TRAFFIC SURVEILLANCE SYSTEM: CCTV CAMERA IN KUWAIT
Catalogs:

- QuicNet/4 Closed Loop System

- SCOOT Adaptive System in Conjunction with QuicNet/4 in Implementation 2005 - 2006
**QuicNet/4** by BI Tran is a robust Advanced Traffic Management System (ATMS), which allows an entire traffic system to be monitored and optimized from a central site. Based on Windows NT™ 4.0, it operates in a multitasking, distributed network environment. It can simultaneously provide traffic engineering and maintenance personnel each with their own real-time graphical user interface.

**Compatibility**

Multiple communication channels simultaneously supports any brand of Model 170, 179, 2070 controllers as well as McCain’s 007 TS1 controller and family of Vector™ NEMA TS1/TS2 controllers. Supported also are other traffic devices with an RS-232 interface, such as changeable message signs and remotely controlled CCTV cameras. Communications can be via-dial up phone, direct-connect copper, fiber optics, spread spectrum radio, or microwave.

**Easy to Use**

A system-wide map displays the status of all traffic devices in real-time. To view an intersection, simply click on that intersection to bring up a window with the real-time intersection display. Select timing parameters, alarm history, operating history, detector counts, split monitor reports, and other information from pull-down menus. Intersection timing parameters or area-wide timing plans can be uploaded and downloaded. Map displays are easily created from any commercial map captured in BMP format.

**Scalable**

QuicNet/4 is economical with as few as 5 intersections by using a single server, and can be expanded to a practically unlimited number of intersections and field masters by adding workstations and communication servers. The QuicNet/4 system in Washington DC controls over 1,400 intersections.

**Field Proven**

There are currently over 150 QuicNet systems in operation, going back to the initial DOS version in 1987. The QuicNet/4 Windows NT version was introduced in 1997, and over 75 systems were in operation by the end of 1999. You cannot find a more proven or more robust traffic management system.
**BI Tran** is the world's leading provider of Model 170, 179 and 2070 traffic controller software, with an estimated 40,000 installed copies.

BI Tran has also distinguished itself by its ability to create custom ITS software for the 170 hardware platform, which can be easily integrated into QuicNet/4. As a result, the same QuicNet/4 system can perform central traffic control and ITS functions such as freeway ramp metering, reversible lane control, and incident management.

The applications below are but examples of BI Tran's ITS capabilities. Please contact BI Tran to discuss your specific requirements.

### Light Rail Priority

Trolleys, which share city streets, are detected by advance detectors. Time of arrival at each intersection is calculated by the 170 traffic controller using the detected speed and position data, and the phases are shortened or extended to assure that the proper phase is in place to let the trolley pass. Following passage, the 170 goes into a recovery mode to return to full coordination as rapidly as possible. BI Tran light rail priority systems are operating in six major U.S. cities.

### Priority Tied to Schedule

In this transit priority refinement, the ID number of individual transit vehicles (buses or light rail) is detected by transponder tags, and priority is only extended if the vehicle is behind schedule by more than a specified amount. Tying priority to schedule minimizes disturbance of normal coordinated traffic.

### Incident Management

The objectives are to detect incidents, notify the proper authorities, and post traffic advisory signs to minimize congestion. BI Trans has implemented a number of such systems using 170 controllers for incident detection, automatic pageing, and variable message sign control. One example is a system where an incident on surface streets surrounding a shopping mall causes variable message signs on an adjacent freeway to warn motorists and suggest an alternative offramp.

### Freeway Ramp Metering

The primary objective is to minimize stop-and-go traffic on freeways by breaking up arriving platoons and so that individual cars can blend in with traffic. BI Tran has installed custom ramp metering software in many states since 1985, and as a result of the knowledge gained has developed its own flexible traffic-responsive ramp metering software.

### Arterial Parallel to Freeway

In this application, incidents on a freeway can be detected by a QuicNet/4 system and cause a different coordinated timing plan to be implemented on an arterial adjacent to the freeway. This is made possible by the fact that the same QuicNet/4 system is used for ramp metering, and surface street traffic control.

### Transit Mall Master

In this application, a 170 master monitors the presence of a bus in each bay of a transit mall (or bus depot) and counts the buses preparing to exit using any of several corridors. This master then issues appropriate priority requests to the 170 controllers at each of the four intersections surrounding the transit mall, thereby assuring the orderly exit of buses.

### Tunnel Control

BI Tran has implemented tunnel management systems which include vehicle counting, incident detection, and reversible lane control. The latter allows either one of two bores to accommodate two-way traffic, so that the other bore can be closed for maintenance. The 170 controller used for tunnel control can also be used to activate signs and sound an alarm if an overweight vehicle is detected.

### HOV Lane Control

In this application, the direction of HOV travel is reversed under time-of-day programming, and lane usage is controlled by warning signs, traffic signals and swing gates which physically block access. These traffic devices are driven by 170 controllers, which receive their instructions from a 170 field master that is part of a QuicNet system.

### Reversible Lane Control

Travel on reversible lanes is controlled by red X, yellow X or green arrow signals hung from gantries, as well as by other traffic signs, such as turning restrictions. BI Tran has reversible lane control systems in operation in multiple states, using a 170 controller for each gantry. The software assures proper rippling for the change of direction process, and incorporates a conflict monitor matrix to prevent unsafe programming.

### Bridge Control

BI Tran has implemented drawbridge control systems, which begin with warnings, control traffic signs and signals from the outside in toward the bridge, then close the entrance gate to the bridge, and finally close the exit gate as the bridge is about to open. Once the bridge has closed again, the process is sequenced in reverse.

### Weigh Station Access

The objective is to avoid the possibility that long queues of backed up trucks at a weigh station spill over onto the freeway. Vehicle occupancy along various points of the weigh station offramp is detected, and if the queue is too long, warning signs and traffic signals are used to cause trucks to bypass the weigh station.

### Arterials Parallel to Each Other

Parallel arterials constitute a small grid, and the QuicNet/4 system can easily set up coordination on such arterials with an offset to assure progression on cross streets. In fact, the same QuicNet/4 system can handle CBD grids, outlying arterials, dial-up closed loops and direct-connect distributed processing.
SCOOT  Adaptive Traffic Control
**SCOOT • Advanced Adaptive Traffic Control in Real-Time**

Peek Traffic is a worldwide supplier of advanced traffic products and traffic management systems with operations based in the United Kingdom, Holland, Scandinavia, Germany and the USA. Peek Traffic designs and manufactures computer based equipment and systems offering technically innovative solutions to today’s traffic engineering problems. These solutions provide readily definable benefits which include direct cost savings with a high rate of return on investment, increased road safety, improved amenity and greater efficiency with minimal intrusion into the environment. Improved flow of commercial and industrial traffic cuts congestion costs, reduces pollution and contributes to the national economy.

**SCOOT Split, Cycle-time and Offset Optimisation Technique**

SCOOT is the world’s most advanced real-time adaptive urban traffic control system. With traffic authorities in Europe, North America, South America, Africa, the Middle East and Asia, SCOOT is in constant control. It provides economic and environmental benefits by improving vehicle journey times and reducing the numbers of stops and delays when compared with the best fixed-time plan UTC (Urban Traffic Control) systems. SCOOT adapts continuously to traffic conditions in real-time therefore there is no need to carry out periodic surveys to update signal timing plans.

SCOOT, implemented as an algorithm, is supplied by Peek either as a complete stand-alone UTC system or as an addition to existing UTC hardware and software. As a stand-alone system SCOOT UTC can be a centralised, integrated implementation or can operate as cells in a distributed networked system. As an addition to an existing UTC system SCOOT is provided with hardware compatible to the existing system architecture. Peek provides the wide range of skills necessary for full turnkey implementation of SCOOT UTC systems.

A number of rigorous independent trials assessing the benefits of implementing SCOOT have been carried out. These show that SCOOT can reduce delay by up to 32% over isolated junction control and up to 20% over fixed-time plan control with fuel saving benefits of up to 10% over isolated junction control.
Features

- Proven performance in over 50 cities throughout the world
- Easy to set up and adjust without the need for complex traffic or congestion monitoring
- An adaptive system which optimises signal timings in real-time with strategies for congestion management
- Fully responsive to all variations in traffic flow conditions
- SCOOT can be added to existing UTC system infrastructures
- Developed through long-term collaboration between government and industry
- Implemented with a range of detector technologies with tolerance of detector malfunction
- Small incremental changes are applied to signal timings in response to variations in traffic flow

Benefits

- Can be applied to new sites with confidence
- Simple and cost effective to operate
- Improved journey times with fewer stops and delays and reduced fuel consumption in comparison to the best fixed-time plan systems
- Removes the need to generate or update fixed-time plans
- Eliminates high cost system upgrades or replacements
- Continued programme of enhancement and support
- Maintains improved performance over fixed-time plans even in adverse operational conditions
- No sudden or large alterations of signal timings to disrupt traffic flow

Implementation

Peek implements a stand-alone SCOOT system as part of a general purpose UTC package. This comprises operator interfaces, central computing equipment, data transmission instation and outstations and traffic signal controllers. The modular architecture employed permits the implementation of a wide range of system sizes to minimise capital and operational costs.

Peek’s UTC package is designed to meet the requirements of national authorities by providing the following facilities:

- Signals controlled by SCOOT, fixed-time plans or the system operator
- System performance monitoring and fault management
- Car park guidance and information
- Priority for emergency vehicles and public transport
- Control of Variable Message Signs for driver information
- Comprehensive traffic monitoring including queue and congestion detection
- Statistics and logs derived from system data

Data communication between the control centre and signal controllers uses Peek OTU’s (Outstation Transmission Units) meeting national requirements for data transmission. These OTU’s operate over dedicated lines of the public telephone network, or equivalent private transmission circuits, either point-to-point or multi-point.

As an alternative to implementing a totally new SCOOT scheme, Peek can enhance an existing UTC system with add-on SCOOT facilities. This has been achieved in a number of successful projects with a range of specifications.
The basic structure of SCOOT is similar to that of the well-known TRANSYT method of calculating fixed-time plans. Both methods incorporate a model of the traffic network which predicts delays and stops caused by specific signal settings. There are three optimisers, one for each of the crucial timing parameters, split (green duration), offset (co-ordination between signals), and cycle-time. The model is used by these signal optimisers to identify beneficial changes to signal timings. However, unlike TRANSYT, in which average delays are calculated from historical traffic flow, the SCOOT model uses data obtained on-line from detectors on the street. The optimisation can therefore be carried out and the results transmitted to the signal controllers in real-time.

Traffic data is collected for each link from detector sites upstream of the signals (ideally at the link entry) and is used by SCOOT to calculate link cyclic flow profiles. SCOOT uses these profiles to predict the behaviour of the vehicle queue at each downstream stopline, taking account of platoon dispersion. SCOOT then calculates an index of the efficiency of traffic movement for all links in the network. As SCOOT also models congestion situations, where appropriate an allowance for congestion is included in this efficiency index. This enables SCOOT to calculate timings to minimise the possibility of traffic queuing back and blocking an upstream junction.

The SCOOT database contains the timings for the next scheduled change to each signal in the network. This set of timings is equivalent to the plan data in a fixed-time UTC system. In normal operation the SCOOT signal optimisers make frequent but small adjustments to this set of timings to calculate the next set of signal change times, thus adapting the plan to variations in traffic flow. Response to longer term changes in traffic behaviour is by the accumulation of a sequence of these small alterations, hence SCOOT controls signals on a plan which gradually evolves. Timing adjustments are made to optimise the efficiency index (delays, stops and congestion) as calculated by the model.

Confidence through service

Conforming with international quality standards for design, manufacture and installation, Peek Traffic products offer reliable performance in demanding user environments. To ensure peak performance over the long term, Peek Traffic offers comprehensive after-sales support for its products through a fully trained complement of support engineers providing installation, training and service.
170E Controller

- Multi-purpose microcomputer
- Meets or exceeds most specifications, including latest Caltrans and City of Los Angeles specs
- Operates in hostile environments
- Vertical board design
- Accepts 2 plug-in communications modules
- Low maintenance
- Low wattage, removable power supply
- Wired for future memory expansion (J4 slot)
McCain Traffic Supply introduces its first microcomputer, the 170E. California Department of Transportation and City of Los Angeles specifications have been met. The Model 170E incorporates the latest concepts in design for operation in hostile environments.

The Model 170E is designed to operate traffic applications from two/eight phase intersections to computerized network systems. When different software packages are used, the Model 170E’s applications extend to: ramp metering control, matrix sign control, sprinkler control, pump control, and changeable lane control.

All modules have been designed to increase reliability, reduce maintenance, and lower power consumption. Printed circuit boards are mounted vertically to conserve motherboard space. All removable modules may be mounted on extender cards for ease of maintenance.

The CPU module includes the MPU; a clock generator capable of doubling the basic frequency; a quad ACIA with RS232 interface and five clock speeds from 19.2 to 307.2 KHz; up to 32K of battery backed, write protected RAM, decode logic; and dual bus drivers. An optional 32K EPROM may be installed eliminating the need for a Program Module. This feature reduces complexity and total power drain.

The single input module uses CMOS technology to increase noise immunity in hostile environments. All input circuits are resident on this module to facilitate maintenance. All Down Time Accumulator and power up/down circuitry are located on this module along with the 2.2 farad standby power capacitor.

A single output module contains all output circuitry. Lightning protection devices have been added to eliminate high energy voltage and current spikes.

The Model 170E is equipped with an efficient linear power supply. The six outputs are as follows:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Current</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5V Logic</td>
<td>±0.1V</td>
<td>2.4A</td>
</tr>
<tr>
<td>+5V Modem</td>
<td>±0.25V</td>
<td>300MA</td>
</tr>
<tr>
<td>+5V Front Panel</td>
<td>±0.25V</td>
<td>500MA</td>
</tr>
<tr>
<td>-5V Spare</td>
<td>±0.25V</td>
<td>300MA</td>
</tr>
<tr>
<td>+12V Modem</td>
<td>±0.6V</td>
<td>1.0A</td>
</tr>
<tr>
<td>-12V Modem</td>
<td>±0.6V</td>
<td>300MA</td>
</tr>
</tbody>
</table>

During a power-down, all supplies are held within specifications for a minimum of 70 milliseconds following the NMI signal. The power supply is self contained and may be easily removed from the front of the 170E controller unit. Power is supplied through an 18 pin power connector to the motherboard.

All pieces of the Model 170E have been designed on a CAD system and are manufactured on numerical control equipment for best form and fit. Module interconnect is provided by a motherboard with separate busses for I/O and Memory. Connectors C1S, C2S, C20S, C30S, and C40S are mounted vertically at the rear of the Model 170E. The front panel is hinged and held in place with three thumb screws. The wrap around design of the front panel prevents all removable circuit boards from backing out of their connectors. The 170E can accommodate two MODEM Modules.

The Model 170E is supplied with write protected NOVRAM and also a high capacitance device for powering the Down Time Accumulator to completion during a power-down condition. Should the power-down condition last beyond the discharge of the standby capacitor, the unit will still power up with the RESTART TIMER true and the DTA minutes timer displaying 255.

Specifications

- Operating Temperature Range........... -40 to +85 degrees C
- Power..................................... 115VAC, 60Hz, typically 40 watts
- Dimensions............................. 7” H x 13” D x 19” W
- Weight..................................... 25 lbs. with Memory Module
- Timing Accuracy......................... As good as 60Hz power line frequency
- Power Supply............................ Easily removable, efficient AC/DC linear power supply with long holdup after power-down.
- Communications...................... Four RS232 compatible ACIA ports with up to two dual MODEM slots.
- Modules................................. All modules vertical with mechanically keyed PC edge connectors.

Warranty

The Model 170E is warranted against defects in materials and workmanship for a period of two (2) years from the date of original shipment.

Mission Statement

To serve our customers by providing the best quality of products and service the industry has to offer.
Model 2070 and 2070 Lite Controller Units

The 2070 and 2070L represent the newest line of controllers and are part of the ATC family of traffic signal controllers currently being worked on by the ATC National committee. The 2070 line of controllers are based on state of the art, open architecture designs allowing for maximum flexibility in operation and programming. The power of the 2070 is enhanced by using off the shelf VME cards to suit the operators requirements thus making the 2070 configurable for each agencies needs. The 2070 Lite is identical to the 2070 but lacks the VME card cage for more standard and cost sensitive applications.

The 2070 controller is constructed as a modular system. Each functional part I/O, Communications, CPU is designed into a separate and removable module. Modules can be replaced or upgraded on an individual basis without having to return the entire unit for upgrading. The modules provide parallel and serial I/O for the cabinet interfaces with 64 inputs and outputs arranged in two connectors. The communications modules provide for RS232, RS485, as well as 1200 and 9600 baud modem communication. The processor module contains a state of the art Motorola 68360 Microcontroller. The user may select between an off the shelf VME card (2070 only) or a manufactured type “B” CPU module.

The software is written in industry standard C or C++ and is coded in a modular format. Modules can be added or removed without affecting the rest of the program. The operating system in current use is OS9, a popular OS that has a small footprint and high degree of flexibility. The OS9 module interfaces between the “C” code and the hardware making the 2070 controller a true computing system.

User interface is by means of the front panel keyboards or laptop. Two keyboards are provided on the front panel and allow the operator to enter or change timing over the full range of timing parameters or a laptop computer can be used to upload or download timing for greater flexibility and data integrity. The 2070 user interface is designed as a menu driven environment. For each step in the operation the operator is prompted through the use of menu selections which guide him through all of the timing parameters.
### 2070 Features

- Exceeds Caltrans 2070 ATMS Controller Unit Specifications
- Open Architecture ensures compatibility with off-the-shelf products
- VME Hardware - Standard VME modules from Multiple Vendors
- OS/9 Software - Standard Software Modules from Multiple Sources
- Flexible design to meet specific user needs
- Easy system upgrades by adding VME boards and software extensions
- Multitasking - Each 2070 unit can run multiple applications
- Multiprocessing - Each 2070 unit can accommodate multiple CPU's
- Physically compatible with Model 170 Controllers and facilities
- Large back lighted liquid crystal display, 4 lines of 40 characters
- Designed and built for unattended operation in harsh environment

### 2070 Assemblies

- Housing - 19” anodized aluminum, compatible with Caltrans 170 facilities motherboard for field I/O, transition module and 2 COMM modules
- Chassis - VME P1 standard, 5 slot, 3U size, automatic BG and IRQ jumpers
- Processor - Motorola 68360, 32 Bit, 24.576 Mhz, CPU instruction set
- Memory - 32Mbit DRAM, 32 Mbit flash memory, 512Kbit NV-SRAM
- Comm - 1 SDLC, 5 ACIA (up to 115.2k baud)
- 2 Buses-VME P1, multilevel arbiter master/slave FAIR requester EIA RS-485 to motherboard (6 COMM + modem control)
- Transition module adapts VME bus to EIA RS-485 bus
- Security - DATAKEY provides multiple levels of human access
- OS - OS/9 Kernel, SCFMAN, SPFMAN, PIPEMAN, RBFMAN, etc.
- Field I/O:
  - Processor - Motorola 68302 used to filter inputs and store outputs
  - I/O - 64 inputs, 64 outputs for control of equipment
  - COMM - 1 SDLC available via C12S
- Front Panel:
  - Processor - Intel 89C52 implement terminal emulation
  - Operation - Emulates a Digital Equipment Inc. VT100 Terminal
- COMM - Up to 38.4 K baud ACIA to CPU plus variable ACIA C50S
- Display - 4 line by 40 LCD with contrast adjustment knob
- KeyPad - One 3x4 keypad, plus one 4x4 keypad
- Power Supply - Provides +5, +/-12VDC, plus isolated +12VDC for Field I/O
- Note: 2070L does not have a VME card cage.

### ITS Applications:

- Ramp Metering Control
- Transit Priority Systems
- Emergency Preemption Systems (Fire/Police/Ambulatory)
- Adaptive Intersection Control
- Changeable Message Signs
- Surveillance Camera Control (Pan/Tilt/Zoom)
- Video Detection Systems
- Integrated Corridor Management
- Dynamic Message Signs
- Environmental Monitoring Systems (Weather and Air Quality)
- Highway Advisory Radio (HAR)

### 2070-7A Serial Communications Module

The 2070-7A is not included as part of the 2070 Unit, but is available as an option. Normally, the 2070-7A is used to connect the 2070 Unit to local serial devices, such as printers, terminals, personal computers, and serial modems.

### Features:

- Two Serial Communication Channels
- Converts EIA RS-485 to EIA RS-232
- Front Panel LED lamp for transmit and receive for each modem
- Occupies either or both of the two leftmost slots of the motherboard

### Specifications

- Temperature Range: -37 ~ +74 (Operating)
- Service Voltage: 95 to 135 VAC, 57 to 63 Hz
- Power Consumption: 20W
- Physical dimensions: 7” H x 13” D x 19” W
- Weight: 15 lbs.

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Mission Statement

To serve our customers by providing the best quality of products and service the industry has to offer.
VideoTrak®-905

VideoTrak®-905 is engineered as the next generation detection standard. VideoTrak® provides solutions to the problems associated with below ground detection technology. VideoTrak® provides for complete intersection detection, automatic incident detection, freeway detection/management, freeway ramp control, vehicle counting/classification, and collection of traffic statistics.

VideoTrak®-905 is the result of the integration of field-proven video image processing technology, developed into an open architecture VME platform that promotes interface with advanced traffic management systems. A patented multi-resolution Pyramid processor allows efficient analysis of real-time video information in order to identify traffic conditions, adapt to various environments, and monitor for adequate image quality and proper camera operation. Tracking-based algorithms minimize missed vehicle detections and false detector actuations common in previous generation tripline video vehicle detection systems. Remote or on-site display of the traffic scene provides visual verification of detection accuracy.

Video transmission is possible over standard telephone lines with VideoTrak®'s integrated video compression feature. VideoTrak®-905 offers affordable, robust and user-friendly tracking-based video detection for a variety of traffic management applications. VideoTrak® is designed to meet the needs of transportaion engineers, globally.

Features:

- True “wide-area” detection via tracking technology
- Proven tracking-based algorithms
- Multi-resolution Digital Signal Processing
- 3U VME open architecture platform
- Built-in image stabilization
- Retrofit with existing monochrome cameras
- Shadow filtering reduces false detections
- Specialized algorithms compensate for occlusion
- Compatible w/ NEMA, TS1/TS2, Type 170/179 and 2070 and ATC controllers
- Provides an affordable above-ground alternative for accurate detection
- Offers up to 64 vehicle detector/incident detection outputs
- Provides up to 128 detection zones
- Allows 4 video inputs, 1 surveillance video input and 1 analog video output
- User-friendly setup and interface via Windows® software
- Does not require expensive setup computers. Will work with notebooks/laptops
- NEMA and CE compliant
- Digital video available via RS-232/modem on computer display - no video capture hardware required
VideoTrak®-905

Functionality
VideoTrak®-905 accommodates up to 4 standard monochrome CCD cameras, in RS-170, NTSC, CCIR or PAL formats. VideoTrak®-905 provides accurate vehicle tracking and presence detection during environmental conditions such as darkness, rain, snow, fog, blowing dust, lightning, and wind. VideoTrak®’s patented tracking algorithms incorporate specialized shadow filtering, image stabilization, and automatic field of view gain adjustment. VideoTrak® is capable of 32 zones of detection per camera and allows the user to view video on a standard desktop or notebook computer for system setup and monitoring.

Detection Zone Statistics
VideoTrak®’s traffic statistics may be stored in user defined intervals. Data can be recorded in 10, 20, or 30 second periods, as well as 1, 10, 15, 30, or 60 minute periods. Real-time per vehicle records are available when connected to the setup computer either at a remote location or on-site. Vehicle classification by length is available in 5 user-selectable classification bins.
- Volume/counts (# of vehicles)
- Lane Occupancy (% time lane is occupied)
- Speed (avg. speed in mph/kph)
- Density (avg. density=volume/speed)
- Headway (avg. headway in seconds)
- Length (avg. veh. length in ft/meters)
- Delay (avg. delay in seconds)
- Queue Length

Incident Detection Statistics
In addition to the detection zone statistics, any of a camera’s 32 zones can be configured for automatic incident detection and output. The following incidents can be monitored:
- Vehicle presence for ‘n’ seconds or minutes
- Vehicle speed (under/over selected speed)
- Wrong way detection
- Queue length exceeded
- Delay exceeded
- Occupancy exceeded
- Length exceeded
- Red traffic signal runners

Configuration Requirements
VideoTrak®-905 is quickly and easily configured for complete intersection or roadway detection and can replace existing detection devices. Small CCD video cameras may be positioned on a signal pole, mounted on a traffic signal mast arm or any other stable structure. Only power and video connections are required for each camera. Standard notebook/laptop computers may be used for detection zone setup and viewing of detector actuations within the traffic scene. Separate “supervisor computers” and special video monitors are not required with VideoTrak®-905.

ATMS Real-Time Protocol
VideoTrak® can act as a data collection outstation and provide larger traffic management systems with real-time traffic data via an ATMS (Advanced Traffic Management System) communications protocol. The ATMS package provides developers a mechanism to “poll” VideoTrak® for current statistical and status information that can then be used for a myriad of functions such as Adaptive Traffic Control, Incident Detection, Tunnel Management, etc.

Installation and Support
A detailed site survey by a Peek Traffic Systems, Inc. trained representative is conducted prior to the deployment of VideoTrak®-905. The survey will ensure that the choice of camera locations, optics and data/video interconnect is appropriate for the application. Technical support for all Peek products is available worldwide.

Two Year Limited Warranty
Peek Traffic warrants this product against manufacturing defects in materials and workmanship for two years from date of shipment from the Peek Traffic factory. Specific contracts and regional laws may vary or alter these terms. Peek Traffic products are protected by one or more U.S. and international patents.

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VideoTrak® Part Number System

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<th>S</th>
<th>-220</th>
<th>-P</th>
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<td>( \text{P = PAL} )</td>
<td>( \text{S = SECAM} )</td>
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<td>( 1 ) or ( 2 ) (For 910 only)</td>
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<td>Base Part Number (CHASSIS)</td>
<td>( 905 = 4 ) camera only</td>
<td>( 910 = 4 ) or ( 8 ) camera</td>
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</table>

Peak Traffic reserves the right to alter any of the Company’s products or published technical data relating thereto at any time without notice.
Rev. 01/00
**FAMILY OF VANTAGE PROCESSORS**

- Multi-camera Vantage Plus for TS-1 or TS-2 applications
- Shelf-mount single camera Vantage One for cost-effective deployment when only a few cameras are required
- Rack mount, single camera Vantage Edge 2 for TS-1 or TS-2 input file or detector rack based applications

**HIGH PERFORMANCE VIDEO DETECTION CAMERA**

- Variable focal length lens is ideal for “one size fits all” applications
- Easily installed, minimizes need for lane closure
- Shielded against sun and inclement weather
- Ideal for temporary or permanent installations
- Produces surveillance-quality video usable for transmission

**VANTAGE APPLICATIONS**

- Intersection Detection
- Highway Data Collection

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**Vehicle Detection Without the Cost and Hassle of In-Pavement Detectors**

In a world where traffic responsive signal operation depends on vehicle detection, the Vantage™ video detection product family from Iteris delivers accurate, dependable, vehicle detection with nothing embedded in the roadway.

Imagine — a vehicle detector that works day or night, rain or shine, using only video and Digital Signal Processing (DSP) technology. That can be installed without closing lanes, and can be moved without additional cost. And, that works during construction when trenching causes detectors embedded in the pavement to fail.

Best of all, Vantage costs less than embedded detectors, and is easy to use, reducing installation and training time and expense.

That’s the Vantage Advantage!
Designed to Work The Way You Do

Vantage is the result of years of testing by users and installing contractors. Consider these built-in advantages:

Easy to Install

Vantage processors mount in the traffic control cabinet and a cable connects outputs to the controller. Cameras are mounted on street lighting mast arms or poles. Video and power cables are run from the cabinet to each camera. The Processor connects directly to coax cabling from each camera, or can now receive the video signal through our new wireless system! Isolation amplification is included in the Vantage Plus™ Processor, eliminating the need to buy extra equipment to protect against transients or compensate for coax cable losses.

Easy to Use

The processors include full programming capability, eliminating the need for a separate PC. A programming menu is displayed as an overlay on the video image from each Vantage camera. Detectors are drawn on the camera video image using a mouse and the video menu.

Dynamic Zone Reconfiguration™

DZR™ allows the modification of one zone at a time without affecting existing detection zones. Once vehicle detectors are saved in memory the detection starts immediately. Best of all, Vantage is so simple to use that basic training can be done in less than an hour.
All Weather Performance
Vantage delivers accurate vehicle detection under challenging outdoor weather and lighting conditions.

Low Cost, Low Maintenance
The processors and cameras are solid state devices requiring little or no maintenance. That means lower life cycle cost to you, and an extended detector life that is unmatched by embedded detectors. All Vantage products are backed by Iteris’s decades of experience and expertise, building reliable video products for customers worldwide.

VRAS™ – Vantage Remote Access System
VRAS is a powerful software tool, which provides remote access capability to the Vantage processors for monitoring traffic flow, customer support and system diagnostic applications. The Windows based software can easily be installed on any notebook or PC equipped with a modem.

VRAS offers the following enhanced functionality to Vantage systems:

- View images from a remote location in a single frame or continuous frame mode
- View images from different Vantage cameras
- Reconfigure and archive detection zones for each Vantage camera
- Perform system diagnostics remotely
- Remote counting data retrieval
Iteris, Inc., a subsidiary of Odetics, Inc., is a leading provider of advanced information, software and sensor technologies that improve the efficiency and safety of surface transportation. Iteris has combined information technology, system integration and applied sensors to offer a broad range of telematics and transportation solutions.

Iteris has matured alongside the ITS Industry since the early 1990s, and has emerged as a flourishing company with distinguished projects and awards nationwide, including the National ITS Architecture prime contract awarded by the Federal Highway Administration (FHWA) for the National Intelligent Transportation Systems (ITS) Architecture Evolution and Support Program.

With corporate headquarters in Anaheim, California and offices nationwide, the company is committed to the transportation industry - striving to apply its talents to solving the challenging problems of the movement of people and goods. By applying advanced engineering, best industry practices, experience and imagination, Iteris creates open solutions that solve ITS problems today and allow for future growth and flexibility.

Iteris Solutions

- Transportation Systems Consulting and Technology
- AutoVue™ Lane Departure Warning Systems
- Vantage™ Video Detection Systems
- Video Surveillance Systems
- Mil-Lektron™ Video-over-twisted-pair Systems
- Special Applications Integration Services

Iteris manufactures and sells its Vantage video detection, Mil-Lektron video transmission, and video surveillance products for traffic control applications at intersections, giving traffic managers tools to mitigate traffic congestion by modifying traffic signal timing or detecting incidents. Vantage also offers data collection software solution for highway management systems. Over fourteen thousand Vantage sensors have been deployed in hundreds of agencies in 49 states, as well as Europe and Asia. The product is currently sold through a network of thirty independent dealers in North America, Asia, Europe, and South America.
TRAFFIC ENGINEERING
HANDBOOK
Fifth Edition

James L. Pline
Editor

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The Institute of Transportation Engineers (ITE) is an international educational and scientific association of transportation and traffic engineers and other professionals who are responsible for meeting mobility and safety needs. The Institute facilitates the application of technology and scientific principles to research, planning, functional design, implementation, operation, policy development and management for any mode of transportation by promoting professional development of members, supporting and encouraging education, stimulating research, developing public awareness, and exchanging professional information; and by maintaining a central point of reference and action.

Founded in 1930, the Institute serves as a gateway to knowledge and advancement through meetings, seminars, and publications; and through our network of more than 15,000 members working in some 80 countries. The Institute also has more than 70 local and regional chapters and more than 90 student chapters that provide additional opportunities for information exchange, participation, and networking.
CHAPTER 13
Traffic Control Signals

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Introduction
This chapter is a supplement to the Manual on Uniform Traffic Control Devices (MUTCD), which contains the standards, options, and guidance for the installation and maintenance and removal of highway traffic signals. This chapter should not be considered or used as a total replacement for the MUTCD. The MUTCD shall govern in the resolution of any conflicts between the two documents.

Highway traffic signals are power-operated traffic control devices by which traffic is warned or directed to take a specific action. Included are vehicular traffic and pedestrian signals, movable bridge signals, freeway entrance ramp control signals, lane-use control signals, and flashing beacons.

Vehicular traffic signals (traffic signals) are highway traffic signals that alternately assign the right-of-way to the various vehicular and pedestrian movements at an intersection or other roadway location.

Traffic signal control equipment is now almost exclusively microprocessor-based. Both software and firmware are used for intersection control, small arterial systems, and large area-wide systems. The rapid expansion of technology and of knowledge, innovation, flexibility, and capability require that a practitioner obtain the latest technical documents from the standards-setting agencies and the latest technical data from manufacturers and suppliers before selecting hardware, software, and communications systems and methods for a specific project.

Traffic control signals, installation and operation, have been the subject of study since their introduction. It is recognized that road users sometimes do not honor the right-of-way assignment of the traffic signal, or make other violations of the directives given by the traffic signal displays. These and other factors can result in collisions. Although rare compared with the total volume of traffic being controlled, collisions present a serious problem that remains under study.

The general public harbors many misunderstandings concerning the application of traffic signals and the likely results of their installation at a specific location. Traffic signals, which are seen by many people as the cure for every traffic problem, are believed to eliminate collisions and congestion, to reduce operating speeds, and to make every intersection a safe place for children to cross the street and for adults to drive. Politicians often see installation of a traffic signal as a means to keep the public happy, to generate votes, or to reward influential supporters.

Traffic engineers know that a traffic signal is not a panacea and can actually contribute to collisions, congestion, delay, and speeding. Traffic engineers must balance the potential benefits and drawbacks of signalization against often unreasonable public demands and emotions.

Selection of Operational Types

Extreme care should be taken in the selection of traffic control equipment so that proper features for present and future operations will be available or can be added when required. There are several methods for determining which type of operation should be applied to a particular intersection. A PC-based software program that allows intersection and system operation to be modeled, evaluates Measures of Effectiveness (MOEs) as selected by the user, and provides recommended controller phasing and timing is highly recommended.

In evaluating the recommendations of the program, the advantages of each type of control as noted above should be considered. Since new programs and new versions of old programs are moving into the marketplace rapidly, no specific programs will be reviewed here. Technical journals, the Center for Microcomputers in Transportation (McTrans) at the University of Florida, and PC Trans, University of Kansas, should be consulted for the most current software program offerings.

Controller Units

Control cabinets and components are manufactured to two major standards in the United States: National Electrical Manufacturers Association (NEMA) and Type 170. Before selecting a type of control equipment, the practitioner should review current technical literature on these standards, which have evolved since first being published.

Hardware manufactured in accordance with either standard must meet guidelines for functional, physical, and environmental interchangeability and for both human and electrical interfaces. Each standard addresses the internal features of the control cabinet and each principal unit within it. Equipment from various manufacturers must be compatible and must provide the defined set of hardware features.

Equipment manufactured to standards set by other countries is also available. Some of this equipment provides electrical interfaces that comply with the U.S. standards, but the equipment may provide different or extended capabilities.

A primary difference between the NEMA and Type 170 family of signal controllers is the source and application of the signal controller software. The NEMA standard specifies the features, functions, and timing intervals in the software supplied with the controller as firmware.

The NEMA software is not subject to modification by the agency or by others. Some vendors may modify the software for an agency, but modified software is no longer NEMA-standard. Software for the Type 170 family is available from many equipment suppliers as a service to the agency. Because it is typically from a third-party vendor (software house), the source code—a valuable asset—may be unavailable to the agency. The operating system parameters are available, so the agency can write its own software if it prefers. Since the software is not a part of the Type 170 standard, modifications to the software do not affect its hardware compatibility.

The information about the specific standards provided here is general and not meant to be a detailed recitation of the qualities or the differences or an endorsement of any standard.

NEMA

The original NEMA standard, TS 1-1989, did not address traffic signal system communications and other features such as preemption and priority control. The NEMA TS 2-1992 standard addresses compatibility issues related to these features while maintaining a level of downward compatibility.

This standard also addresses the internal features of the control cabinet and each principal unit within it. Equipment from various manufacturers must be plug-compatible and must provide the defined set of hardware and software features. The software is supplied as firmware with the controller.
The NEMA controller is controlled by a microprocessor and driven by software, much like a personal computer. It can be set up as an on-street local system master.

**Type 170/2070/2070N**

The Type 170 controller family is controlled by a microprocessor and driven by software. The equipment manufacturer does not control the controller software, however. The controller will accept and operate software developed by the operating agency and by other software developers.

Type 170 equipment may be configured in the field for use as a traffic signal controller, an on-street local master, a ramp-metering controller, a landscape-irrigation controller, or for other traffic control applications.

Type 2070 and Type 2070N are members of the Type 170 family. The Type 2070 Advanced Transportation Controller (ATC) was developed primarily by the California Department of Transportation (Caltrans) and the City of Los Angeles to provide the advantages of a high performance, open-standard controller that is compatible with both the NEMA and the existing Type 170 cabinet. The ATC has additional capability to run advanced traffic control strategies and has enhanced communications capabilities. By the addition of VMEBUS modules or serial ports, functions such as video-imaging detection, camera control, changeable message sign control, preemption interface control, and additional intersection monitoring can be performed. The additional capability also offers the user more freedom to design phasing plans and to select compatible phase combinations.

Type 2070 is compatible with the Caltrans/New York Department of Transportation cabinet standards. Type 2070N, which is compatible with NEMA cabinets, contains NEMA TS 11989 and TS 21992 compatible digital interfaces.

The operating agency is responsible for providing the controller software either by its own forces or by a third-party supplier. Numerous equipment suppliers will provide a software package with the equipment, as a service to the agency. Because this software may contain features, functions, and timing intervals not found in the NEMA software, the definitions of and availability of the intervals are not necessarily the same as those defined in the NEMA software.

**Signal Operation**

Traffic signals may be in one of three operational modes: dark mode, steady mode (stop-and-go), and flashing mode.

**Dark Mode**

During dark-mode periods, all the signal indications are off or blank. It is most commonly associated with power failures at traffic signals which usually operate either steady or flashing mode, except when the traffic signal is out of service for seasonal shut-down periods or the like, and the signal heads are either removed, turned, or hooded. Dark mode may be a part of the operational pattern for ramp control signals, beacons, and some movable bridge signals.

**Steady Mode (Stop-and-Go)**

During steady mode, traffic signals operate in the normal green, yellow, and red sequence. Green vehicular signal indications are displayed to a set of compatible controller phases and red signal indications to all conflicting controller phases. The yellow change interval and, if used, the red clearance interval follow the green indications before the green indications of the next set of compatible controller phases are displayed.

Pedestrian signal indications Walking Person (WALK) and Flashing Upraised Hand (Clearance) followed by a steady Upraised Hand (DON'T WALK) may be displayed with the vehicle indications. They may also be displayed as an independent controller phase in the sequence.