorists in the median continued in that lane even though the red "X" was displayed. It was apparent that motorists in the median lane were aware of the incident but could not leave this lane though they were attempting to do so. This indicates that advance notification is very important in warning motorists of

impending lane closures, particularly during congested periods when capacity is being exceeded. The ability to reduce freeway traffic under such circumstances by entrance ramp closure can be very beneficial. Ramp signals for closing ramps were not installed at the time of these pictures, but are to be installed in the next two months. More control of entering traffic will assist in reducing situations such as described herein.

To illustrate the situation in the foregoing paragraph, a series of pictures taken during the same maintenance operation but at a later time presents the build up of congestion in the center and shoulder lanes and illustrates the forced violation of the red "X" by motorists in the median lane due to the lack of room to merge into the adjacent lanes. Figures 12 through 15 present traffic flow viewed from the West Grand Boulevard camera location covering the area directly in advance of the maintenance operation. The lack of space to merge into the adjacent lanes running full, restricts the median lane traffic from merging and results in the situation depicted in figures 13 and 15.

Incidentally, we have noted that motorist compliance to the red "X" is continually improving as they gain experience through increased exposure to the control system

Figure 12.

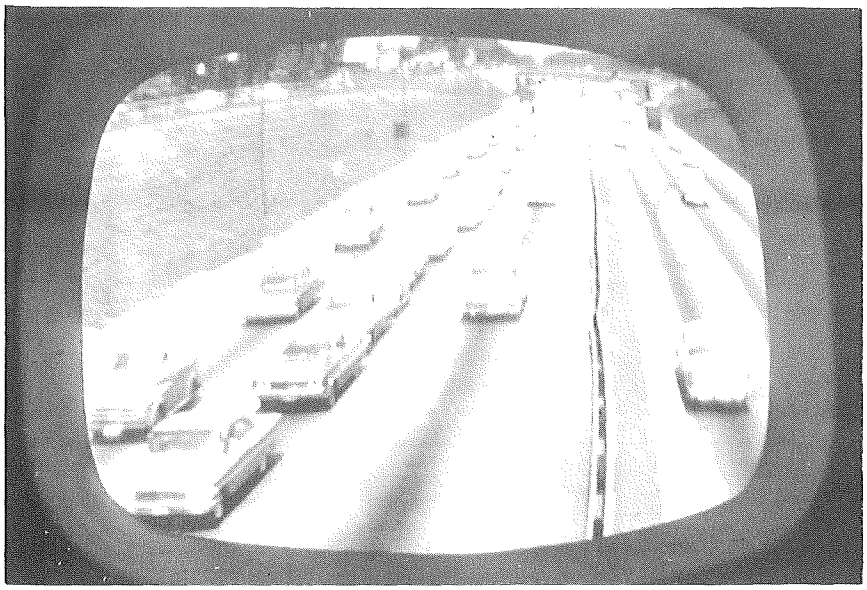


Figure 13.

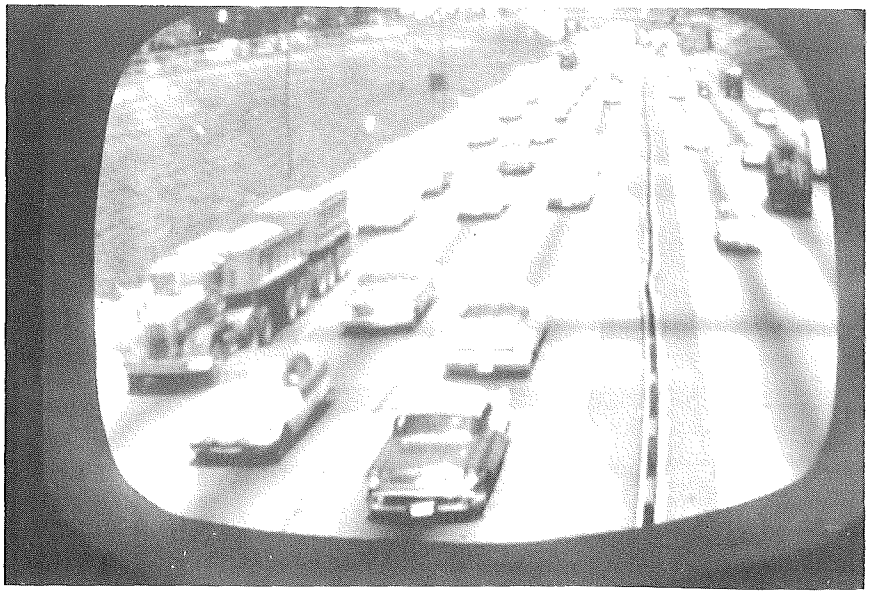


Figure 14.

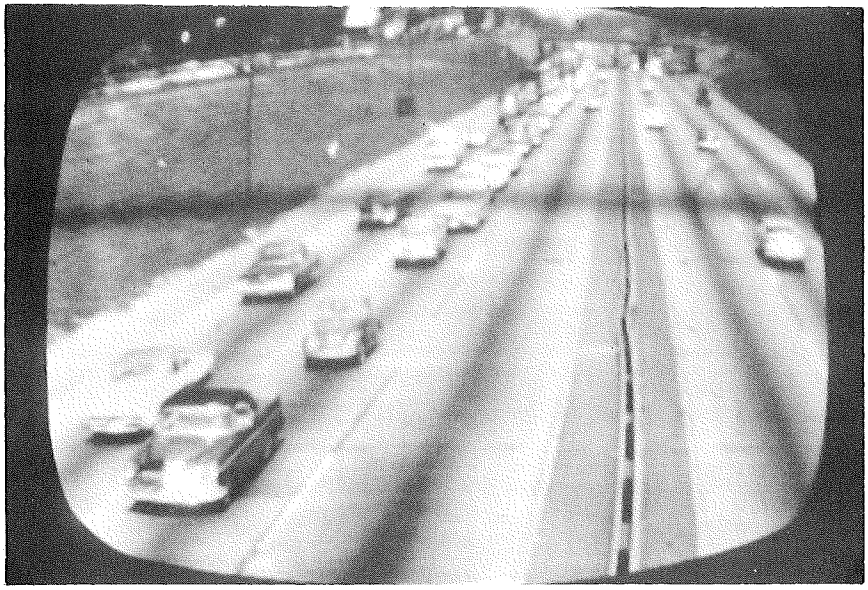
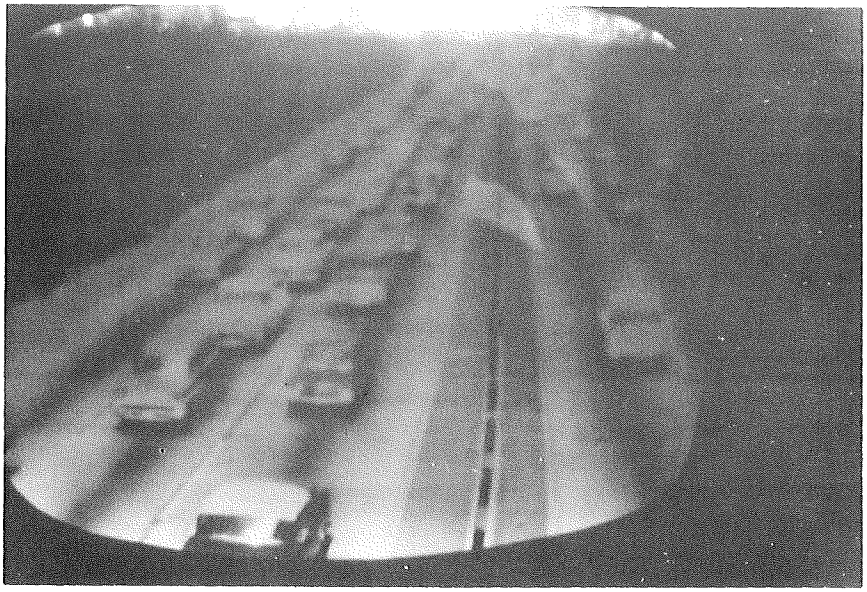


Figure 15.



II. EFFECT OF ACCIDENT ON FREEWAY TRAFFIC FLOW

On May 17, 1962, two minor accidents occurred on the John C. Lodge Freeway during the morning peak traffic period in the southbound direction. The two accidents happened in the area viewed from the Euclid camera but occurred approximately 50 minutes apart. The vehicles involved in the accident in each case were moved to the shoulder where the police assisted the motorists.

Many occurrences such as these have been observed frequently by TV surveillance and the visual effect upon freeway traffic flow, as expected, is very apparent and noticeable.

Study of the effect of such incidents is part of the objective of the Freeway Surveillance Project. Still photography was used to provide a permanent record of these situations. The use of motion pictures direct from the TV monitors has been proven feasible and is planned for future studies. The scheduling of this type of study is of course limited to the random occurrence of the incidents.

This presentation illustrates the decided reduction in the flow of traffic caused by the accident and particularly the effect of parked vehicles involved upon this freeway traffic following the removal of these vehicles from the roadway to the shoulder.

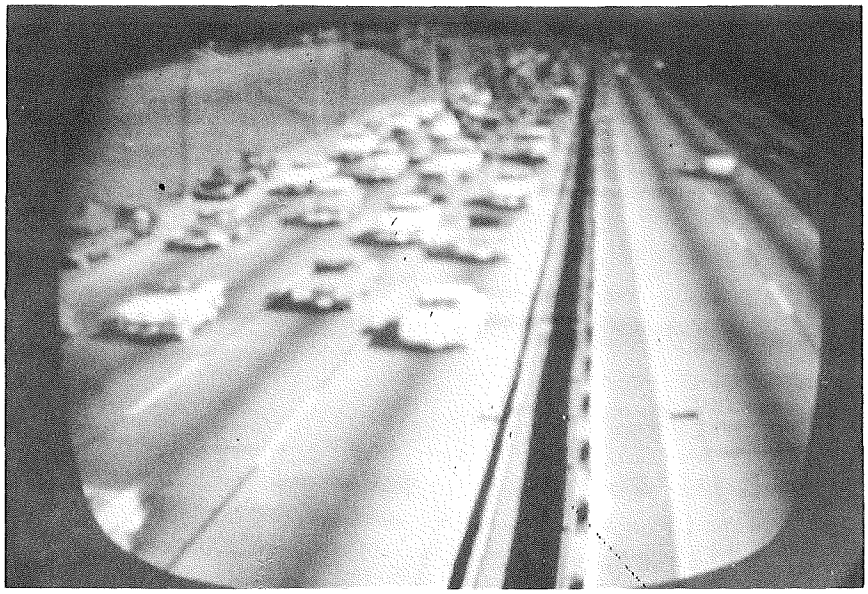


Figure 1 shows the two vehicles parked on the shoulder and also the police vehicle and officers performing their customary functions. This picture, taken at 8:10AM indicates how motorists react in a situation such as this. Note particularly the difference in spacing of the freeway traffic in advance of the parked vehicle as compared with the spacing of the freeway traffic which has passed the parked vehicles. This phenomenon has been observed frequently during incidents such as this from TV surveillance. Motorists approaching the incident notice the parked vehicles, particularly the police vehicles. The instinctive reaction is to slow down, resulting in reduced spacing as they attempt to observe the happenings on the shoulder. After they have passed the incident their speed increases as does their spacing. This is apparently a normal reaction based upon curiosity of the motorists when such things occur.

Figure 2 is a closeup illustrating the telephoto feature of the TV and the possible details discernible using this lens.

Figure 3 presents the traffic flow in the area immediately beyond the accident vehicles location in the field by the Seward camera. Note the traffic in the near portion of the picture is free flowing whereas the traffic in the rear portion is much more closely spaced.

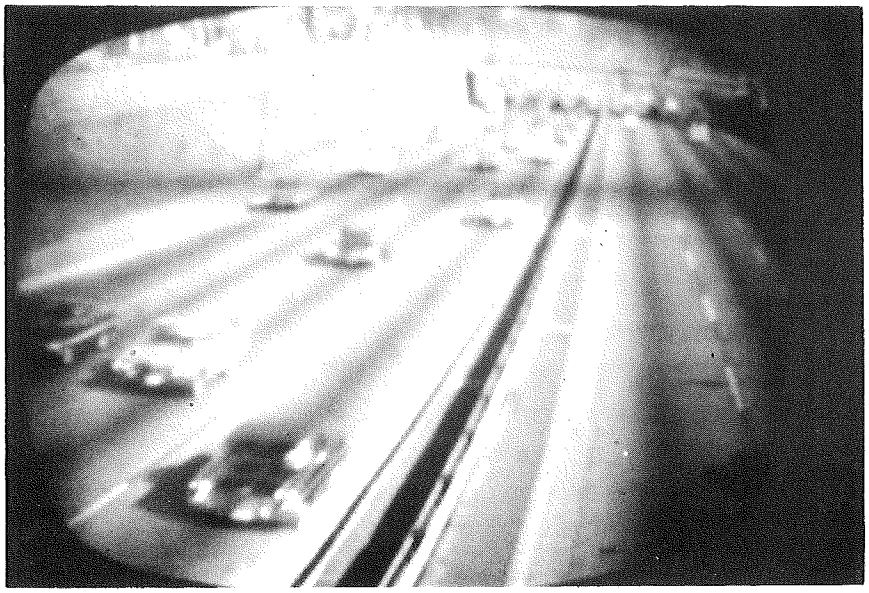


Figure 4 presents traffic flow in the area viewed by the Gladstone camera. This covers a distance from 1055 feet to 2115 feet in advance of and approaching the accident vehicles on the shoulder. Note the close spacing of vehicles as congestion begins to build up.

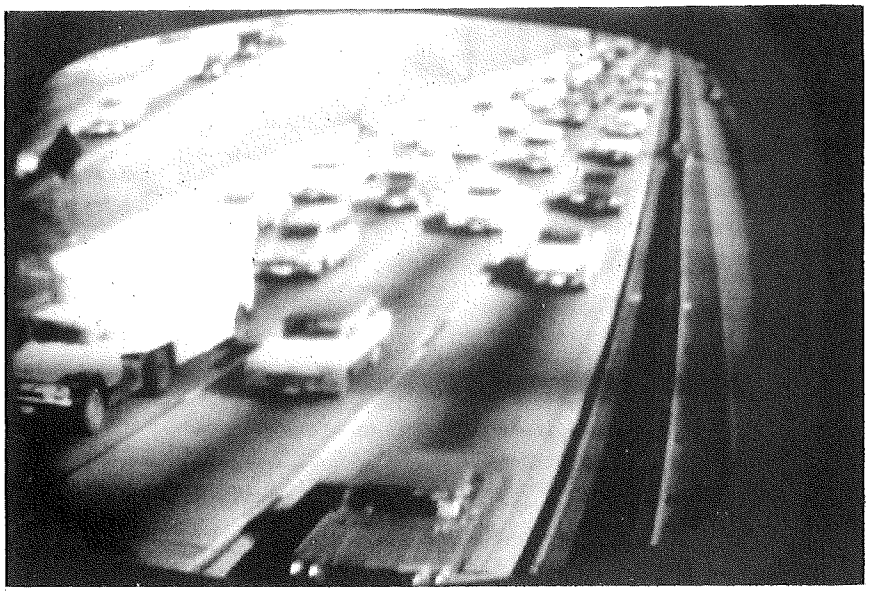
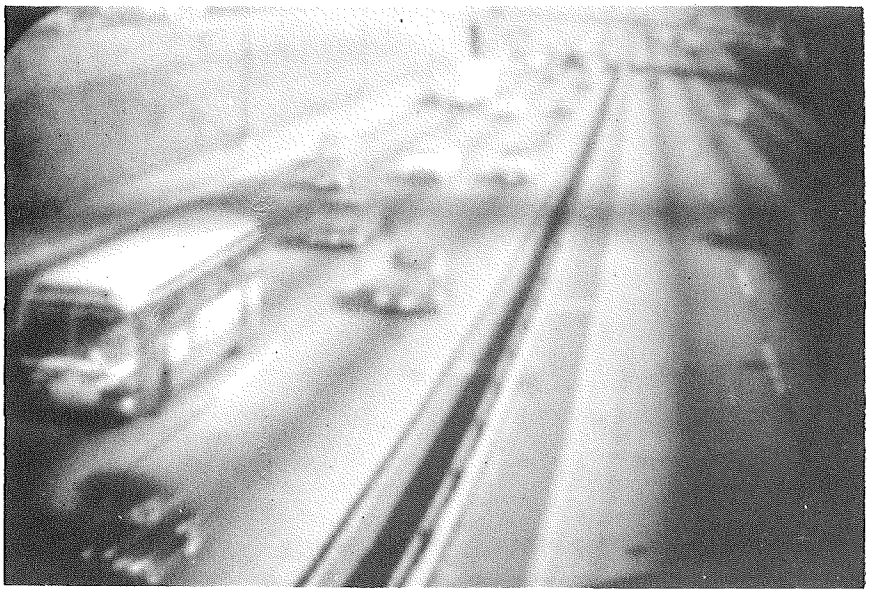


Figure 5 presents the traffic flow in the area viewed by the Clairmount camera. This covers a distance from 2115 to 2975 feet in advance of and approaching the accident vehicles on the shoulder. Pictures 1 to 5 were taken in rapid succession.

Figure 6 presents again the traffic flow in the area viewed by the Seward camera. This is the same location as Figure 3 and is immediately beyond the accident vehicles on the shoulder.



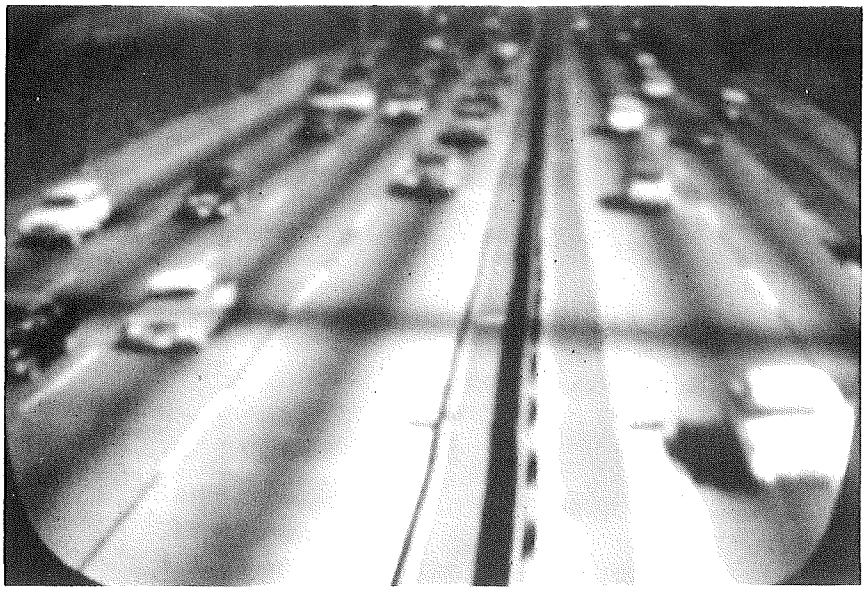
The second accident occurred a short time following the first incident. The photos here were taken after the vehicles of the first incident had left the shoulder. The second accident occurred in the area viewed by the Euclid camera. The accident occurred under the Gladstone Bridge in the southbound direction. Figure 7 presents the accident vehicles and the police on the shoulder. Note the difference in spacing of the vehicles in advance of and south of the location of the vehicles on the shoulder. The spacing of vehicles after they pass the vehicles has lengthened.

Figure 8 presents traffic flow in the area viewed from the Gladstone camera location and illustrates the congestion directly in advance of the vehicles on the shoulder.

Figure 9 presents the traffic flow in the area viewed from the Euclid camera immediately beyond the incident. This photo illustrates the traffic clearing after it has passed the incident and is proceeding in a free flowing condition as compared to the traffic in the rear portion of the picture adjacent to the incident.

Figure 10 presents the traffic flow in the area viewed from the Calvert camera covering a distance from 4200 feet to 5620 feet in advance of the incident. Note how the traffic congestion generated back one mile in advance of the incident.

Figure 11 presents traffic flow in the area viewed by the Euclid camera directly south of the incident. This is the same area as presented in figure 9.



In the two situations presented by these photos, the accident vehicles parked on the shoulder combined with the police vehicles as the officers were performing their functions, affected freeway traffic in such a way to cause traffic to back up bumper to bumper all the way to the Davison Freeway Interchange located $1\frac{1}{2}$ miles in advance of the incidents. For a majority of the time traffic congestion generated even beyond the Davison Interchange to the north.

Freeway traffic flow as illustrated by these photos is very sensitive to the type of incident presented here. Motorists automatically react to such situations and it is very interesting to observe that, compared to traffic approaching the incident, the motorists having passed the incident began to increase their spacing and speed.

Motorists reaction is a vital area for study in freeway traffic. The future research in this area will attempt to use this method of observing motorists reaction and to improve traffic in these situations by the use of the Signal Control System. Future studies for this purpose are planned.

Conclusion:

The photographic presentation of the effects of the incidents are presented in this report. The purpose of this report was to investigate the practicability of obtaining visual records of freeway traffic behavior by photographs directly off the TV monitors. The still photos included here left something to be desired and are not of the ultimate quality obtainable. This problem can be solved by the use of better photographic methods. Nonetheless, these pictures are sufficient to illustrate in a simple manner the effects of (1) the accident vehicle parked on the shoulder upon freeway traffic and motorist behavior and (2) the effectiveness of the lane signals in clearing blocked lanes. It also illustrates very pointedly the sensitivity of freeway traffic to incidents such as this under high volume conditions.

This initial effort to study such situations has proven the feasibility of using still and motion pictures as one of the tools to provide permanent visual records for research and study of freeway traffic characteristics and behavior.