

A VTR SYSTEM WHICH RECORDS ON-THE-SPOT ACCIDENT SCENES

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SUMMARY

The purpose of this research has been to evaluate a VTR system, which records the on-the-spot accident scenes in order to get information how and why traffic accidents occur. This report describes the details of the methodology, test site, instrumentation and recording procedures of this system and explains several examples of the accident caught by this system. The system has been set at an intersection of busy traffic where accidents occur frequently. Two TV cameras were mounted on a high pole built specially for this purpose. The intersection is lighted at nights. The television cameras view over the intersection and the traffic scene is recorded on VTR throughout day and night. But, the record is erased after every two hours except when an accident occurs. The traffic noise and the sound of the accident are recorded simultaneously. The co-ordinates of the intersection roads and the exact time are also recorded being overlapped on VTR.

We caught on-the-spot accident scenes three times in about four months. The records were very helpful for the accident investigation of the police. This system seems very useful for accident investigation and analysis though some revision are necessary.

1. INTRODUCTION

The accident of automobiles shows a trend of increase in recent years in Japan. Almost a half of automobile accidents, occur at the points of road intersections. With this in mind, the authors have tried to develop a VTR system by which automobile accidents can be recorded on the spot. At the same time, the author tried to collect basic data on traffic safety through the analytical study of recorded scenes in an attempt to pushing its utility. The authors set the VTR system at a road intersection located 1-chome, Shimoyama, Koga City, IBARAKI Prefecture near to our Institute where relatively many automobile accidents occurred in past years. The VTR system installed at this spot has been in operation since 1 July, 1971. Up to the date, three actual scenes of accidents have already been recorded by the system.

The authors' work attempted to record and analyze actual scenes of automobile accidents is believed to be a unique and the first program of this kind in Japan. The analyt-

ical work of traffic accidents is usually conducted after the accidents occurred. The recording by the VTR system before and after accidents in fairly accurate and clear and makes it easy to analyze the feature of accidents. Therefore, the movements of pedestrians and automobiles involved in accidents can be analyzed by the new system. Various data on collision (speed and collision form), extent of injuries of both occupants and pedestrians and the damage of vehicles can be obtained. Demonstrating real accident scenes recorded by the new VTR system, idea on traffic safety can be pushed forward among the people.

2. OUTLINE OF THE VTR SYSTEM

This VTR system is operated continuously for 24 hours by an automatic device. The diagram of the system is shown in Fig. 1. This VTR system provide two cameras, one recording road conditions and another recording background meshes. The scenes recorded by the two cameras are composed into one and recorded on a video tape. Therefore, we can confirm the time of accident occurrence and the speed of collision as well as its derrection.

- The system provide two recorders, each of which is able to be operated continuously for one hour and alternated each other automatically.

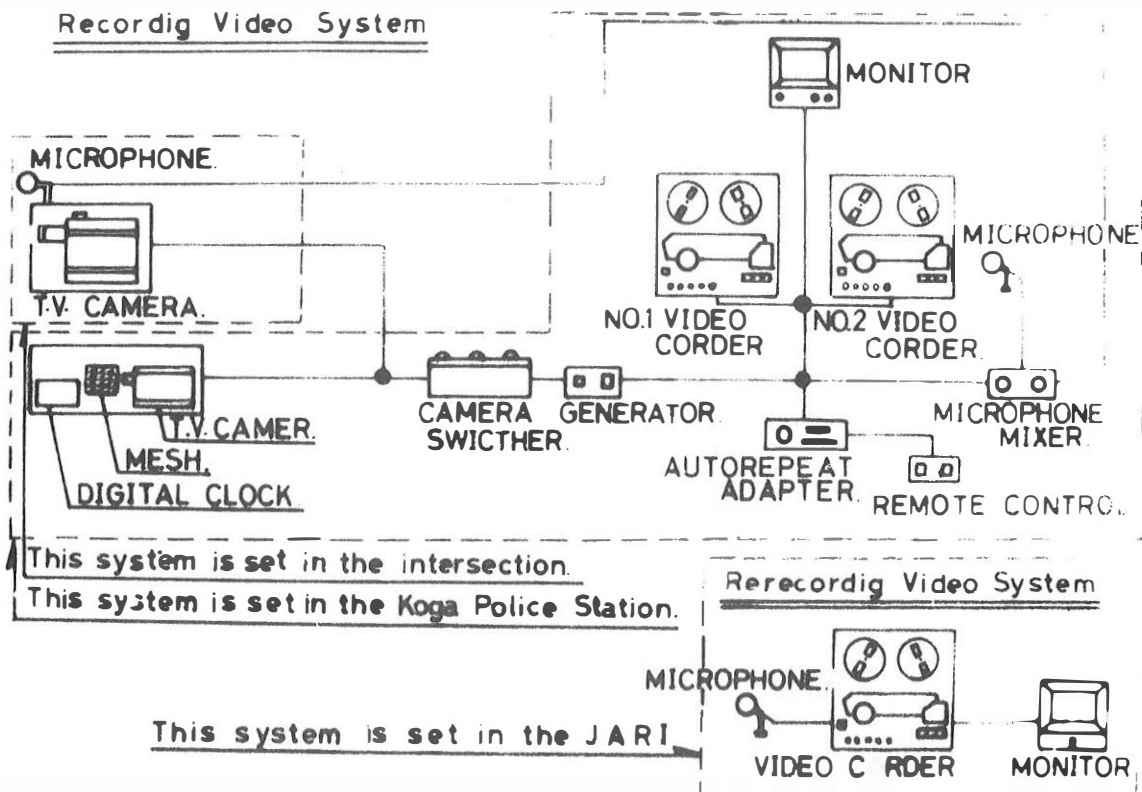


Fig.1- Construction of the VTR recordig system for traffic accidents on-the-spot.

- The record tape is wiped out in every two hours unless any accident is recorded.
- It records 60 scenes every a second.
- The recorders use a tape of one inch wide making it possible to record clear pictures.
- The television camera is set stop an iron pole as high as 19 meters. It monitors the seems around the intersection of roads by wide-angle lens with a focal distance of 8.5 mm.
- Mercury lamps (about 1000 w) are installed on 4 poles of as high as 11 meters. (Fig. 2 shows distribution of illumination) in order to record during night hours.

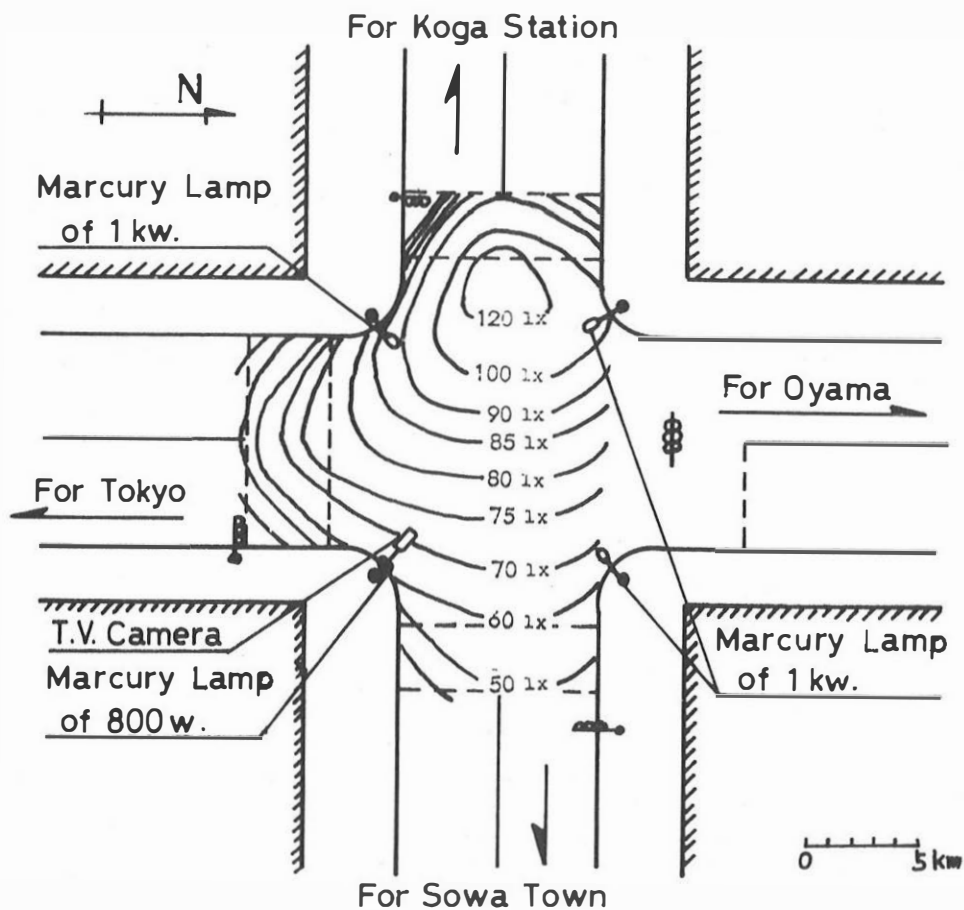


Fig.2- Distribution of illumination of lights at night in the intersection of road.

3. INSTALLATION OF THE VTR SYSTEM

Installation place of the system should meet the following conditions.

- (1) The place where many accidents are apt to occur and accident scenes can be caught by the camera.
- (2) The place where accidents of various types may occur including head-on collision, rear-end collision and accidents for pedestrian.
- (3) The place where TV cameras, microphons and lights can be set easily.
- (4) The place near to a police station and residents cooperating in operation of VTR system.
- (5) The place located in the vicinity of the Japan Automobile Research Institute, Inc.

At the state of planning, we selected the candidate locations as shown in Table 1 and finally decided to set the VTR system at an intersection of Koga City. Automobiles passing this intersection average 38,000 vehicles a day. The spot faces a main street in Kaga City and the width of both roads is about

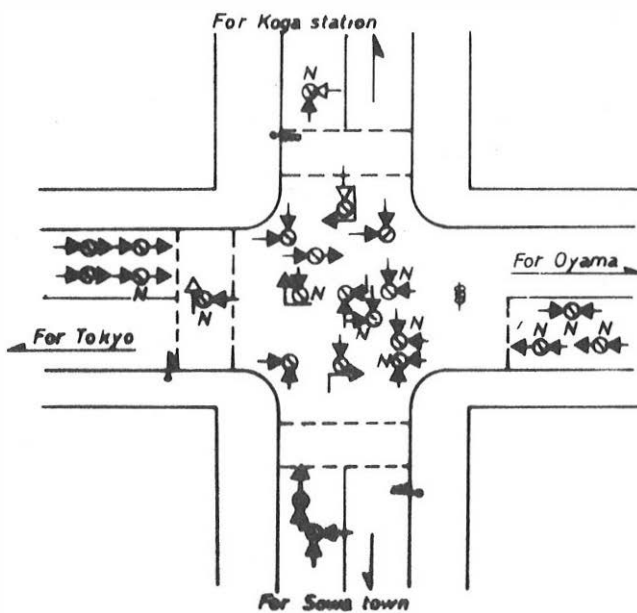
Table 1 The point of which accidents were occurred frequently

The name of the metropolis and districts	The name of the intersections	The name of the cities and wards	The number of occurrence	The dead	The serious wounded	The slight wounded
Fukuoka Pref.	Sekiya	Dazaifu Town	103	0	4	131
Accident occurred most frequently in Japan.						
The Tokyo Metropolis	Geto Bashi	Itabashi-ku	68	1	8	106
Accident occurred most frequently in Metropolis.						
The Tokyo Metropolis	Iwamoto	Chiyoda-ku	45	1	3	63
The Tokyo Metropolis	Shuda	Chiyoda-ku	34	0	6	54
Ibaraki Pref.	Ichimo	Katsuta City	44	1	12	55
Accident occurred most frequently in Ibaraki.						
Ibaraki Pref.	Inada	Katsuta City	30	1	9	47
Ibaraki Pref.	Shimoyama	Koga City	23	0	1	27

Note. From January to December 1969

ten meters. All accidents, which occurred at this intersection in 1969 and 1970 are shown in Fig. 3 and Fig. 4.

The number of accidents in 1970 increases by nearly 1.4 times as compared with that recorded in 1969. However, since the VTR system was installed in July, the number of accidents showed a marked decrease. Only 7 cases happened during a period from July to December. It can be concluded that the VTR system could serve in reducing automobile accidents.

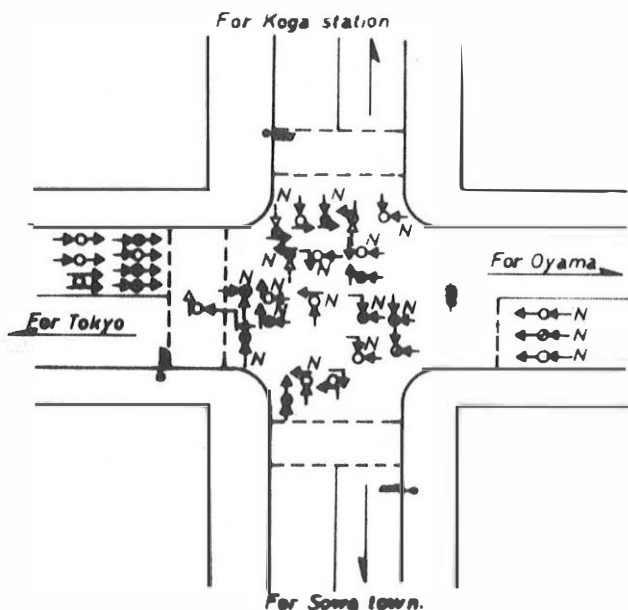


Number of occurrence	23
Accidents at the day-time	8
Accidents at the night-time	15
Bicycle accidents	1
The dead	0
The wounded	34

Explanation of mark

- :Fatal accidents
- :Accidents of the serious wound
- :Accidents of the slight wound
- :Accidents on damage of materials
- N:Accidents at night
- ←:vehicle
- ←:Motor cycle
- ←:Bicycle
- :Pedestrian

Fig. 4—The state of accident of Koga City intersection of 1969



Number of occurrence	32
Accidents at the day-time	14
Accidents at the night-time	18
Bicycle accidents	0
The dead	2
The wounded	27

Explanation of mark

- :Fatal accidents
- :Accidents of the serious wound
- :Accidents of the slight wound
- :Accidents on damage of materials
- N:Accidents at night
- ←:vehicle
- ←:Motor cycle
- ←:Bicycle
- :Pedestrian

Fig. 5— The state of accident of Koga City intersection of 1970

4. PROCEDURE OF SETTING THE VTR SYSTEM

- (1) The TV camera should be installed at the point above and near the center of an intersection. The reason is to measure exactly the velocity and direction of collision.
- (2) Camera with a wider view should be used to catch exactly the condition of before collision as well.
- (3) The system should be kept free from variations of temperature and humidity as well as rain. In this system the TV camera was set atop the pole of 20 meters high at the corner of intersection as shown in Fig. 5.

A wide-angle lens with a focal distance of 8.5 mm was used in the TV camera, in order to catch of scenes of as for wider as possible. In view of the fact that accidents happened frequently during night rather than day hours, three mercury lamps, each 1 km and two mercury lamps each 400 w were installed at four corners of the intersection. The strength of illumination was (50 - 120 Lx) on the surface of the intersection. (see Fig. 6)

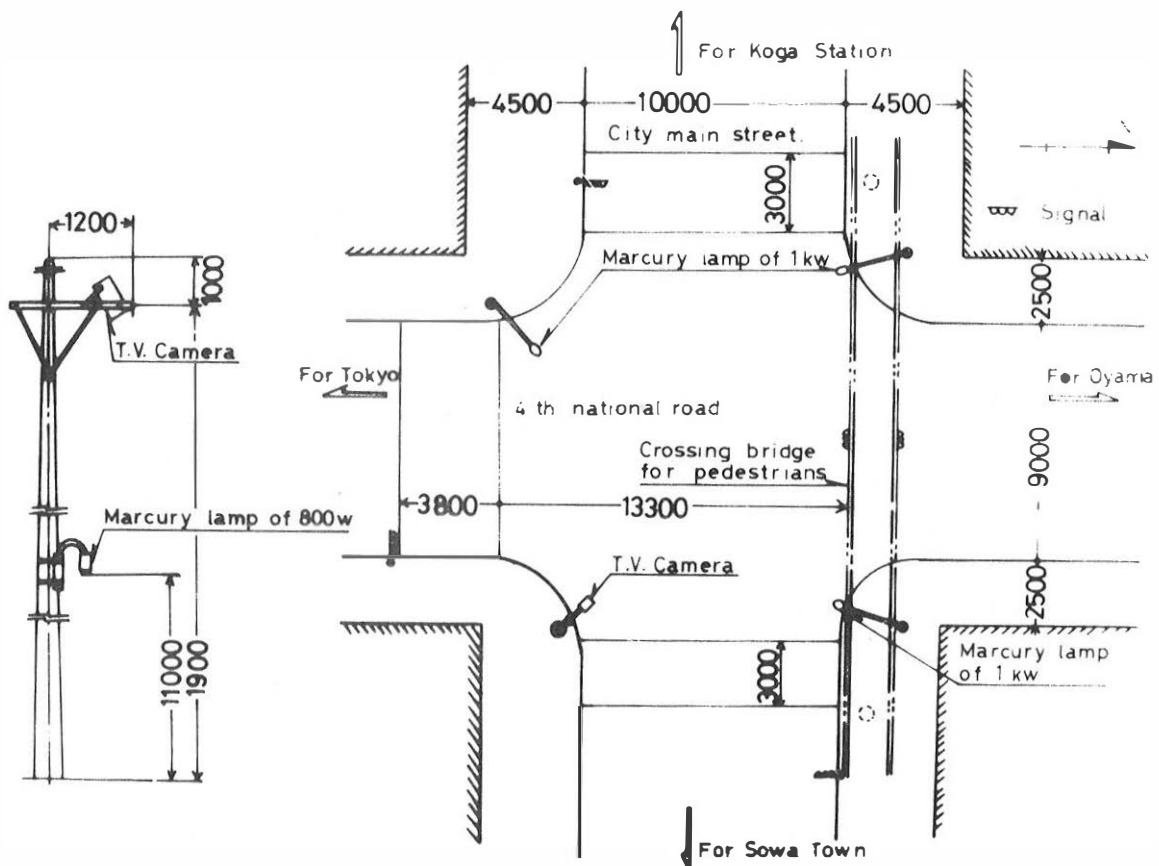


Fig. 5-Setting of TV camera for on-the-spot accidents.

As a result we could record accident scenes during night hours as well. The reflections were transmitted by wire to the Koga Police Station, which is located about 50 meters apart from the spot. The transmitted figures were recorded by the VTR system, which was installed in the building of the police station. (see Fig. 7)

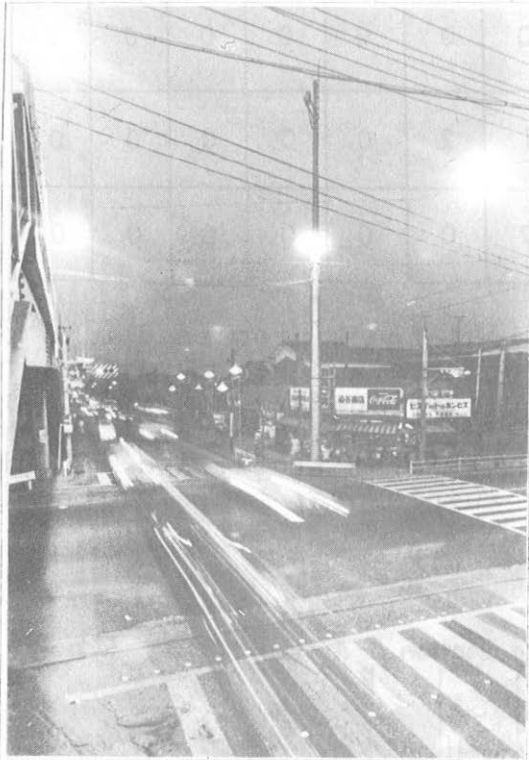


Fig. 6 - Night lights scene.

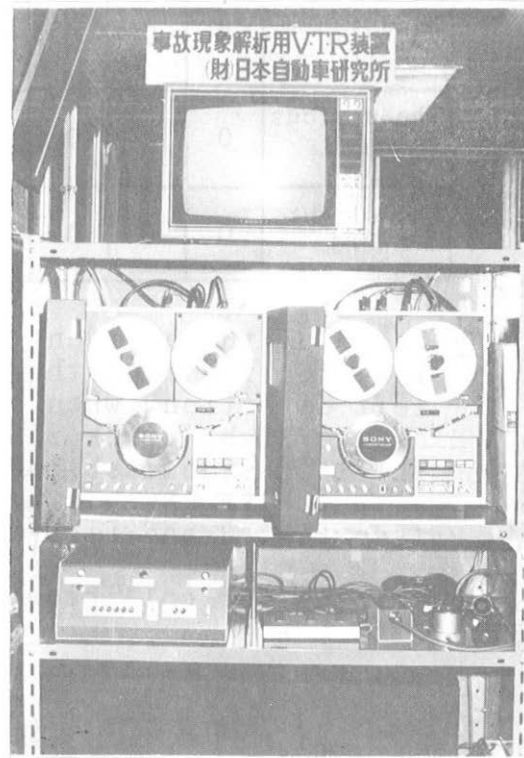


Fig. 7 - Set of VTR recorders.

5. THE STATE OF ACCIDENTS

In 1970, 32 accidents occurred, and 2 persons died in the accidents, which occurred at the intersection. This means that three accidents occurred every month on the average. Since the VTR system was installed at the intersection in 1971, number of accidents decreased to a half as shown in Table 2. Particularly, accidents during night hours decreased remarkably owing to the lighting set at the intersection.

6. EXPLANATION OF TRAFFIC ACCIDENTS RECORDED BY THE VTR SYSTEM

During an one-year period after the VTR system was set at this intersection, the number of automobile accidents there showed a marked decrease. Only three accidents scenes were recorded in the same period.

Example No. 1:

◦ Date: Saturday, 11 September, 1971, p.m. 1:32(JST)

Table 2 The state of accidents in Kaga City intersection after setting VTR recording system

Time State of accidents	1971						1972					
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Number of occurrence	2 (D:1) (N:1)	0	2 (D:1) (N:1)	1 (D:1)	3 (D:1) (N:2)	1 (N:1)	0	0	0	0	0	0
Dead	0	0	0	0	0	0	0	0	0	0	0	0
The serious wounded	0	0	0	0	1	2	0	0	0	0	0	0
The slight wounded	0	0	0	0	2	0	0	0	0	0	0	0

- State of the accident: A light truck proceeded into this intersection from the Koga Station and began to turn to the left direction, when a bicycle following on the left side of the light truck ran straight on without being aware of the left sideflash lamp of the light truck, and collided with the truck and then was turned over to the left side. (see Fig. 8 and Fig. 9)
- Velocity of collision: 12 km/h

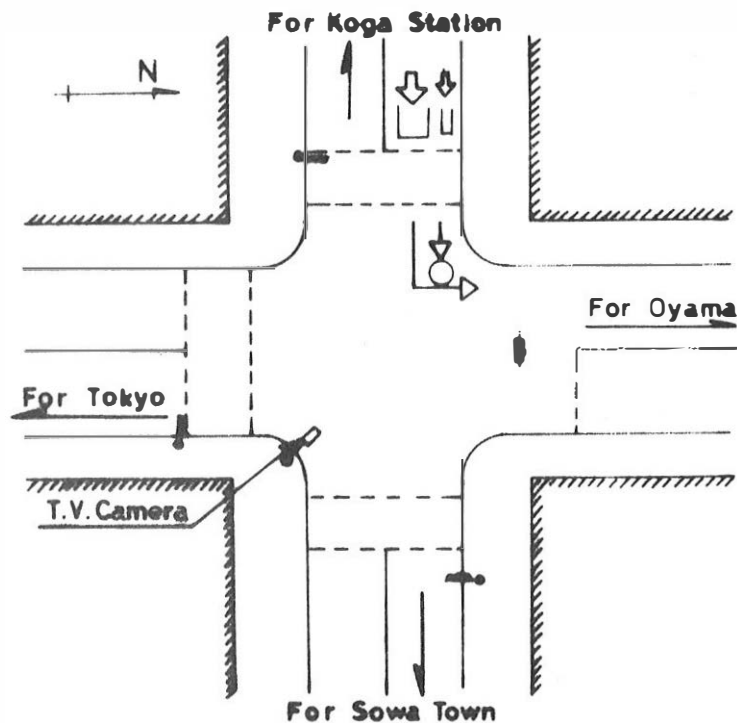


Fig. 8-A sketch of traffic accidents on-the-spot.

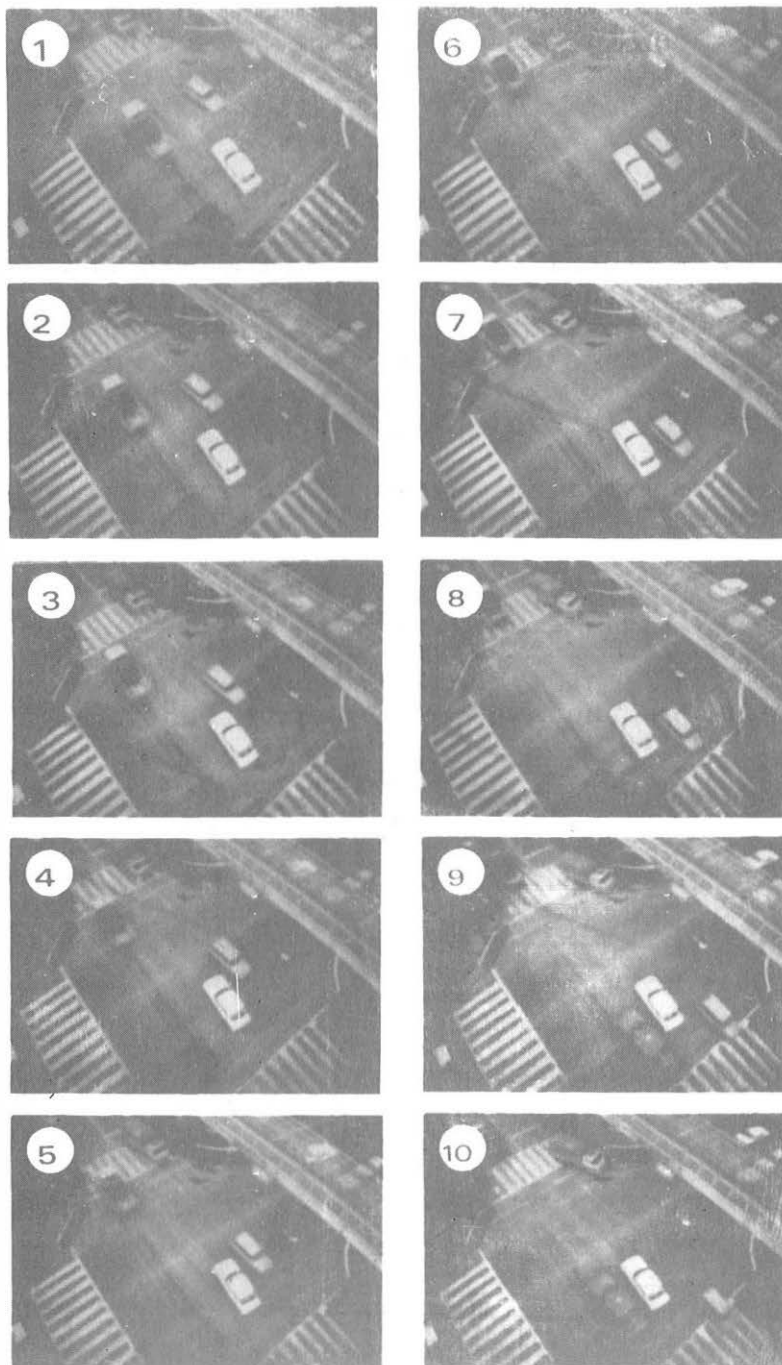


Fig. 9- Process of accident which was caught by video monitor (Interval 10/60 second).

- Grade of injury: A person who was riding on bicycle got a bruise on his left knee. (recovered completely after 3 days)
- Notes: We showed before him the accident scene recorded by this VTR system. He noticed that the cause was his carelessness and that the flash lamp equipped on the side of the light truck was signalling. It can be pointed out that this accident was such a type as might be prevented.

Example No. 2:

- Date: Saturday, 23 September, 1971, p.m. 9:02 (JST)
- State of accident: An intoxicated man was moving from the Sowa Town to the Koga Station by bicycle. After proceeding into this intersection, (see Fig. 10 and Fig. 11) he was turned over as riding bicycle.
- Velocity of bicycle: 27.2 km/h
- Grade of injury: He had an abrasion on his head. (completely recovered after one week)
- Notes: The driver of a taxi passing the intersection spotted a man falling down, and judged that it was a hit-and-run accident. The driver informed the Koga Police Station of this accident. The Police issued an emergency search instruction. However, the police confirmed after observing

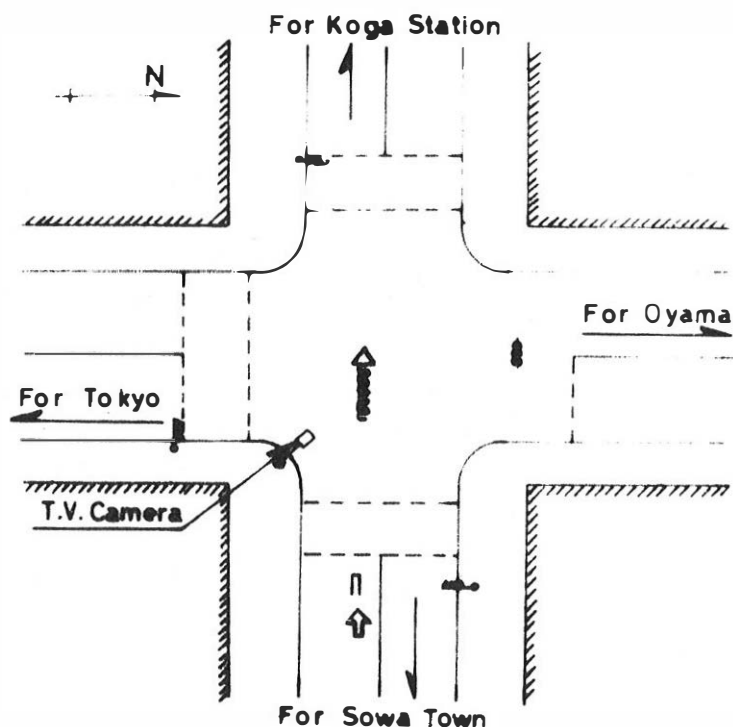


Fig.10- A sketch of traffic accidents on-the-spot.

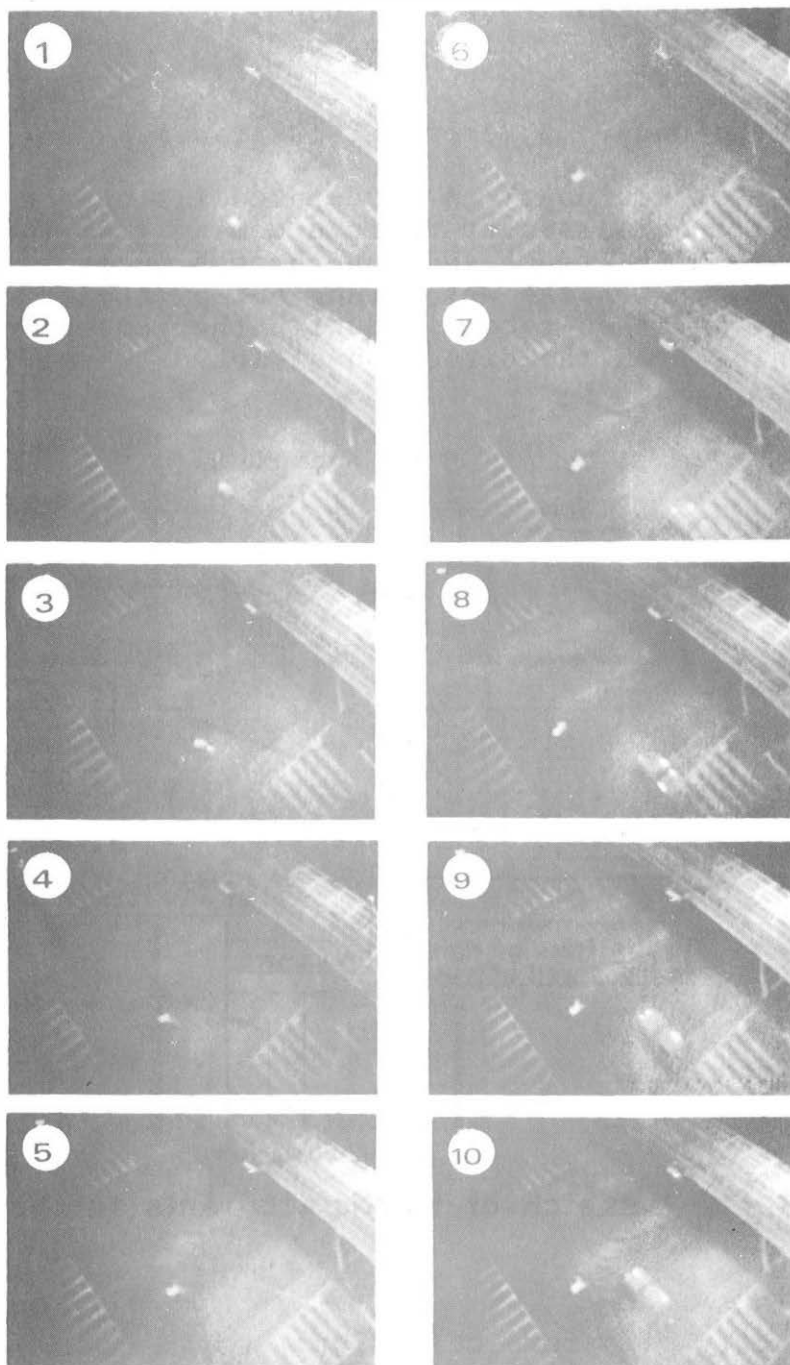


Fig.11- Process of accident which was caught by video monitor (Interval 10/60 second).

the video tape that it was a more single accident. Soon after, the police released the instruction. As the result, we were thanked by the Koga Police Station. It was made clear in the video tape that almost of the drivers passing near-by the fallen bicyclist run away because they might be involved in the suspects.

Example No. 3:

- Date: Sunday, 5 December, 1971, a.m. 2:42(JST)
- State of accident: A head-on collision occurred between a small type passenger vehicle coming from the Koga Station and an 8-ton truck running through Oyama toward Tokyo. The passenger vehicle was sprang out by the truck after collision, and then recollided with the another passenger vehicle running from the direction of Tokyo. (see Fig. 12 and Fig. 13)

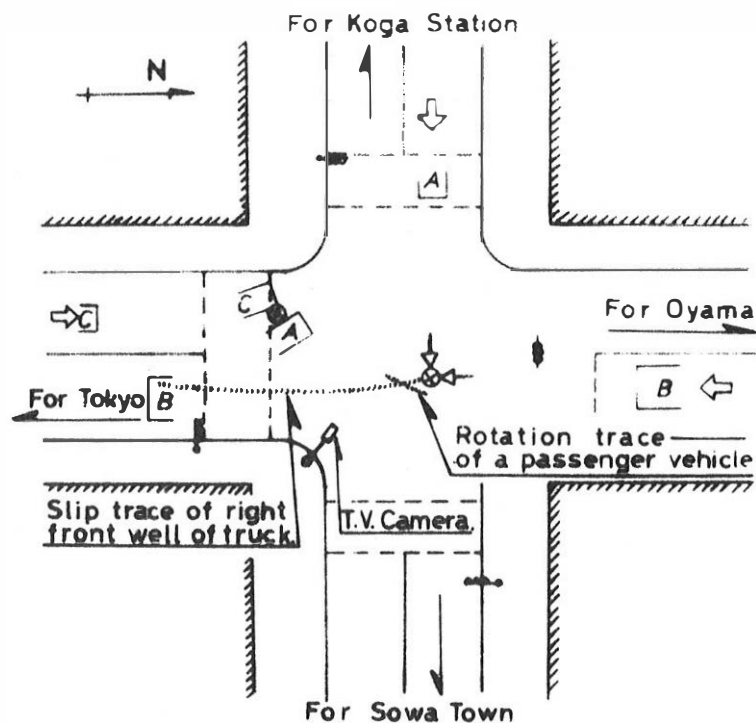


Fig.12-A sketch of traffic accidents on-the-spot.

- Velocity of before collision:
 - Passenger vehicle (A): 30 km/h
 - 8-ton truck (B): 57.6 km/h
- Damage of vehicles:
 - Passenger vehicle (A): Left fender, left door and front wind-shield glass were broken out. (see Fig. 14)

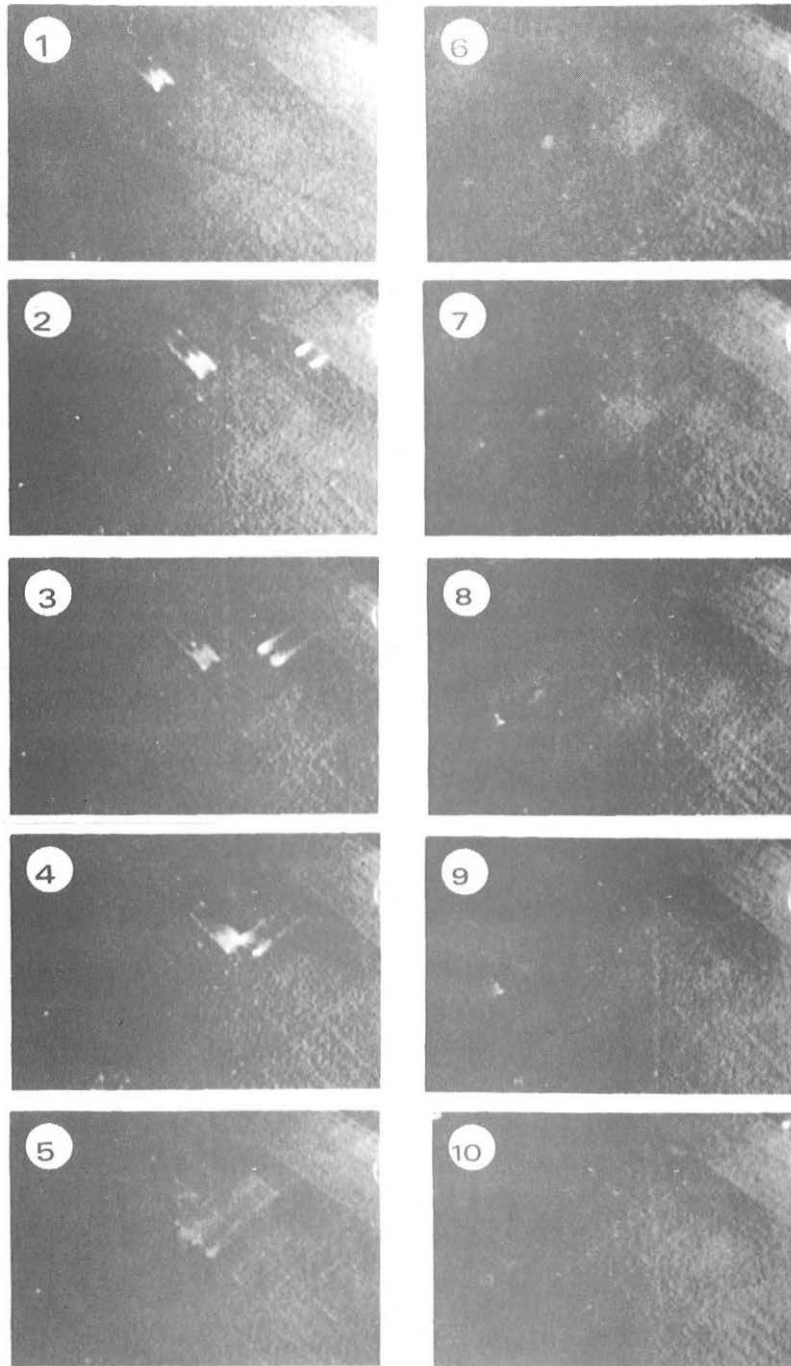


Fig.13- Process of accident which was caught by video monitor (Interval 10/60second).

8-ton truck (B): Half right of bumper was broken (see Fig. 15)

Another passenger vehicle (C): Right fender and right bumper were broken slightly. (see Fig. 16)

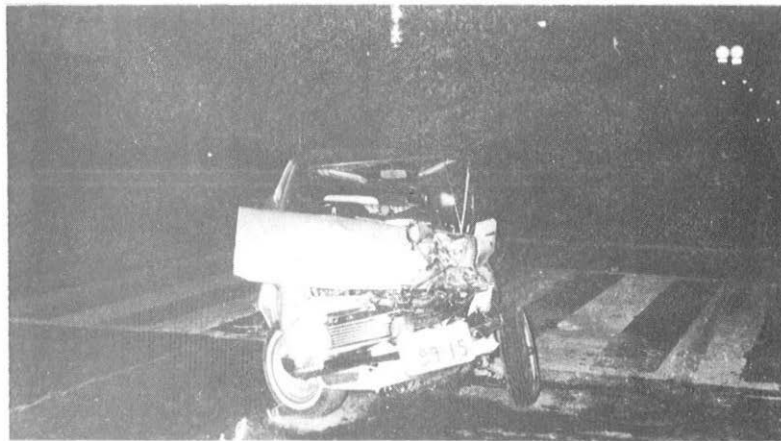


Fig. 14— Damaged appearance of a passenger vehicle



Fig. 15— Damaged appearance of 8-ton truck



Fig. 16— Damaged appearance of another passenger vehicle

- The state of vehicle occupants injury:
 - The driver of first motor car:
 - Severe injury (required 3 weeks to heal completely)
 - Face contusion (the forehead 5 needle stitching, the eye-brow 5 needle stitching)
 - Slight injury of the joint and palm of both hands the contusion and wound of the left knee joint.
 - The concussion of the brain
 - The other occupant in the driver compartment
 - Severe injury (required 3 weeks to heal completely)
 - The contusion of the back of the head (2 glass fragments of soy bean size were extracted from the wound, 2 needle stitching)
 - The contusion and light injury of the forehead, the right cheek and the chin
 - The contusion of the left arm (the traces of heavy hit)
 - The concussion of the brain
- Notes: Two person in a car were thrown out through a broken wind-shield. But, two doors of the driver's seat were kept as closed. The cause of this accident was the carelessness of the driver in a vehicle who disregared a traffic signal. This fact made clear by VTR system. However, the driver insisted persistently that he should stopped for a time in accordance with a red signal. This proves that accidents should be analyzed by a scientific method.

7. EFFECTS OF SETTING THE VTR RECORDING SYSTEM

The authors could confirm that the VTR recording system is a very effective system for analyzing automobile accidents, and also very effective for the police in inquiring into traffic accidents. The fact that the number of accidents decreased rapidly can be regarded an indirect effect. As less as 7 accidents happened from July to December in 1971. After we installed that system. Such a good result is mainly owing to an effective bright illumination set at the intersection. Moreover, the residents of Koga City who were aware of the VTR recording system through newspapers, contributed partly to the good result. Durinh six months from January to June in 1972, no accident was reported at this intersection. This main reasons are that the intersection was improved in January 1972, and on-the-spot accident scene (Example No. 3) was telebroadcasted over a national TV network. Under these circumstances many drivers are obliged to drive. It is concluded, therefore, that the VTR system (see Fig. 3) is very effective to decrease indirectly traffic accidents.

Table 3 Decrease of number of accidents

		Period	Number	Primary cause
Number of accidents before VTR system was set.		From January to June 1971	4/month	
Number of accidents after VTR system was set	The former term	From July to December 1971	1.1/month	<ul style="list-style-type: none"> ◦ light at night ◦ a part of users were known the VTR recording system was set in intersection
	The latter period	From January to June 1972	0	<ul style="list-style-type: none"> ◦ Improving of the intersection ◦ VTR recording system was telebroadcasted on a national network, so drivers put in motion more carefully on the intersection

8. CONCLUSION

In Japan, the authors have developed for the first time the VTR recording system by which traffic accidents can be recorded on the spot. The system seems to be the first trial in the world making it possible to operate continuously through day and night. The VTR recording system for traffic accident on-the-spot proved to be a very effective method to analyze traffic accidents. In directly, this system proved to offer an effective mean to the police for inquiry and analysis of automobile accidents and moreover to attract carefulness on the part of drivers.

The VTR system in use is very expensive, because we gave costed considerably since we tried to fabricate almost all possible functions into the system. It is proved, however that even the simplified system with minimum necessary function, capable of recording alone, will meet requirements in the general.

Through the fabrication and operation of the new system, the authors received hearty cooperation of the headquarters of Ibaraki Prefectural Police, Koga Police Station, Ministry of Construction, and other authorities concerned. In concluding this report, the authors express appreciation for Dr. M. Kondo, Executive Director of our JARI and many persons who cooperated with us.

9. REFERENCE

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