Closed Circuit Television System for Incident Identification and Verification: I-5, Seattle Freeway System

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CLOSED CIRCUIT TELEVISION SYSTEM FOR INCIDENT IDENTIFICATION AND VERIFICATION

I-5, Seattle Freeway System

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ABSTRACT

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INTRODUCTION

A freeway Surveillance, Control and Driver Information (SC&DI) system has been installed by the Washington State Department of Transportation for the Seattle metropolitan area. This system will eventually include the application of corridor management techniques for the limited access facilities in the seventy mile loop around and across Lake Washington. The first stage in this effort is the development of a management system for the 17 miles of Interstate 5 corridor through the Seattle CBD. Work on this I-5 portion has been segmented into a number of construction contracts. The closed circuit television system - south half was one of the first of these contracts completed.

THE ROLE OF CCTV

The closed circuit television system covers the sections of I-5 having the highest peak period volume levels. This section includes the length of the reversible center roadway and the connection of I-5 with two other major freeway routes, SR 520 and I-90.

The CCTV system will function as an incident identification and verification tool as a supplement to the electronics surveillance subsystem. Induction loop data monitored by the central computer will provide incident detection. Once the incident is detected system operators can visually scan the incident scene. This will allow operators to provide accurate information as to the nature of the incident, the need for service vehicles, and the need for changes in control strategy.

A secondary use of the visual coverage will be to provide accurate timely driver information. Incident information will be relayed to drivers over commercial AM radio stations to allow them to make intelligent judgements as to the best route to reach their destinations.

CCTV SYSTEM STATUS

The CCTV system expansion is being accomplished in two stages. The initial state of construction, which rebuilt the existing system south of the Roanoke Interchange and extended the system from Yesler Way to Spokane Street, is now complete. The second stage will upgrade and extend the system north of the Roanoke Interchange to N. 155th Street.

Since the electronic surveillance system and other SC&DI construction is not complete the CCTV system is being operated in only a limited capacity. The major operational emphasis currently is driver information. The system is monitored during commuter peak periods and traffic flow information is provided to local AM radio stations.

Detection of incidents is a secondary function to driver information. The system is configured with 16 cameras fed into two monitors. Operators must pan cameras to view some areas. The net result is that only a small percentage of the operators time is spent viewing a particular location and therefore the system is not highly effective as a means of detecting incidents. The system has been used to advantage, however, to verify incidents for the Washington State Patrol. The need for verification is greatest when multiple incidents occur in the same section and are reported by other sources. Video data can provide clarification of location and severity to aid in dispatching service vehicles more quickly.

CURRENT EQUIPMENT EVALUATIONS

As indicated earlier full operational assessments are not yet available. However, several problems have become apparent during construction and initial operation phases which may be important to other prospective users. These problems are in the areas of equipment performance and maintainability.

One major element to be "demonstrated" in the Seattle system was the use of the Newvicon image pickup tube. This tube was selected as an alternative to the videcon and silicon diode tubes. It is more "burn" resistant than the videcon and has lower "blooming" characteristics than the silicon diode tubes. This later advantage may now be negated by some of the newer low bloom silicon tubes. Functionally we have found the Newvicon tube to be a practical application for highway surveillance. The combination of the camera and tube produce a noticeable improvement in operation at lower ambient light levels without unacceptable blooming.

During the installation period it did become apparent that the tube as a production item would not meet the manufacturers' own written specifications. The manufacturers specifications indicated 800 lines of resolution. In practice it appeared that production models, even on a hand selected basis, could only produce up to 750 lines and that a more reasonable expectancy was 500 lines of center resolution. This conclusion is based upon a testing of a limited sample by the Department and statements made by the camera manufacturers. Also, it is difficult to isolate camera performance from tube performance since the apparent lack of resolution could have been attributed in part to the camera electronics. Camera manufacturers have since downgraded their specifications in cameras utilizing the Newvicon.

The cameras utilized in the system are the RCA TC1005N. The Department is experiencing some problems with the maintenance and adjustment of these cameras. The problems are due to the lack of specific maintenance information on the camera electronics. At the time of the camera purchase maintenance manuals were unavailable from the manufacturer because of recent changes to the electronics by the manufacturer. By the time the manuals were produced some eight months later, additional changes had been made beyond changes made in cameras delivered to the Department. The net result was that neither the "old" service manuals nor the "new" service manuals apply totally to the cameras as delivered.

This obviously makes camera adjustment very difficult and may result in problems of poor camera performance.

The poor camera performance takes the form of failure to properly compensate for changes in field lighting conditions. Since in Newvicon applications the video level is sensed as a measure of light to the camera, failure to compensate properly causes resolution to drop as well as the general scene not having proper contrast. Since the cameras functioned adequately in a test environment, as required by the contract, the conclusions reached to date are that either: (1) camera adjustment is a problem; or (2) camera electronics are not capable of compensating for field conditions which are different from test conditions.

The following points are suggested to avoid the problems on future contracts.

1. Manufacturers specifications should not be used in specifying closed circuit television equipment. Contracts should include specific tests to be performed by the contractor with the criteria for acceptance or rejection clearly defined.

2. Training should be require to be supplied by the contractor for the field maintenance of the equipment. This training should be conducted by the manufacturer of the camera equipment and geared to the knowledge level of the technicians and the complexity of the work to be performed. For example, this training could be from as simple as field adjustment or maintenance of the cameras up to discreet component rebuilding depending on the skill level of the technicians.

3. Maintenance manuals required to be supplied by the manufacturer should be examined by the contractor to assure that when step by step procedures are followed the appropriate results are produced.

OPERATIONAL EVALUATION

The "Current Equipment Evaluations" section emphasized the negative aspects of the system with the intent of advising others considering installations of this type of some potential problems. These comments should in no way be taken to indicate that the Seattle system is not functioning will nor that failure are at an intolerable level.

The closed circuit television system is functioning well to meet the needs for visual surveillance. The image quality during twilight hours has been improved significantly and the 10:1 zoom lenses appear to be a worthwhile investment. The rate of failure of equipment components is at about the level expected for a new system of this type. The primary source of failure has been line amplifiers in the wide band RF transmission system and the television camera units. Maintenance data over the next one year will be a good indicator of on-going maintenance costs.

CONCLUSIONS

The following conclusions have been reached regarding the installation and operation of the closed circuit television system.

1. The system provides a viable means of verifying incidents for law enforcement officials.

2. The system provides clarification on the location and severity of the incident to aid in dispatching service vehicles in a timely manner.

3. The system operates with the normal amount of equipment failures for the type of technology employed.

4. The Newvicon tube is provide a noticeable improvement in operation at lower ambient light levels.