

### **3. TEST SESSIONS**

#### **3.1 OVERVIEW OF TEST PROCEDURES**

Each test was conducted using the following basic steps:

1. Camera/video installation,
  2. AVC equipment installation,
  3. AVC equipment start-up,
  4. Video start-up,
  5. Monitor video and AVC equipment, and record weather conditions,
  6. Test shut-down,
- and
7. Remove and store AVC equipment.

Camera and video installation involved placement of the video cameras and recorders for traffic stream video and lane-change monitoring. The traffic stream camera (pole camera) was mounted in a metal box at the top of a utility pole near the mobile office. It was angled to monitor the traffic stream in a test area marked with a 40 foot long test area. The video output was connected to a VCR in the mobile office for recording the video. The camera was set to display time and date on the video output. Standard speed recording was used for the detailed (48-hour) test periods and extended play recording speed was used for the long term (7-day) test.

The lane-change monitoring camera was mounted in a modified traffic control box located on the overpass at the end of the test area. It was angled to look directly between the two westbound lanes and covering the entire test area. The video output was connected to a VCR in a traffic control cabinet at the end of the overpass. This camera did not have the capability to display time and date, so a time/date generator was installed between the camera and the VCR. In this manner, the video was time stamped for use in the data reduction. Extended play recording speed was used for all tests.

The AVC equipment installation involved the placement of each of the classifiers in the appropriate traffic control box, connection of sensor leads, and check-out of operation. Some of the classifiers required the use of a personal computer (PC) in order to record detailed vehicle-by-vehicle information. Others required occasional downloads of information to a PC during the tests to avoid overflowing the internal memory of the classifiers. The PCs needed by vendors were connected to the classifiers during the equipment installation. The following is a list of the classifiers which required connection to a PC during the detailed testing sessions:

Mikros Systems TEL-2CM -

Connected to a PC running a monitoring program provided with the classifier. The monitoring program logged the vehicle-by-vehicle information and stored it on the PC's hard disk.

- Peek Traffic TraficOMP III - The vendor supplied a modified instruction set on an EPROM which transmitted the vehicle-by-vehicle data (the screen display) to a serial port on the unit. The serial port was connected to a portable PC running a terminal emulator program. Data was stored by using the logging capability of the terminal emulator.
- PAT Equipment AVC-100 - One of the PAT units (PAT 2) did not have the internal memory to store the vehicle-by-vehicle data. This unit was connected to a PC running a monitoring program supplied by the vendor. The program stored the data using a logging function.

The following is a list of the classifiers which, due to memory limitations, had to have data downloaded to a PC during the detailed testing sessions:

- Peek GK-6000,
- Electronic Control Measure HESTIA,
- International Road Dynamics TC/C 530-4D/4P/4L,
- Golden River Traffic Marksman 660, and
- Diamond Traffic Products TT-2001.

The remaining classifiers had sufficient internal memory to store the vehicle-by-vehicle data for the entire 48 hours of the detailed testing sessions.

Once the equipment was installed and checked out, the AVC equipment was turned on and recording of the traffic begun. The internal clocks of the classifiers and the video recorders were then synchronized. Each classifier was checked to ensure proper operation.

The video recorders for the lane-change camera and the pole camera were started once all the classifiers were operational. The starting of both cameras marked the official start of the test.

The test site was manned continually during the detailed (48-hour) testing periods. The person manning the site changed the video tapes as needed, and downloaded the data from the classifiers which required storage on the PC to avoid overflowing the internal memory of the classifier. During the first 48-hour test, the air and pavement temperature were measured manually, and the precipitation and wet/dry pavement conditions observed

on a 15-minute interval. During the second 48-hour test, the temperatures and rainfall amounts were recorded using a PC interfaced to temperature sensors and a rain gauge.

At the end of the first 48-hour test, the classifiers, computers and video equipment were stopped. Data was downloaded from the classifiers using a PC if needed and the power was turned off to the equipment. All of the equipment was removed and returned to storage where batteries were connected to chargers as needed.

At the end of the second 48-hour test, the classifiers were reconfigured to record binned data on 15 minute intervals for the long-term (7-day test). The pole camera video recorder was also switched to the extended play recording speed. The first two days of the 7-day test were the same two days used for the second 48-hour test, and the remaining 5 days were those immediately following the detailed test. The site was not continually manned during the remaining five days of the 7-day test. Every approximately 5.5 hours, the video tapes for the pole and lane-change cameras were changed. Temperature and rainfall monitoring continued for the five days as well.

## **3.2 DETAILS OF INDIVIDUAL TESTS**

### **3.2.1 First 48-Hour Detailed Test**

#### **3.2.1.1 Test Date and Conditions**

The first detailed test session was conducted May 5 - 7, 1993. The air temperature during the test ranged from 55 degrees F to 86 degrees F. The pavement temperature ranged from 63 degrees F to 118 degrees F. The weather was sunny and clear and there was no precipitation during the test. This test was intended to be conducted under good weather conditions as the a baseline for the remaining tests.

The traffic during the test was typical weekday traffic for the site. There was no traffic congestion during the test and the average speed of traffic was typically near 65 MPH. The average daily traffic (ADT) in the test lane (as determined from the video data reduction) was approximately 9700 vehicles.

#### **3.2.1.2 Participating Vendors**

The vendors and classifiers that participated in the first 48-hour test included all of those listed in Table I except the Golden River Traffic Marksman 660. The Golden River equipment was sent back to the vendor for repair and was not returned in time to be included in this test. The Mitron Systems TEL-2CM was included in this detailed test, but the Mitron equipment provided binned data rather than vehicle-by-vehicle output. All of the remaining equipment either recorded individual vehicle records internally or were capable of transmitting these records to a PC for storage.

### 3.2.1.3 Problems and Exceptions to Test Procedures

There were no significant problems with the test equipment encountered during the first test. The air and pavement temperatures were recorded manually every 15 minutes using a thermocouple and hand-held meter.

The problems experienced with the participating vendor's equipment during the first 48-hour test are as follows:

- Mikros Systems TEL-2CM - This systems had a software bug in the TELCOM software used to download data to the PC. The download utility skipped the data stored in certain portions of the classifier memory when downloading to the PC. This resulted in gaps averaging one gap every 2 hours that ranged in time from 16 minutes to over 2 hours. This problem was fixed after this test with a TELCOM software upgrade from the vendor.
- Peek TrafiCOMP III - Twice during the test, the classifier's processor halted and the equipment stopped classifying vehicles. The gaps totalled about 3 hours and 26 minutes. To restart the processor, the cover of the unit had to be removed and the processor reset.
- Peek GK-6000 - This classifier required periodic downloads to a PC to store data. During these downloads, the classifier didn't record traffic data. The downloads took generally greater than 15 minutes.
- Electronic Control Measure HESTIA - New PC software received from the vendor prior to the first 48-hour test was incompatible with the firmware installed in the classifier. The classifier could not be set up at the beginning of the test with the new software. The vendor sent the old software by express courier and the classifier was started approximately a day late. The system also locked up once during the test and lost about 8 hours of data. A full reset was required to restart the equipment.
- TimeMark Delta II - A 1 MB memory card installed in the classifier was not recognized by the unit. The unit continued to classifier until the internal memory was full and then stopped recording vehicles. The result was that the final 18 hours of the first test were not recorded by the unit.
- International Road Dynamics TC/C 530-4D/4P/4L - The processor in the classifier seemed to lock up occasionally. Some time the unit returned to normal operation on its own, but other times the unit had to be stopped and restarted in order to correct the problem. The data showed gaps in the lane 1 record only corresponding to these down times. The vendor updated the firmware (ROMs) in the unit after this test to correct the problem.

- Diamond Traffic Products TT-2001 - The memory in this unit filled more quickly than expected in the early part of this test. Approximately 24 minutes of data collection was lost when the memory filled up before it could be downloaded to a PC. The download cycle was shortened from 4 to 3 hours to avoid this problem for the rest of the test.

### **3.2.2 Second 48-Hour Detailed Test**

#### **3.2.2.1 Test Date and Conditions**

The second 48-hour test was conducted September 9 - 11, 1993. The air temperature during the test ranged from 62 degrees F to 84 degrees F. The pavement temperature ranged from 61 degrees F to 110 degrees F. The weather was partly cloudy and there was no precipitation during the test. This test was scheduled in the hopes of rainfall, but the only rain was a brief sprinkle which did not register on the rain gauge or significantly moisten the pavement.

The traffic during the test was typical weekday traffic for the site. There was no traffic congestion during the test and the average speed of traffic was typically near 65 MPH. The ADT in the test lane (as determined from the video data reduction) was approximately 10,600 vehicles. The ADT was higher during second 48-hour test because it was near the Labor Day holiday.

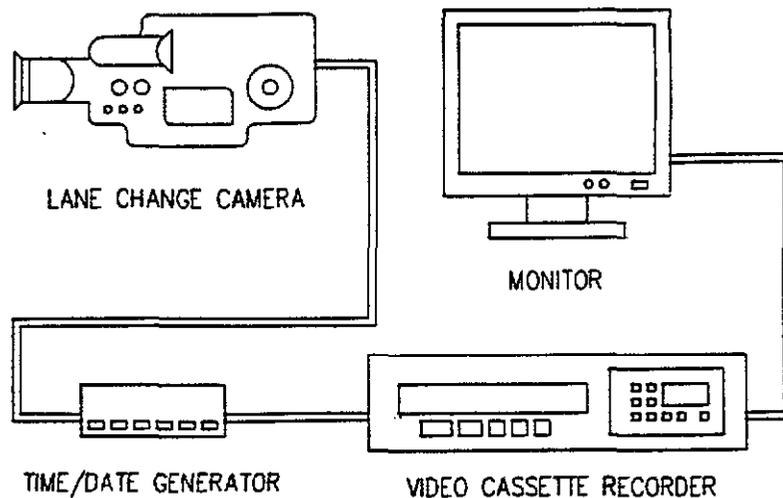
#### **3.2.2.2 Participating Vendors**

All of the classification equipment listed in Table I was included in the second 48-hour test except the Mitron Systems MSC-3000. Failures in the piezoelectric sensors used by the Mitron classifier resulting in the vendor electing to withdraw from the remaining tests. The Golden River Traffic Marksman 660 was repaired and participated in this test. The Diamond Traffic Products TT-2001 received a software upgrade (new ROMs) between the first and the second tests. The upgrade had a bug in the data recording algorithm which resulted in errors in the data file stored by the unit. All of the remaining classifiers were operated in the same way as they did in the first 48-hour test.

The augmented road tube test was conducted in parallel with the second 48-hour test. Two road tubes were installed across the outside lane of the highway and two were installed across both lanes of the highway. The classifier used for this test was a Peek TraficOMP III (Peek 241) supplied by the Georgia DOT. The intent of the test was to determine how accurately the road tubes could monitor traffic in multiple lanes, particularly in heavy traffic.

#### **3.2.2.3 Problems and Exceptions to Test Procedures**

During the second 48-hour test, the main problem was an incorrect configuration of the lane-change camera and recorder. The camera used for recording lane changes did not



**Figure 21. Correct Configuration of the Lane-Change Camera, Time/Date Generator and VCR**

have the capability to imprint time and date on the video. A time/date generator was added in the line between the camera and the VCR to add the time and date to the video image before being recorded. This configuration is shown in Figure 21. During the second test, the VCR and time/date generator were accidentally swapped in the configuration. Thus the time and date was displayed on the local monitor during the test, but was not recorded by the VCR for use during data reduction. Careful use of the VCR's tape time counter and manual time synchronization with the pole camera was required to match vehicles that change lanes with the appropriate vehicles in the ground truth data. This problem did not affect the results of the test.

The road tube test appeared during testing to be working properly. During data reduction, however, it was found that the classifier had been set up to sum the traffic in both lanes and not record the traffic counts in individual lanes. This would have made it very difficult to separate the traffic to determine errors in the count due to 2 or more vehicle in different lanes passing over the sensors at the same time. The data is still being reviewed, but the initial assessment indicates that the test will need to be repeated in order to obtain accurate data. Currently, the plans are to repeat the test in parallel with a follow-on test. The results will likely be available for the final version of this report.

The problems experienced with the participating vendor's equipment during the second 48-hour test are as follows:

- **Peek GK-6000** - This classifier required periodic downloads to a PC to store data. During these downloads, the classifier didn't record traffic data. The

downloads took generally greater than 15 minutes. The data also inexplicably ended in one file 6 hours before the end of one of the downloaded files.

- PAT Equipment Corporation AVC-100 (P-L-P) - This classifier appeared to operate correctly most of the time during the test, but the reporting software required to convert the binary data files into readable text files could not convert the data files. The problem is still under discussion with the vendor. The classifier also appeared to be having classification problems a couple of times. These were checked out using the other AVC-100.
- PAT Equipment Corporation AVC-100 (L-P-L) - Two small gaps (less than 15 minutes) occurred when the equipment was intentionally disconnected to check out an apparent problem with the other AVC-100.
- Diamond Traffic Products TT-2001 - The last 16 hours of data were lost when the internal battery in the classifier malfunctioned. The unit would not operate even when the charger was connected to the unit. An external battery was used during the remaining 5 days of the 7-day test.

### 3.2.3 Seven-Day Test

#### 3.2.3.1 Test Date and Conditions

The 7-day test was conducted September 9 - 16, 1993 in conjunction with the second 48-hour test. The air temperature during the test ranged from 50 degrees F to 86 degrees F. The pavement temperature ranged from 61 degrees F to 117 degrees F. The weather was partly cloudy and there was no precipitation during the test. Like the second 48-hour test, this test was scheduled in the hopes of rainfall, but the only rain was a brief sprinkle which did not register on the rain gauge or significantly moisten the pavement.

The traffic during the test was typical traffic for the site. There was no traffic congestion during the test and the average speed of traffic was typically near 65 MPH. The average daily traffic in the test lane (as determined from the video data reduction) was approximately 10,100 vehicles.

#### 3.2.3.2 Participating Vendors

The participating vendors for the 7-day test are the same as those for the second 48-hour test. The road tubes used for the augmented tube test did not last the entire 7 days, but did last through one full day of the detailed recording period (48-hour test).

#### 3.2.3.3 Problems and Exceptions to Test Procedures

No notable problems with the test procedure occurred during the remaining 5 days

of the 7-day test (after the second 48-hour test). The classifiers were converted to a binning mode (rather than vehicle-by-vehicle mode), and the pole and lane change video recorders were switched to the extended play recording speed (tape changes required every 6 hours).

The problems experienced with the participating vendor's equipment during the second 48-hour test are as follows:

- Mikros Systems TEL-2CM - Approximately 3 days of data was lost due to an error by the test personnel. The unit was not configured to record binned data after the 48-hour detailed test was complete causing the internal memory of the unit to fill up. This was not a problem with the classifier, but a setup error.
- Peek GK-6000 - Problems occurred while trying to set up the classifier to collect binned data. The vendor assisted in the conversion, but the classifier missed approximately 2 days of data collection. The unit also failed to record one 30 minute period at the end of one day.
- PAT Equipment Corporation AVC-100 (P-L-P) - This classifier appeared to operate correctly during the test, but the reporting software required to convert the binary data files into readable text files could not convert the data files. The problem is still under discussion with the vendor.
- TimeMark Delta II - Gaps in the classification data occurred during the periods of time when the data was being downloaded to a PC. These gaps were 20 and 11 minutes in length. Most of the last day of data was lost due to data being corrupted in the memory of the classifier. Attempts were made to recover the data by the vendor, but they were unsuccessful.
- Diamond Traffic Products TT-2001 - An external battery was required to operate the unit. The battery was installed approximately 8 hours after the start of the 5-day binning period.