DESIGN, SUPPLY, INSTALL, TRAINING & MAINTENANCE OF TRUCK OVERNIGHT MONITORING SYSTEM

To:
Jacko Maree

Submitted by:

Date: SEPTEMBER 2008

ABSTRACT

Consistent, real-time License Plate Recognition (LPR) for vehicles passing through the covered entry and exit lanes (Phase 1) will be provided to accommodate the need for reliable traffic data, including how many trucks stay longer than 1 hour. The system can integrate multiple lanes and multiple cameras per lane into a sophisticated vision-based LPR system that identifies and tracks number plates on vehicles travelling past the cameras. The LPR system will capture all vehicles entering and exiting the lanes, storing the vehicle image, license plate if present, date, time, lane and other data as required. The raw data can be imported into any statistical package for detailed analysis. The software will allow vehicles to be enrolled into a notification list, linking this information to the license plate. The time the vehicle was on site will be established and recorded. All of the field systems which generate the traffic data employ the same SeeCar OCR engine, which will run on the local processing units. The OCR engine processes images, locates the relevant license plate ID in the image, and produces an alphanumeric result for each image processed. The OCR engine is based on neural network technology and can be trained to recognize different fonts, characters and syntax. Using outputs of several cameras, a back end program can be used to calculate the number of vehicles per time period and expected income from truck overnight parking.

It is suggested to phase in the solution over three phases, allowing each phase to build on the previous success. The 1st phase will record all vehicles entering and exiting, produce a daily log of vehicles and each vehicles time on site. It is suggested that the LPR data be provided live on site at the office, home and on the Internet via ADSL, allowing real time monitoring of all cameras and the alarms generated.

The financial offering for the advanced LPR solution is provided as:

- A once off capital amount OR
- A rental option (R4 981.75) OR
- An option for a cost per transaction solution (50c per truck).

Table of Contents:

LIST OF FIGURES

Definitions, acronyms & abbreviations

AGC -Automatic Gain Control - A circuit for automatically controlling amplifier gain in order to maintain a constant output voltage with a varying input voltage within a predetermined range of input-to-output variation
Aperture - In television optics, it is the effective diameter of the lens that controls the amount of light reaching the photoconductive or photoemitting image pickup sensor.
Aspect Ratio - The ratio of width to height for the frame of the televised picture 4:3 for standard systems, 5:4 for 1K x 1K, and 16:9 for HDTV
Automatic Brightness Control - In display devices, the self-acting mechanism which controls brightness of the device as a function of ambient light.
Automatic Gain Control - A process by which gain is automatically adjusted as a function of input or other specified parameter.
Automatic Iris Lens - A lens that automatically adjusts the amount of light reaching imager.
Automatic Light Control -The process by which the illumination incident upon the face of a pickup device is automatically adjusted as a function of scene brightness
Bandwidth - The number of cycles per second (Hertz) expressing the difference between the lower and upper limiting frequencies of a frequency band; also, the width of a band of frequencies
Blooming - The defocusing of regions of the picture where the brightness is at an excessive level, due to enlargement of spot size and halation of the fluorescent screen of the cathode-ray picture tube. In a camera, sensor element saturation and excess which causes widening of the spatial representation of a spot light source.
Brightness - The attribute of visual perception in accordance with which an area appear to emit more of less light. (Luminance is the recommended name for the photo-electric quantity which has also been called brightness.)
CCD - See Charge Coupled Device
C Mount - A television camera lens mount of the 16 mm format, 1 inch in diameter with 32 threads per inch.
CCTV - Common abbreviation for Closed-Circuit Television
Charge-Coupled Device CCD - For imaging devices, a self-scanning semiconductor array that utilizes MOS technology, surface storage, and information transfer by shift register techniques.
Contrast - The range of light to dark values in a picture or the ratio between the maximum and minimum brightness values.
Contrast Range - The ratio between the whitest and blackest portions of television image
DDE – Dynamic Data Exchange
Depth of Field - The in-focus range of a lens or optical system. It is measured from the distance behind an object to the distance in front of the object when the viewing lens shows the object to be in focus.
Depth of Focus -The range of sensor-to-lens distance for which the image formed by the lens is clearly focused.
DLL – Dynamic Linked Library
EPS - Edge pre-select
Fiber Optics - Also called optical fibers or optical fiber bundles. An assemblage of transparent glass fibers all bundled together parallel to one another. The length of each fiber is much greater than its diameter. This bundle of fibers has the ability to transmit a picture from one of its surfaces to the other around curves and into otherwise inaccessible places with an extremely low loss of definition and light, by a process of total reflection.
Field - One of the two equal but vertically separated parts into which a television frame is divided in an interlaced system of scanning. A period of 1/60 second separates each field start time.

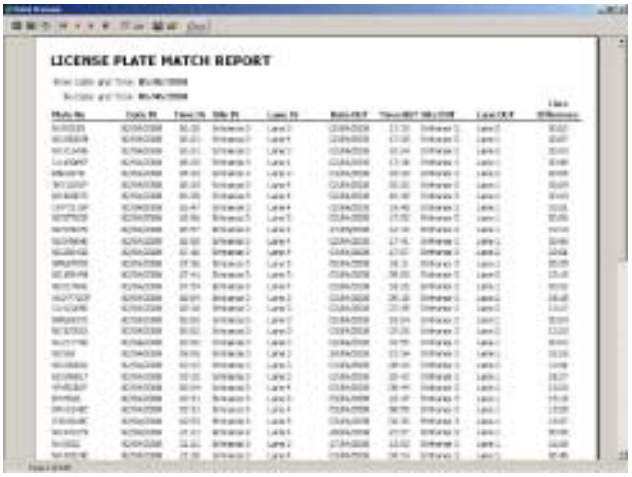
Field of View - The maximum angle of view that can be seen through a lens or optical instrument.
Focal Length - Of a lens, the distance from the focal point to the principal point of the lens
Focal Plane - A plane (through the focal point) at right angles to the principal point of lens
Focal Point - The point at which a lens or mirror will focus parallel incident radiation.
Gbps – Giga Bits per second
HTS – Hi-Tech Solutions
Iris - An adjustable aperture built into a camera lens to permit control of the amount of light passing through the lens.
IO – Input output
IP – Internet Protocol
IR – Infra Red
JPG – Joint Photographic Group Image Format
LED – Light Emitting Diode
Monitor - A unit of equipment that displays on the face of a picture tube the images detected and transmitted by a television camera.
MSMQ – Microsoft Message Queue
ND Filter - A filter that attenuates light evenly over the visible light spectrum. It reduces the light entering a lens, thus forcing the iris to open to its maximum.
Patch Panel - A panel where circuits are terminated and facilities provided for interconnecting between circuits by means of jacks and plugs.
PC – Windows based Personal Computer
Pixel - Short for Picture Element A pixel is the smallest area of a television picture capable of being delineated by an electrical signal passed through the system of part thereof. The number of picture elements (pixels) in a complete picture, and their geometric characteristics of vertical height and horzontal width, provide information on the total amount of detail which the raster can display and on the sharpness of the detail, respectively.
PWC - pulse width control
RFID – Radio Frequency Identification
Shutter - Ability to control the integration (of light) time to the sensor to less than 1/60 second; e.g: stop motion of moving traffic.
Signal-to-Noise Ratio - The ratio between useful television signal and disturbing noise or snow
Snow - Heavy random noise.
Spike - A transient of short duration, comprising part of a pulse, during which the amplitude considerably exceeds the average amplitude of the pulse.
TCP – Transmission Control Protocol
TBL – Terminal Block
Test Pattern - A chart especially prepared for checking overall performance of a television system. It contains various combinations of lines and geometric shapes. The camera is focused on the chart, and the pattern is viewed at the monitor for fidelity.
VB – Visual Basic
VDC – Voltage Direct Current
Vertical Resolution - The number of horizontal lines that can be seen in the reproduced image of a television pattern
VES – Vehicle Enforcement System
Zoom - To enlarge or reduce, on a continuously variable basis, the size of a televised image primarily by varying lens focal length.
Zoom Lens - An optical system of continuously variable focal length, the focal plane remaining in a fixed position.

INTRODUCTION

Overview

The Traffic Logging System (TLS) Solution will be provided to accommodate the need for consistent, real-time traffic data. The traffic data will come from the License Plate Recognition (LPR) of all vehicles passing through the covered transport lanes. The system, referred to as the TLS, will provide a take-and-discard methodology for the vehicles' video and license plate data. Vehicles using the lanes will be captured allowing proactive, real time reaction to vehicles spending more than an hour on site. The road side portion of the solution proposed uses the See Lane DLL software.

The See Lane DLL is a state-of-the-art vision based recognition system for medium speed roadside installations. The system can integrate multiple lanes and multiple cameras per lane into a sophisticated vision-based License Plate Recognition (LPR) system that identifies and tracks number plates on vehicles travelling at medium speeds. The system is used world wide for various applications, including traffic data analysis, toll roads, rush hour monitoring and average speed and car flow studies. The application is supported by a full set of optical and hardware sub-systems as well as software applications and utilities.
The system will work to detect and capture the license plate information for every vehicle passing through the covered lanes. It will be the responsibility of the motion detection software to determine vehicle presence, via the advanced digital recording software. The TLS cameras will then capture a set of images, the See Lane DLL will process these and output the best image and the resulting license plate, lane, time and associated data to the network. The on site servers will capture the data for further processing as required.



- **Flow estimation** – the number of vehicles on site per time period.
- **On-line reports** – the information can be reported in order to supply live reports from the site.
- **Monitoring** – the recognition information may be used for various security applications.
- **Average Time** – using outputs of several cameras, a back end program can be used to calculate the average time on site of the vehicles.
- **Enforcement** - The license plate data can be used for a wide range of enforcement techniques, including alarm on stolen vehicles, prevention of drive away etc..

Figure 1 Example of a typical match report

System description:

The proposed system consists of a number of lanes, within the truck stop area, with multiple cameras monitoring the specific areas. Each camera is connected wirelessly to an IP switch which allows any of the connected computers to view and process the data obtained from the cameras. If any of the cameras goes down, an alarm is generated immediately. If any of the computers fail, the other computers automatically take over the processing of the cameras attached to that computer.

Figure 2 Entrance lane at Mooi River Truck Stop

All vehicles passing the camera will be recorded in terms of the time, lane, direction, license plate (if present), automatic detection of unauthorized vehicles, an alarm if the vehicle is wanted (black list) and other database operations.

System Architecture

SeeLane is a turn-key system comprises of the following elements:

• **PC** running Windows XP Pro

• **SeeCar DLL** - which is used to analyze the images and extract license plate string
• **1-4 Recognition Camera** unit(s) to capture the images. These cameras are high resolution state of the art cameras that are connected to the PC via a gigabit network.

• **Gigabit Network –** 8-port switch and network card (or motherboard network).
This is an internal network used for communicating with the cameras.

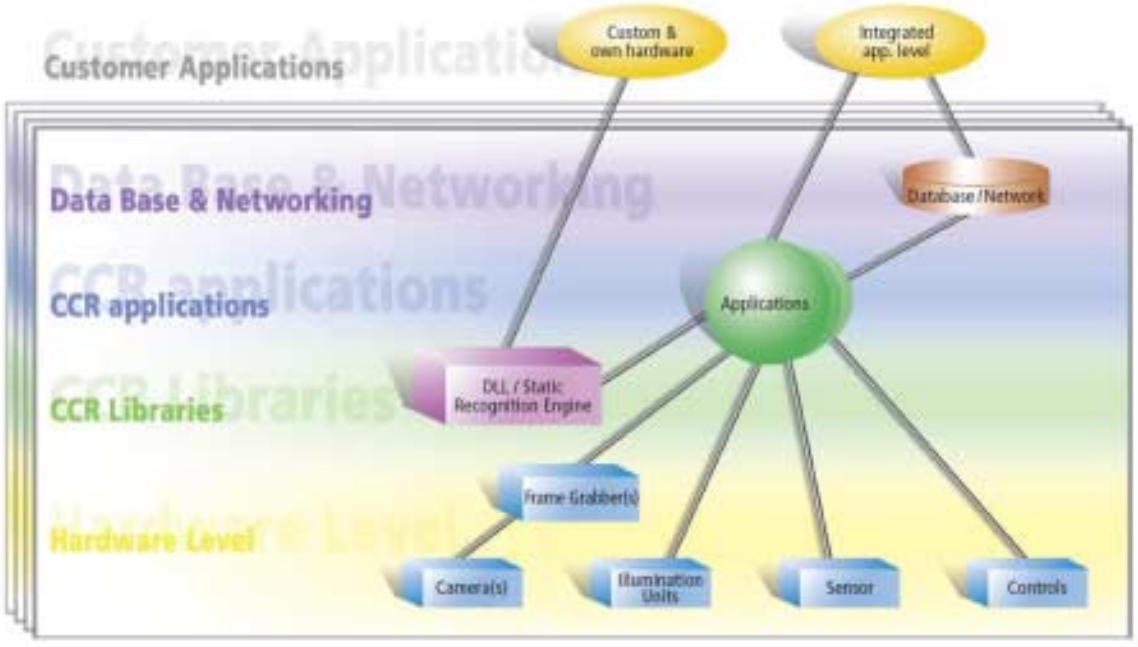


Figure 3 Elements making up the proposed solution

• **Illumination units** to illuminate the plates. The illumination units may be external lights, or solid state strobe units that are supplied.

• **I/O card** – Not required for this system but could be provided. The input/output board with multiple I/O discrete lines supports the sensors and illumination control. It is connected via a cable to a terminal interface board with easy connections and indicator lights.

• **BW dedicated rear plate camera** – used as an option to supply images used for specific capture of the rear plate only. This is used for additional recognition where no front plate is present.

• **Sensors** to indicate the presence of the car (a sensor for each lane). These are not required and are not included.

• **See Lane**

The See Lane Windows application interfaces the hardware elements (camera/illumination unit(s), IO card and sensor). It controls the illumination (if present), reads the video inputs and passes the images to the DLL in order to obtain the recognition results. The application displays the image and recognition results. It then exports the results using messages and image files. Its man-machine interface supports on-line setting control, which can easily adapt the application to various types of configurations. The image below illustrates how the items link together on site and in the control room. All the items indicated in the image below reside on site, except for the remote database which will be on the central server in the control room.

Block Diagram

A breakdown of the proposed system is shown in the following illustration, which shows a typical configuration of the LPR system (single lane). Although a monitor is shown, it is optional, and a remote access thru the network is usually the standard configuration.

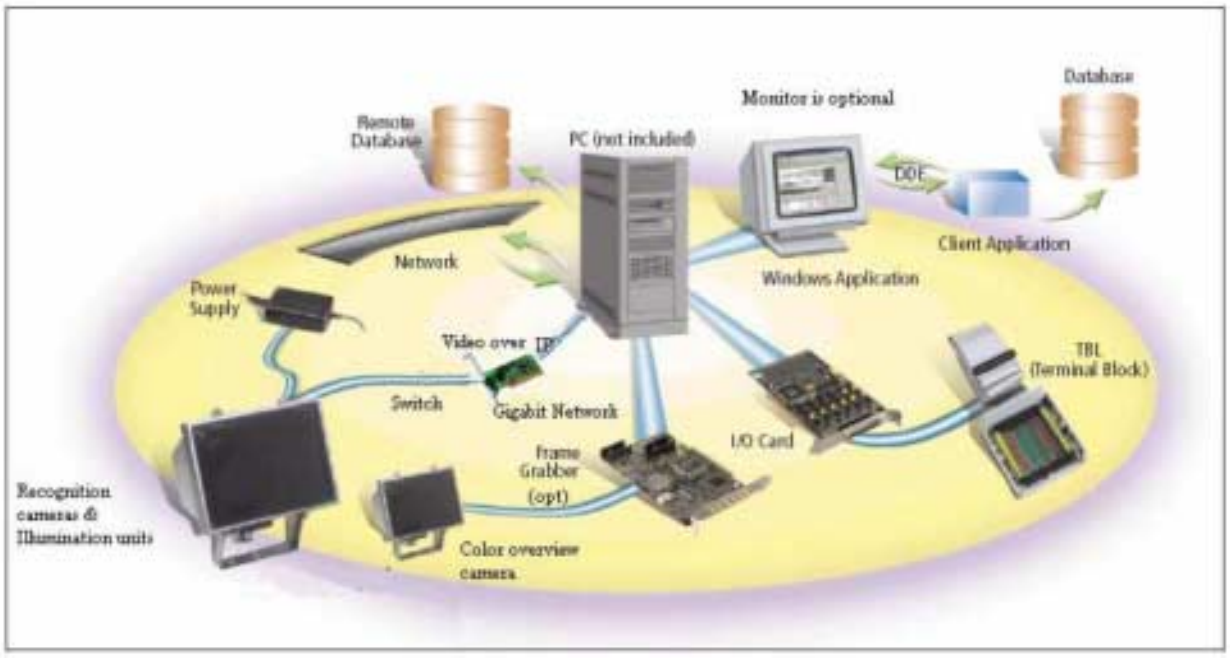


Figure 4 See Lane Connectivity

The See Lane application runs as a background Windows application in the PC (in the centre), which has a gigabit network connection (from a network card or the motherboard), via a Gigabit switch to the IP recognition camera(s) (with integrated illumination). The number of these high resolution cameras depends on the width and number of lanes, but is limited to 64 or less cameras based on traffic volume.
The PC has an I/O card which is connected via a terminal block to the sensors and the illumination control signals. An option of a colour / BW overview picture and video is available with a colour / BW overview camera.

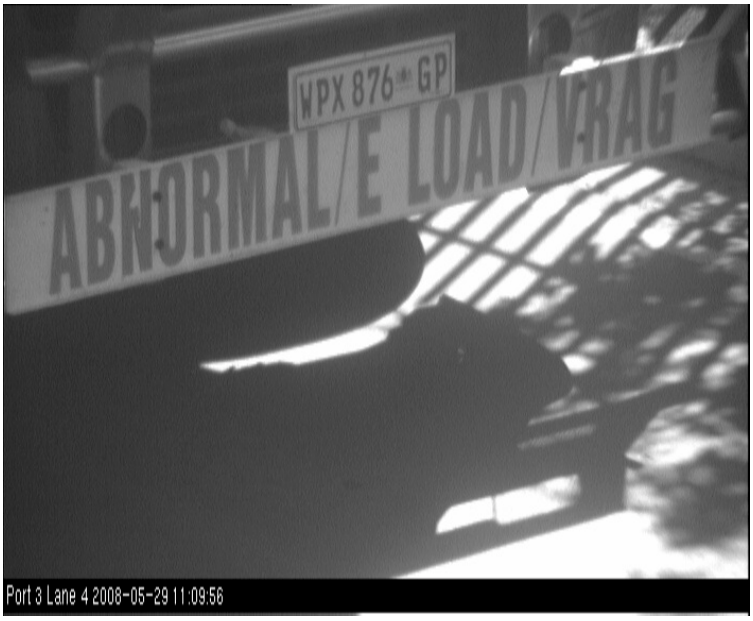


Figure 5 BW image of a truck captured via the LPR system

SITE LOCATION

Figure 6 Overview of the Mooi River Truck Parking area EXIT

Figure 7 Mooi River Site Parking Exit Lane Front Camera View

Figure 8 Site Mooi River: Existing Camera Location

The existing cameras will be incorporated into the system, until these are replaced in phase two.

Figure 9 Site Tugela Truck Inn Front Camera View on vehicle Exit

Figure 10 Site Tugela Truck Inn Entrance and Exit lane locations

Figure 11 Tugela Truck Inn current Camera placement

The existing cameras will be incorporated into the system, until these are replaced in phase two. This will provide an additional overview of the truck

Site Layout: Installation

The design of the system allows for a motion trigger. For each trigger a series of images will be captured. The images will then be automatically reviewed by the application running on the Lane Controller, and the best result will be selected among all identifications. The application will also select the best image to be reported that will contain the plate image. Once a result is determined, the data will be sent by a message to the server. Below is a diagram depicting the physical layout of the equipment involved in the single-lane See Lane TLS system:

Figure 12 With no front plate present a Rear camera could provide valuable information

The above truck would be listed as a trigger; however no plate would be recorded from the front view. In phase two the rear cameras proposed would resolve the above.

Figure 13 A rear camera would recognise the trailer plate of the above truck

TRAFFIC LOGGING

The following illustration shows one of the sites ("Site A" out of N sites) monitored by a License Plate Recognition (LPR) unit. Each unit is connected via a network to a control room. Each LPR unit transmits its recognition results to the control room computer where the data is collected and analyzed. The central computer application then updates and displays the traffic status that includes average journey times between the LPR sites and also traffic flow statistics. This information is presented in **real-time** and saved to a traffic database for off-line processing.

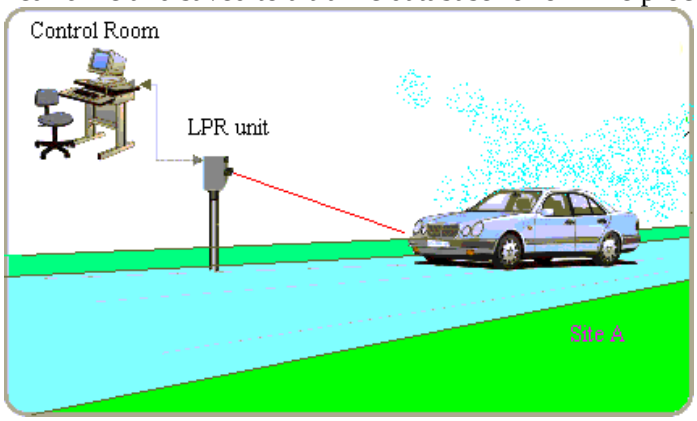


Figure 14 SeeCarFlow illustration (Site A of N sites, with control room)

System Architecture: Overview

The system is based on Hi-Tech Solutions' Vehicle License Plate Recognition (LPR) stand-alone systems. Multiple LPR units are installed at several permanent sites (2) located at the entrance and exit to the truck overnight parking area. Each LPR system performs real-time recognition on passing trucks in a single traffic lane. The LPR unit is based on a Windows application that controls its integrated camera/illumination unit and an LPR recognition engine.

Figure 15 Image Capture and OCR

Each LPR unit reports the vehicle recognition events via TCP/IP network messages to a central computer in the traffic control room. The central computer application

reads the recognition results from all sites, calculates the travel data (in real-time), and displays it to the operator.

This section describes each of the major elements.

LPR units

Each LPR unit is a turnkey system, which is comprised of the following elements:

- a **PC** Pentium running Windows XP
- LPR unit Windows application software package (described below)
- **Recognition DLL** – the recognition engine which is used to analyze the images and extract license plate string
- **Camera/ Illumination** unit to capture the images (detailed below)
- a **I/O card** - multiple I/O discrete lines - which supports the sensors, illumination control and optional gate-open signal (not required in this design).
- **sensor** to indicate a presence of the car (motion in this design)
- **a list** of known vehicles (such as buses or taxis) which will be analyzed separately in the traffic analysis

These components are shown in the following illustration.

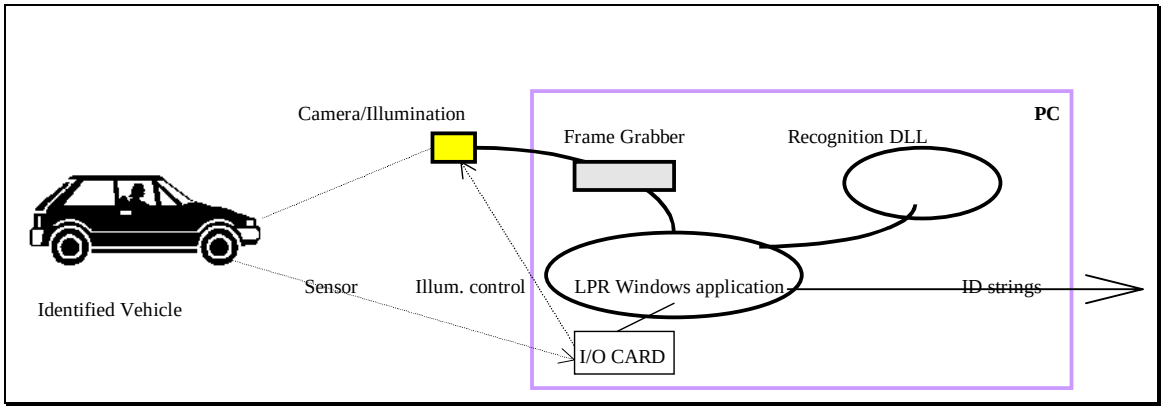


Figure 16 LPR unit Architecture

When a vehicle triggers the sensor, the LPR application activates the illumination (if present - which is controlled by the IO card) and captures a series of images (one or more image fields) which are captured by the frame grabber or IP stream. It then proceeds with the identification of the car.

The LPR system is designed to work **simultaneously** with one to four traffic lanes. However in the SeeCarFlow system the traffic load will limit the number of lanes.

According to the traffic load for each location it will be determined if a single or double lane will be assigned for each PC.

The application also reports on special vehicles that are listed in the 'white-list' (listed in a file, cars.txt). This is used in SeeCarFlow application to differ between standard vehicles and special vehicles when displaying the results.

LPR unit Windows Main Display

The LPR unit application main window is designed to display as much information as possible in a friendly user interface. The window is divided into several display panes, where each pane is responsible for a single system task (video images, system status, identified code, ...).
The different panes include:

- Image Display - shows video from the camera (from one of the lanes)
- History Log - display a list of all identified vehicles
- Identification Window - a graphical representation of the identified vehicle
- Status Window - system messages and sensor status display

An example of such display is shown in the following figure. The vehicle (that is shown) was captured with a front camera/illumination unit and displayed on the image display; its license plate number is shown in the bottom list and graphical display.

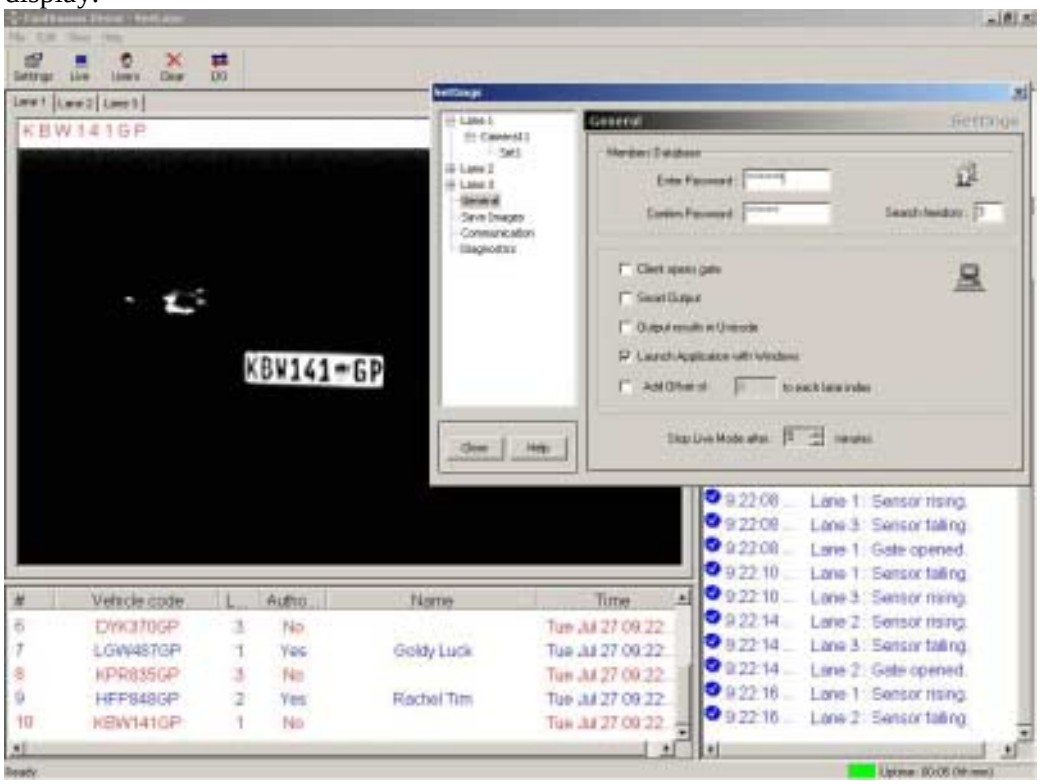


Figure 17 Example of LPR application main view

The application can operate automatically without operation control and can be minimized to a background application.

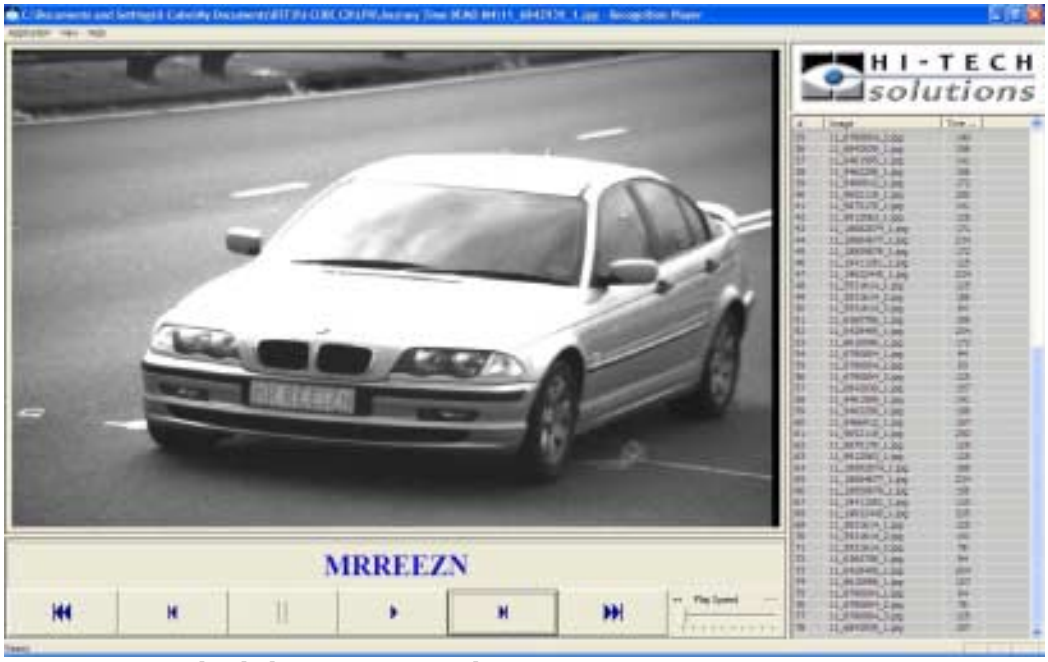


Figure 18 Personalised Plates are recognised using LPR

LPR Client

The LPR unit application is designed to **share** the vehicle identification results with other processes. This can be done either by external communication (RS232 or TCP/IP) or by application-to-application messages. The latter method is implemented by **DDE** messages that are sent after each identification cycle. Each vehicle generates **one message** containing the recognition result.

When a vehicle triggers the motion sensor, the LPR unit application captures a series of images (one or more), then proceeds with the identification of the car. After completing the identification cycle, a DDE message containing the ID is sent to the PC Windows system (along with more information: date and time, lane number, 'white-list' vehicle and image pointer).

This message is intercepted by another application - the LPR client process. This process receives the messages, groups a series of recognition results together (for reducing the network bandwidth requirements) and sends the recognition block across the network via TCP/IP. This data is received at the control room by the SeeCarFlow central application and used for traffic processing.

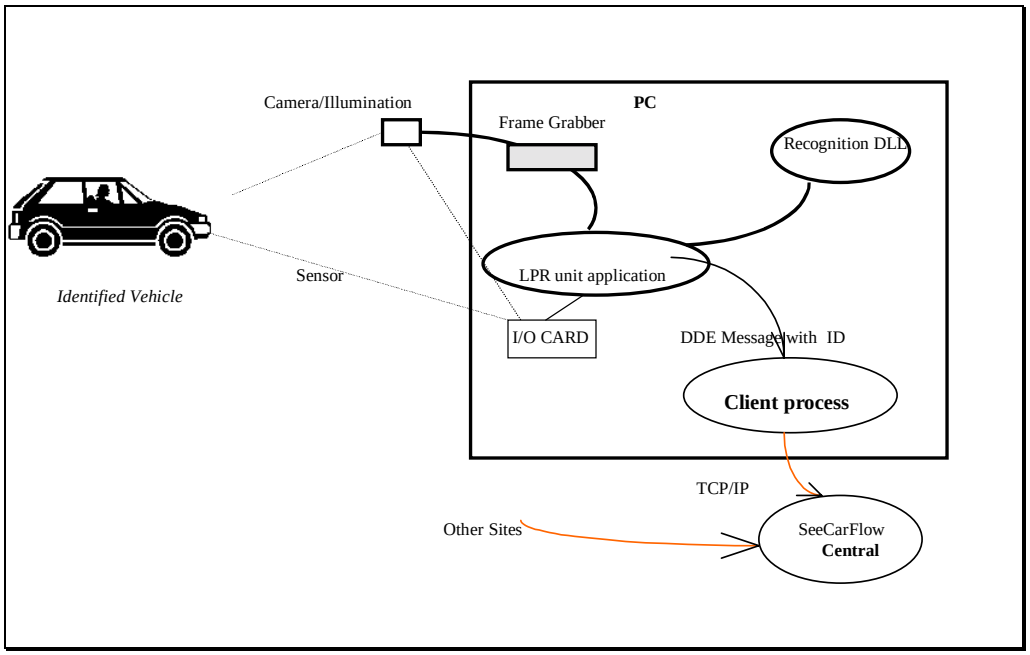


Figure 19 Data flow of the Recognition results

Network

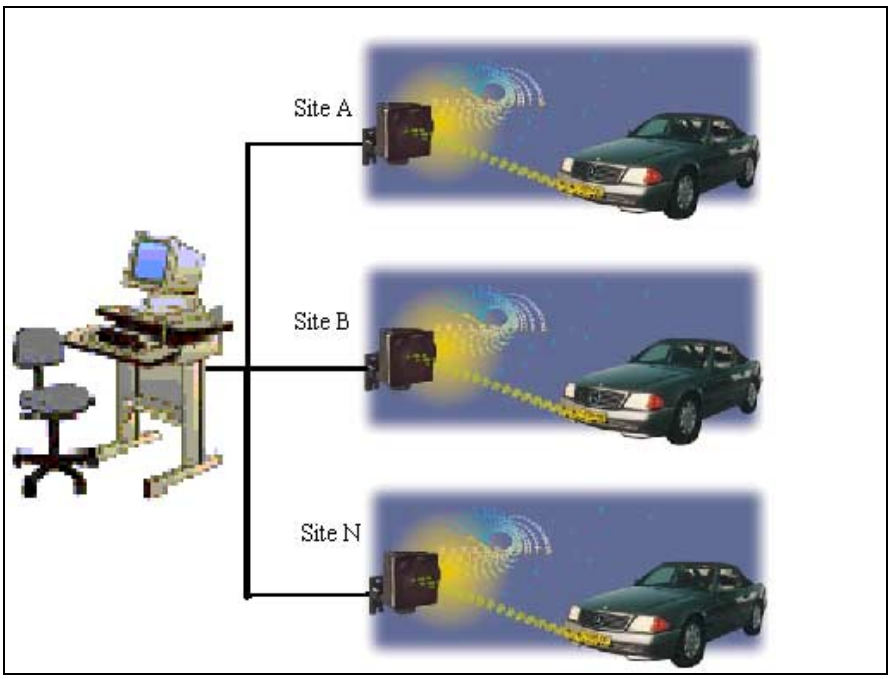


Figure 20 Networked LPR Sites

The sites will be connected together by a network. The recognition results (grouped in a block consisting of several recognition results) are transmitted over the network The TCP/IP protocol is used for this transmission. Each of the Client applications will be a **server** in this network, and connect to the **client** (the central application).

Each of the Client/Server applications has a configurable list of TCP/IP addresses that specify the network connections. Adding a new site is simple so the traffic control system is easy to expand.

The information sent across the network includes also the system status in each site for on-line diagnostic status display.

Additional activities are possible through this network by maintenance technicians:

- change of configuration parameters settings
- software update
- update of list of known (allowed) vehicles
- Other applications as required.

System operation:

Vehicles identified as being important to log on a frequent basis would be enrolled into a database. This database would be stored on the central servers and mirrored on the local computers. When a vehicle that is enrolled into the database passes the camera, notification of that vehicle would be generated, along with any other required information, such as driver name or taxi association or type of vehicle etc.

The database could be generated from:

- Existing Databases
- Driver enrolment via SM, E-Mail, phone, web site etc.
- Uses of the system, that is when a vehicle is detected using the lane it could be then the enrolled into the allowed database.
- Any other existing or future data source as required.

The cameras will capture all vehicles entering and exiting the lanes, storing the vehicle image, license plate if present, date, time, lane and image. The software will allow vehicles to be enrolled into an allowed list, linking this information to the license plate. If a vehicle is detected which is not allowed to use the lane, this will be recorded. If the vehicle is in the black list, an alarm will be generated. The average speed of the vehicle will be automatically determined and an alarm generated if it is over the set speed

System stability

The See Lane systems are based on proven applications that are running in many installations worldwide - in hundreds of lanes and many diversified applications. The newly developed systems share most of the common modules in these systems (such as the recognition DLL), and are tested in various types of tools and methods that are used by HTS development for years. Thus, their stability is guaranteed by the experience in such systems, the development and test methodologies, and in the proven components that build these systems,

Data Output

Data will initially be acquired and kept for every vehicle, and ARUP TRANSPORT PLANNING will determine which images to keep and which to discard. The data for each vehicle will include:

1) **Image** - A stand alone, human readable monochrome JPEG image with a resolution of approximately 1600 pixels by 1024 pixels (for See Lane). This image will display the detected plate on the best recognized image within the set of images that are captured for that event.

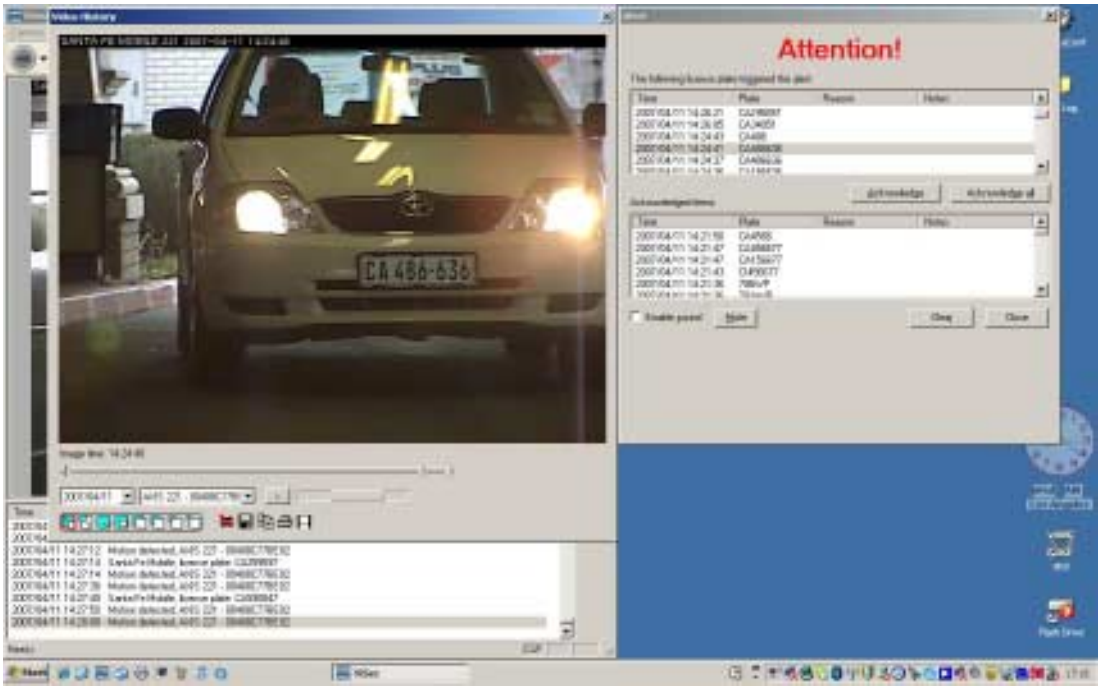


Figure 21 Front end of the LPR solution

2) Optical Character Recognition **Data**:
• Lane (Site) unique ID integer number
• License Plate string
• Date and Time of Image Capture
• File Name (a link to the name of the resulting .jpg file stored in the ARUP TRANSPORT PLANNING server)
• Confidence of the recognition result

The data will be transmitted to the TCS in two forms:
a) Windows DDE (Dynamic Data Exchange) Message - sent to the ARUP TRANSPORT PLANNING server over the TCPIP network. The DDE will contain the VES Optical Character Recognition Data as described above.
b) Image file - which will be stored on the ARUP TRANSPORT PLANNING server, then transmitted to the ARUP TRANSPORT PLANNING over the NCS via a dedicated transfer service running on the Trip Processing Server.

OCR Engine

All of the systems (2 See Lane sites of 4 front cameras) employ the same See Car OCR engine, which will run on the local processing units. The OCR engine processes images, locates the relevant license plate ID in the image, and produces an alphanumeric result for each image processed. The OCR engine is based on neural network technology and can be trained to recognize different fonts, characters and syntax. The systems supplied for the ARUP TRANSPORT PLANNING Project are specially trained to recognize license plates in Southern Africa, and focus on the local South African plates.

Images and video clips

If “Transfer Images” option is configured in See Data settings the application will handle the transfer of locally saved images and video clips from the front end hosts to the SeeData Central Server station.

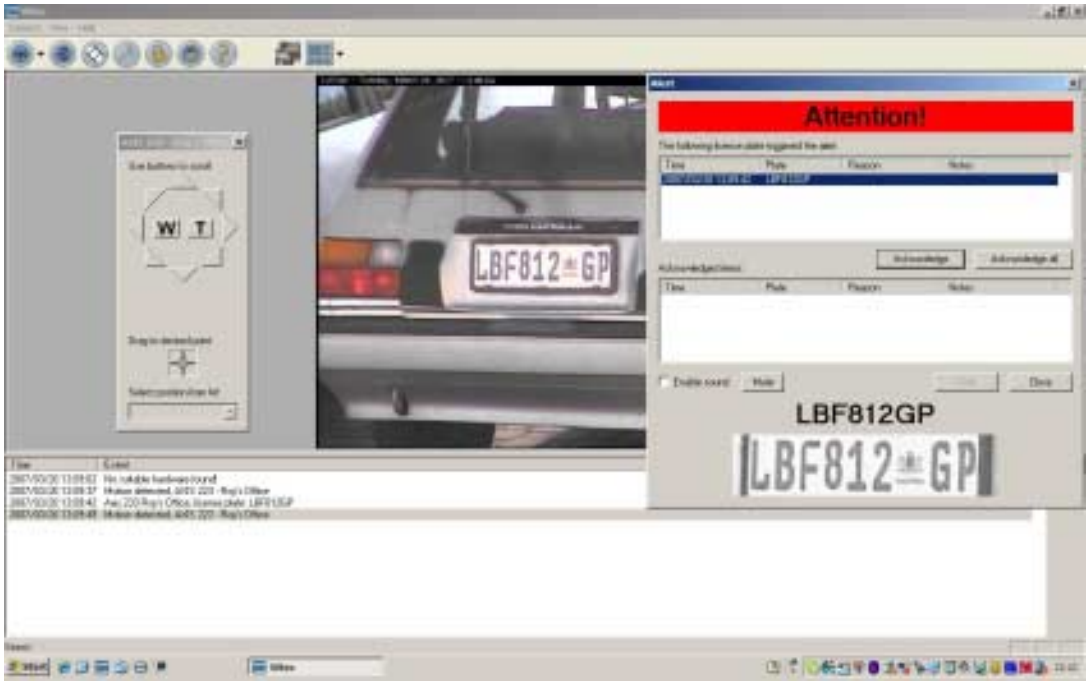


Figure 22 Rear LPR capture and recognition with alarm

Recognition data

Vehicle topic is used for transmitting of recognition data (See Data output). Items of the topic are:

- **CarCode** – string contains recognized license plate
- **Name** – string contains driver first and last name as was found in database
- **Time** – event time in format: “Mon Jul 03 14:29:06 2006”
- **LaneId** – string contains lane index (zero based)
- **Authorized** – string “1” (vehicle is authorized) or “0” (not authorized)
- **File** – string contains saved vehicle image path

• **Confidence** – string contains recognition confidence (“0”-“100”)
• **PlateType** – string contains one based index of plate format
• **Trigger** – string contains exact trigger time stamp in format:”032809233”, which means 3 h 28 m 09s 233 ms

LOG OF EVENTS

Figure 23 Log of the data and images from each site

Figure 24 Vehicle Logged

ALARM GENERATION

A list of vehicles which, when captured, will result in an alarm, can be added to the system. Which vehicles are added to the list, who adds them and how they should be removed needs to be determined.

The alarm list is stored on the central computer and replicated on each of the field computers.

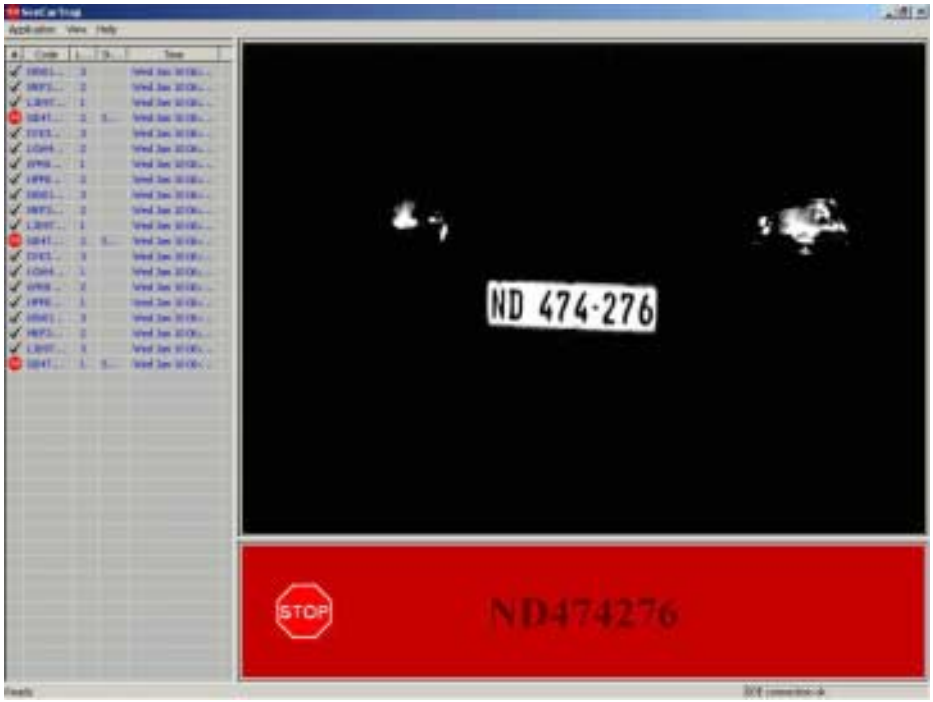


Figure 25 Alarm on vehicle detected

Pulsed Illumination unit

The highlights of the unit is:

- B&W camera with mounted lens
- Pulsed LED array (Near Infra-Red spectrum)
- Case (IP 65 , weatherproof, Enforced Poly-Carbonate, UV protected)
- Control circuit (sync and pulse control, illumination level control)
- Power supply (3A 15VDC) and cables
- Mechanical interface (with 2 degrees freedom)
- Inputs: 2 lines TTL (3 levels of intensity + off)
- Output: Composite Video 1Vp-p / 75Ω
- ISO 9002 Manufactured (by Hi-Tech Solution's sister Company)

The unit is integrated in the LPR unit Windows application, which switches the unit on (only when the vehicle is present), controls its illumination level in various sequences (based on the recognition results and the setting parameters), and captures its images for recognition and optional archiving.

This compact and highly integrated unit is installed Worldwide in hundreds of lanes in various applications and configurations.

Figure 26 Image illustrates the use of the IR.

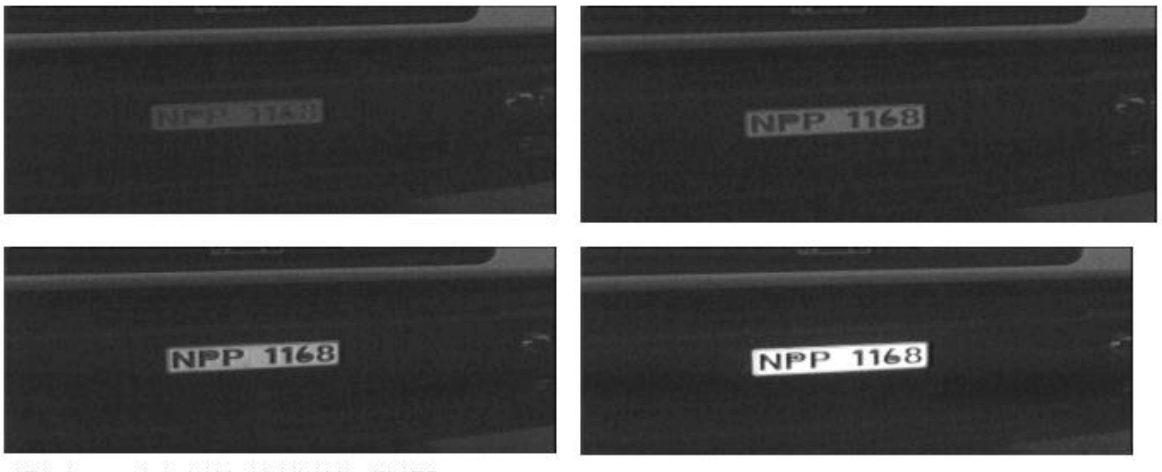


Figure 27 Image illustrates the pulsed operation of the LPR system

Truck Onsite Determination

The following is an example of software developed using the information generated from the LPR hardware and software in the field. The SeeCarFlow application uses the data generated by a number of LPR sites the field for various applications.

Overview

The central application receives recognition updates from all the sites, analyzes the data and matches the vehicle appearances, calculates the data and stores it to database, and displays it in real time.

Figure 28 Time IN and Time OUT

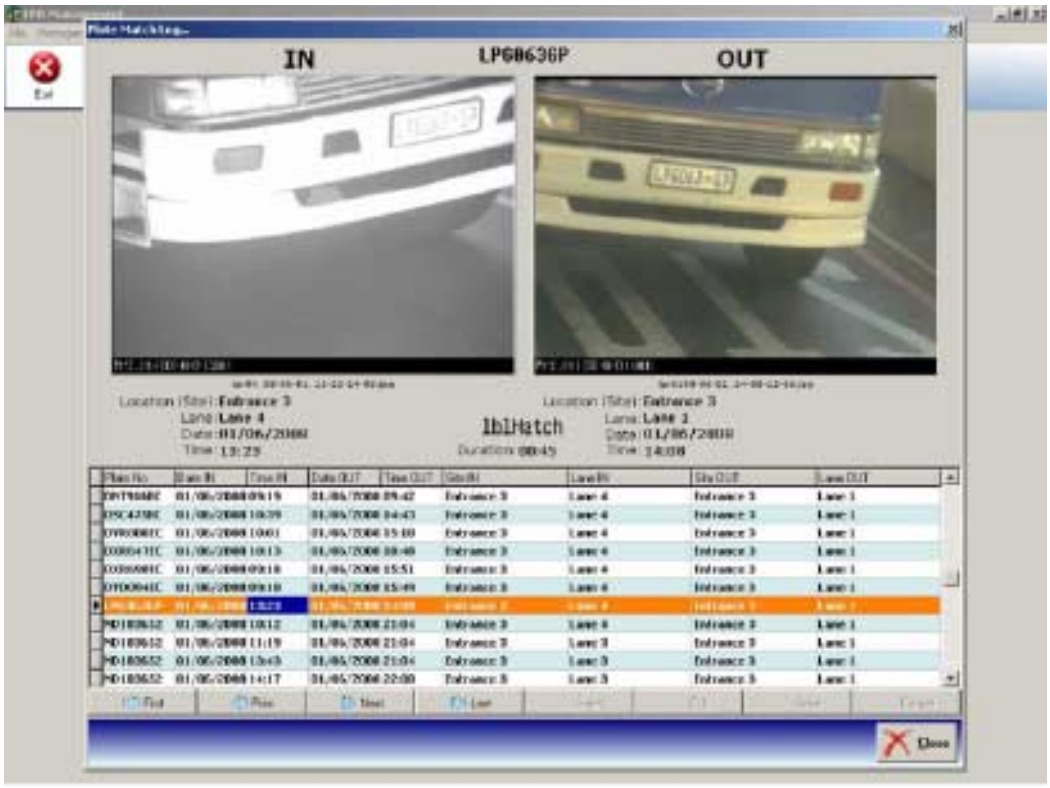


Figure 29 Time on site calculated at 45 min

Figure 30 Time on site: 10 hours 52 min.

Phase I: TRUCK TIME ON SITE

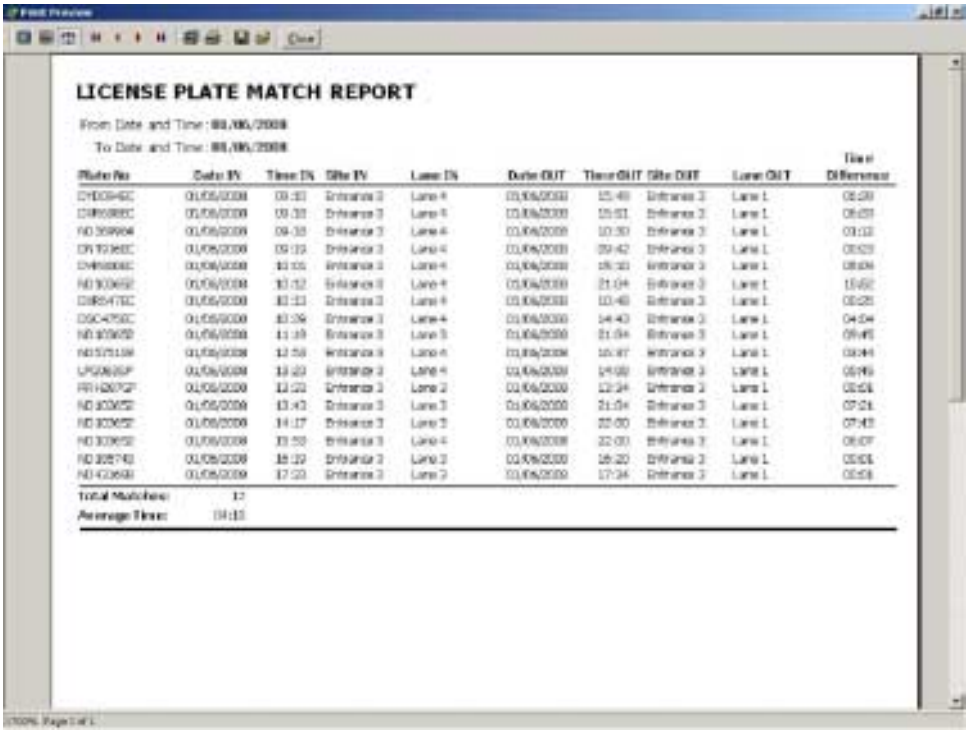
The initial phase includes 2 LPR cameras, with the LPR software. Two overview cameras are included, allowing the truck to be captured when no plate exists or additional info is required. The cameras will be wirelessly connected to the PC in the main office, with a link to the homes on site allowing live and remote viewing. The existing cameras are at this stage linked to the new software, and in the next phase would be replaced with new cameras. The software allows details of known vehicles to be entered and linked to the plates detected. All this data is backed up offsite. The install cost included all cables and material required, other than those detailed below, including permission, power and an ADSL link.

Three payment options are offered:

- A capital amount of R130 004.00 (VAT Excluded) OR
- A monthly rental of R4 981.75 (VAT Excluded) OR
- A cost per transaction solution of 50c per vehicle (VAT Excluded).

You select the best financial option for your current cash flow and long term requirements.

Based on 150 overnight trucks a day, plus 50 fuel (or short term) trucks (those remaining for less than one hour, there would be a total of just over 6 000 vehicles per month.
Based on a rental of R4 981.75, this would be 82c per truck.
However if you took the cost per transaction option of 50c, the monthly cost would be R3 028.91


LICENSE PLATE MATCH REPORT

From Date and Time :

To Date and Time :

Plate No	Date IN	Time IN	Site IN	Lane IN	Date OUT	Time OUT	Site OUT	Lane OUT	Time Difference

Total Matches:

Average Time:

Figure 31 Time IN and Time OUT

Two locations had detailed site visits and based on this the following is proposed:

Products	Licensing	Pricing	Qty	Phase I	Qty	Phase II	Qty	Phase III
F4plus (T/A, A/C, 2800 F/P, TCP,RS485,Flash)	Per Device	R 4,807.70	0	R 0.00	1	R 4,807.70	4	R 19,230.82
Sabre LPR Parking 01 Lane	Per Device	R 15,000.00	2	R 30,000.00	2	R 30,000.00	4	R 60,000.00
Driver License / ID Book Scanner (Single Side) HW only	Per Device	R 3,750.00	0	R 0.00				
Driver License / ID Book Scanner (Single Side) HW & SDK	Per Device	R 8,750.00	0	R 0.00				
Driver License / ID Book Scanner (both Sides) Duplex HW only	Per Device	R 4,750.00	0	R 0.00				
Driver License / ID Book Scanner (both Sides) Duplex HW & SDK	Per Device	R 9,750.00	0	R 0.00				
3-D Facial Recognition - Client	Per Device	R 37,350.00	0	R 0.00				
3-D Facial Recognition - Server	Per Device	R 37,350.00	0	R 0.00				
LPR Camera (Select from LPR Camera Spreadsheet)	Per Device	R 10,659.00	2	R 21,318.00	2	R 21,318.00	4	R 42,636.00
8 port Fast Ethernet Desktop Switch with Power over Ethernet. 4-PoE ports	Per Device	R 999.00	1	R 999.00	1	R 999.00	1	R 999.00
AXIS Video Server (4 Channel)	Per Device	R 8,750.00	1	R 8,750.00	1	R 8,750.00	1	R 8,750.00
DVR Software	Per PC	R 4,978.00	1	R 4,978.00	1	R 4,978.00	1	R 4,978.00
OVERHEAD CAMERAS TO RECORD vehicle TYPE	Per Device	R 3,750.00	2	R 7,500.00	2	R 7,500.00	4	R 15,000.00
PC	Per Device	R 4,750.00	2	R 9,500.00				
Wireless links	Per Device	R 5,750.00	3	R 17,250.00	1	R 5,750.00	1	R 5,750.00
AXIS 233D 50Hz 35x optical zoom dome camera with WDR and area zoom. Auto day/night mode down to 0.5 lux in color and 0,008 in night mode. Continuous 360° rotation and 180° tilt with E-flip. Progressive Scan 4CIF resolution at 30/25fps in MPEG-4 or Motion JPEG. Two-way audio, I/O for alarm/event handling. Includes hard and drop ceiling mount kit, smoked and clear transparent covers and power supply.	Per Device	R 19,978.00	0	R 0.00				
AXIS T95A00 Dome Housing Dome housing for AXIS 213, 214, 215 PTZ Network Cameras and AXIS 231D+,232D+, 233D Dome Network Cameras. Includes clear and smoked bubble, heater with fan, power supply for network cameras. 100-240 VAC input.	Per Device	R 2,137.85	0	R 0.00				
AXIS T95A61 Wall Bracket Wall bracket for AXIS T95A00 and T95A10 dome housing.	Per Device	R 675.00	0	R 0.00				
AXIS T95A67 Pole Bracket Pole bracket for AXIS T95A00 and T95A10 dome housing. Requires AXIS T95A61 Wall bracket.	Per Device	R 857.35	0	R 0.00				
Axis 295 Video Surveillance Joystick Professional joystick for accurate control over network of all Axis pan/tilt/zoom and dome network cameras. Connects to PC workstation over USB. Features a three-axis Hall Effect joystick with X/Y-axis for positioning and turning knob for zoom, and twelve programmable push-buttons.	Per Device	R 3,314.00	0	R 0.00				
Poles per M	Per M	R 2,750.00	2	R 5,500.00				
BOOMS	Per Device	R 12,850.00	0	R 0.00			2	R 25,700.00
BIDIRECTIONAL TURNSTILES	Per Device	R 14,530.00	0	R 0.00				
ZK5000 Reader for Take On Data or BioPC	Per Device	R 960.00	0	R 0.00	1	R 960.00		
Sabre Device Communication Software - T&A and A/C	Per Device	R 1,200.00	0	R 0.00	1	R 1,200.00		
25 Employees / Tenants	Per Site	R 1,199.00	0	R 0.00	1	R 1,199.00		
Access Control Basic Version only - Yearly Admin Fee	Unlimmited	R 300.00	0	R 0.00				
BioPC Hardware Emulator PC Based Software	Per Seat	R 499.00	0	R 0.00				
Thin ID Cards	Per Card	R 20.00		R 0.00				
ZK 5V UPS - 6-8Hours	Per Device	R 295.00	2	R 590.00	2	R 590.00	2	R 590.00
Cables per meter	Per meter	R 314.00	25	R 7,850.00	50	R 15,700.00	50	R 15,700.00
Upgrade from Basic to Premier Version **	Once	R 2,999.00	1	R 2,999.00	1	R 2,999.00		
Export to existing Payroll Packages **	Once	R 499.00		R 0.00				
Sabre Payroll	Unlimited	R 1,199.00		R 0.00				
Sabre Leave Management	Unlimited	R 599.00		R 0.00				
Sabre Advances on Salaries Management	Unlimited	R 599.00		R 0.00				
Sabre Management Software, Remote or Head Office*	Per Seat	R 999.00	1	R 999.00				
Device Monitor and Management Module - Per 16 Devices	Per 16 Devices	R 999.00	1	R 999.00			1	R 999.00
Live Data Collection (Server, Auto Download of Data) **	Once	R 1,199.00	1	R 1,199.00	1	R 1,199.00	1	R 1,199.00
Tracker Premier with SMS & E-mail - single PC**	1 PC Only	R 1,499.00	0	R 0.00				
Tracker Basic Software - Includes FREE Gateway	Per 5 Users	R 1,599.00		R 0.00				
Tracker Premier with SMS & E-mail - Includes FREE Gateway	Per 5 Users	R 2,199.00		R 0.00			1	R 2,199.00
Cell Phone & Web Tracking Module	Unlimited	R 959.00		R 0.00				
Remote Door Unlock Module	Per 5 Users	R 1,199.00		R 0.00				
Siren Management including 220V Relay Interface for PC	Per Device	R 1,199.00		R 0.00	1	R 1,199.00		
Standalone 247SMS Client - FREE with or without system	Unlimited	R 0.00		R 0.00				
Computer Based Training Material - FREE off web site	Unlimited	R 299.00	0	R 0.00				
Off Site backup of data - Free with Software Cover	Per Month	R 180.00	1	R 180.00				
Software Cover - Monthly R 180 by debit order	Per Year	R 2,399.00	1	R 2,399.00				
Includes Telephone / Remote Desktop Support and Updates	Sub Total Cost for System			R 123,010.00		R 109,148.70		R 203,730.82

Figure 32 Typical site designs and components

Phase II: Database connectivity

The 2nd phase of the proposed solution will link to the exiting data sources, allowing the license plate of each vehicle to be determined and linked to the transaction, no of litres, lane uses, license plate entered etc.

Figure 33 Possible database connections required

The current manual log will be replaced with an automatic log, accessible on site at the entrance, at the front desk, at the security check point, from home of the onsite managers and on the Internet.

A biometric device is proposed to log all staff.

Figure 34 Typical Site database

Phase III: AUTOMATION

The key to phase 3 is the automation of the overnight truck stop, allowing the automatic deduction of the fees due with limited manual interaction.

Products	Licensing	Pricing	Qty	Phase II	Qty	Phase III
F4plus (T/A, A/C, 2800 F/P, TCP,RS485,Flash)	Per Device	R 4,807.70	1	R 4,807.70	4	R 19,230.82
Sabre LPR Parking 01 Lane	Per Device	R 15,000.00	2	R 30,000.00	4	R 60,000.00
Driver License / ID Book Scanner (Single Side) HW only	Per Device	R 3,750.00				
Driver License / ID Book Scanner (Single Side) HW & SDK	Per Device	R 8,750.00				
Driver License / ID Book Scanner (both Sides) Duplex HW only	Per Device	R 4,750.00				
Driver License / ID Book Scanner (both Sides) Duplex HW & SDK	Per Device	R 9,750.00				
3-D Facial Recognition - Client	Per Device	R 37,350.00				
3-D Facial Recognition - Server	Per Device	R 37,350.00				
LPR Camera (Select from LPR Camera Spreadsheet)	Per Device	R 10,659.00	2	R 21,318.00	4	R 42,636.00
8 port Fast Ethernet Desktop Switch with Power over Ethernet. 4-PoE ports	Per Device	R 999.00	1	R 999.00	1	R 999.00
AXIS Video Server (4 Channel)	Per Device	R 8,750.00	1	R 8,750.00	1	R 8,750.00
DVR Software	Per PC	R 4,978.00	1	R 4,978.00	1	R 4,978.00
OVERHEAD CAMERAS TO RECORD vehicle TYPE	Per Device	R 3,750.00	2	R 7,500.00	4	R 15,000.00
PC	Per Device	R 4,750.00				
Wireless links	Per Device	R 5,750.00	1	R 5,750.00	1	R 5,750.00
AXIS 233D 50Hz 35x optical zoom dome camera with WDR and area zoom. Auto day/night mode down to 0.5 lux in color and 0,008 in night mode. Continuous 360° rotation and 180° tilt with E-flip. Progressive Scan 4CIF resolution at 30/25fps in MPEG-4 or Motion JPEG. Two-way audio, I/O for alarm/event handling. Includes hard and drop ceiling mount kit, smoked and clear transparent covers and power supply.	Per Device	R 19,978.00				
AXIS T95A00 Dome Housing Dome housing for AXIS 213, 214, 215 PTZ Network Cameras and AXIS 231D+,232D+, 233D Dome Network Cameras. Includes clear and smoked bubble, heater with fan, power supply for network cameras. 100-240 VAC input.	Per Device	R 2,137.85				
AXIS T95A61 Wall Bracket Wall bracket for AXIS T95A00 and T95A10 dome housing.	Per Device	R 675.00				
AXIS T95A67 Pole Bracket Pole bracket for AXIS T95A00 and T95A10 dome housing. Requires AXIS T95A61 Wall bracket.	Per Device	R 857.35				
Axis 295 Video Surveillance Joystick Professional joystick for accurate control over network of all Axis pan/tilt/zoom and dome network cameras. Connects to PC workstation over USB. Features a three-axis Hall Effect joystick with X/Y-axis for positioning and turning knob for zoom, and twelve programmable push-buttons.	Per Device	R 3,314.00				
Poles per M	Per M	R 2,750.00				
BOOMS	Per Device	R 12,850.00			2	R 25,700.00
BIDIRECTIONAL TURNSTILES	Per Device	R 14,530.00				
ZK5000 Reader for Take On Data or BioPC	Per Device	R 960.00	1	R 960.00		
Sabre Device Communication Software - T&A and A/C	Per Device	R 1,200.00	1	R 1,200.00		
25 Employees / Tenants	Per Site	R 1,199.00	1	R 1,199.00		
Access Control Basic Version only - Yearly Admin Fee	Unlimmited	R 300.00				
BioPC Hardware Emulator PC Based Software	Per Seat	R 499.00				
Thin ID Cards	Per Card	R 20.00				
ZK 5V UPS - 6-8Hours	Per Device	R 295.00	2	R 590.00	2	R 590.00
Cables per meter	Per meter	R 314.00	50	R 15,700.00	50	R 15,700.00
Upgrade from Basic to Premier Version **	Once	R 2,999.00	1	R 2,999.00		
Export to existing Payroll Packages **	Once	R 499.00				
Sabre Payroll	Unlimited	R 1,199.00				
Sabre Leave Management	Unlimited	R 599.00				
Sabre Advances on Salaries Management	Unlimited	R 599.00				
Sabre Management Software, Remote or Head Office*	Per Seat	R 999.00				
Device Monitor and Management Module - Per 16 Devices	Per 16 Devices	R 999.00			1	R 999.00
Live Data Collection (Server, Auto Download of Data) **	Once	R 1,199.00	1	R 1,199.00	1	R 1,199.00
Tracker Premier with SMS & E-mail - single PC**	1 PC Only	R 1,499.00				
Tracker Basic Software - Includes FREE Gateway	Per 5 Users	R 1,599.00				
Tracker Premier with SMS & E-mail - Includes FREE Gateway	Per 5 Users	R 2,199.00			1	R 2,199.00
Cell Phone & Web Tracking Module	Unlimited	R 959.00				
Remote Door Unlock Module	Per 5 Users	R 1,199.00				
Siren Management including 220V Relay Interface for PC	Per Device	R 1,199.00	1	R 1,199.00		
Standalone 247SMS Client - FREE with or without system	Unlimited	R 0.00				
Computer Based Training Material - FREE off web site	Unlimited	R 299.00				
Off Site backup of data - Free with Software Cover	Per Month	R 180.00				
Software Cover - Monthly R 180 by debit order	Per Year	R 2,399.00				
Includes Telephone / Remote Desktop Support and Updates	Sub Total Cost for System			R 109,148.70		R 203,730.82
				R 15,280.82		R 28,522.31
				R 124,429.52		R 232,253.13
Installation Cost per unit	Per Device	R 1,199.00	2	R 2,398.00	4	R 4,796.00
Onsite Warrantee per year ***	Per Device	R 1,199.00	2	R 2,398.00	4	R 4,796.00
One on One Training - Up to 8 Hours	Per Site	R 1,199.00	1	R 1,199.00	1	R 1,199.00

REFERENCE SITES:

ASD
AVERAGE SPEED
DETERMINATION

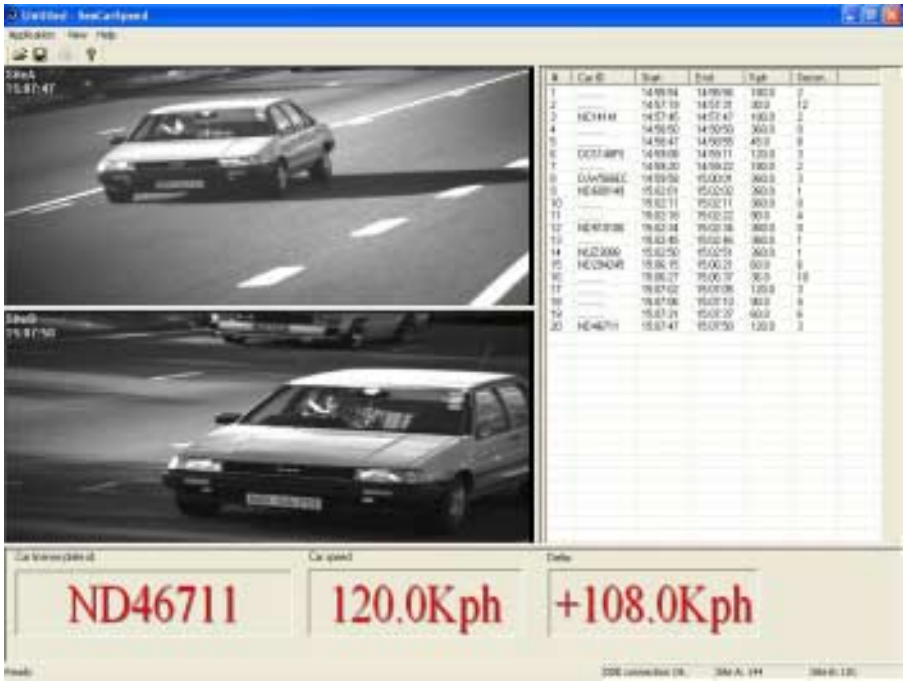


Figure 35 Durban M4 South ASD Example

The development of LPR started in 1995 and first systems were installed internationally in 1996/7. The first systems were deployed in RSA in 1999 by HTSOL

The years experience in ANPR within SA by ASD is over 15 years.

M4 Durban DEMO to Durban Metro

- Total number of vehicles detected: 1593
- Distance between Point A and B: 165M (theoretical distance with D Link directional antenna is 9 KM)
- Full system (Point A & B) hours in operation: 2
- Number of lanes (1 per site), slow lane

Figure 36 Trucks speeding on the M4 towards the airport

Figure 37 Visitors to Durban who obey the rules of the road

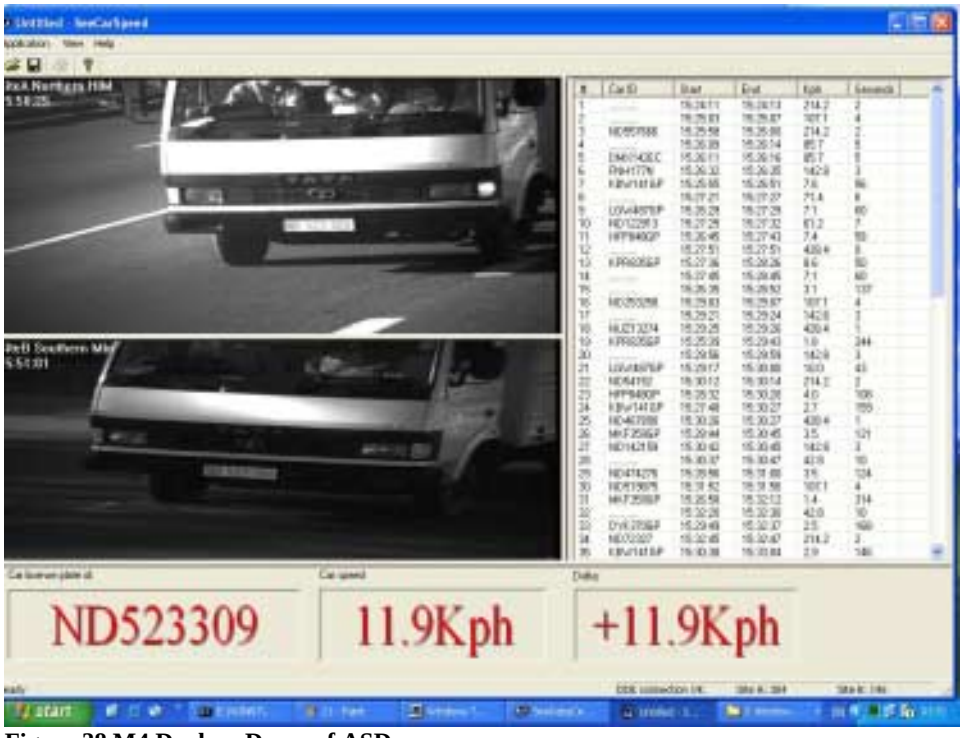


Figure 38 M4 Durban Demo of ASD

PMB to Durban – N3 from Ashburton to Camperdown by I-Cube / ASD

Full Name: John Schnell
Company: KwaZulu-Natal Department of Transport
Business: (033) 3558600
Business Fax: (033) 3558092
E-mail:john.schnell@kzntransport.gov.za
Web Page: http://www.kzntransport.gov.za

Figure 39 Ashburton on the N3

The 3 month demo went from the Ashburton off ramp (Bridge) on the N3 (above), past Camperdown off ramp (below) to Camperdown N3 (Old Road) bridge.

Figure 40 Camperdown on the N3

Ashburton

Figure 41 Ashburton Image Capture Example

Camperdown

Figure 42 Camperdown Image Capture Example

Figure 43 Average Speed Determination created from 2 sites on the N3

Figure 44 ASD example from the N3

Figure 45 Example of data obtained from LPR

Figure 46 Traffic Data Analysis

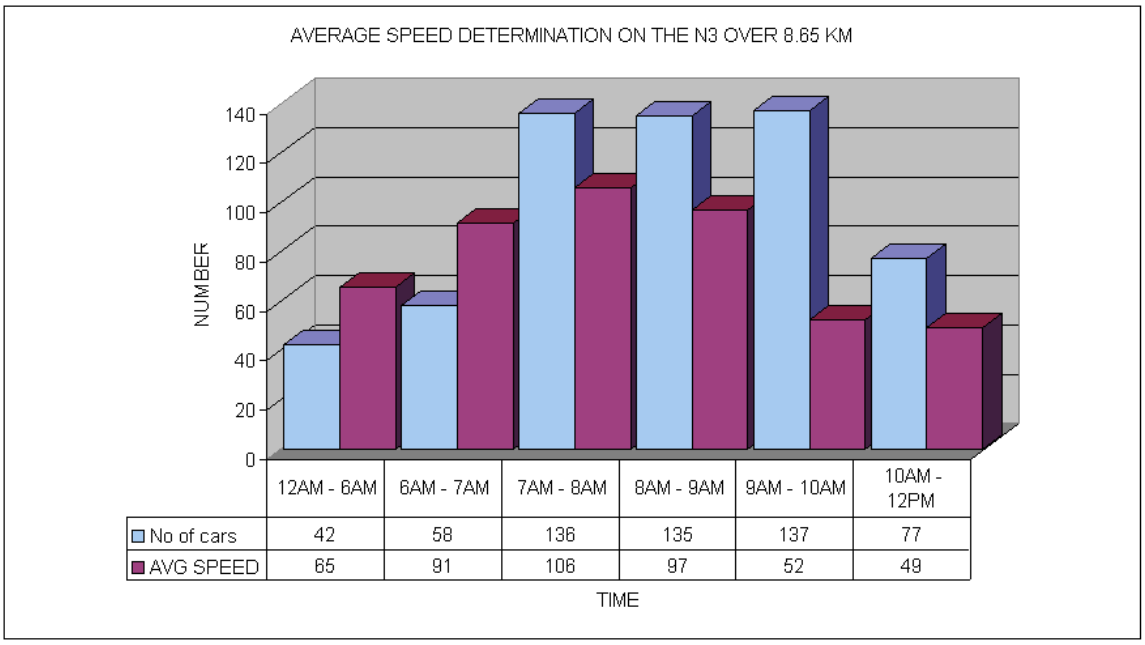


Figure 47 Data generated from the 1 day test on the N3 over 8 KM

Above is some data generated from the 1 day test on the N3 over 8 KM.

Figure 48 Example of a ASD operation in Europe

An example for a toll road installation with multiple lanes in Europe is shown in the following photo.

Hi-Tech Solutions to Supply High-Speed LPR Video Enforcement System for San-Diego SR125 Electronic Toll Collection Project

"The High-Speed LPR Video Enforcement System (VES) will allow the convenient free flow and access of vehicles into SR125"

Hi-Tech Solutions, together with InTranS Group of New York, have been awarded a contract to design and supply over 60 medium and high-speed License Plate Recognition (LPR) systems for the San Diego, CA State Route 125 Toll Road.

The project was awarded by the California Transportation Ventures, the operator of the new SR125 toll road, following a competitive bid process and will be deployed in early 2006.

Medium speed access LPR systems (SeeRamp) will be placed at on-ramps, off-ramps and toll booths, while high-speed travel LPR systems (SeeWay) will be placed at various points along the highway. The LPR systems will capture and locally process images on site, relieving the IT network from high volume, image traffic and bandwidth requirements.

SR 125 SOUTH

The LPR Video Enforcement System (VES) utilizes high-speed LPR technology (up to 100mph) for recognition of vehicle plate numbers, allowing greater precision in Video Violation Enforcement.

Once operational, the VES will allow the convenient high-speed free flow access of vehicles into SR125, while automating electronic toll collection (ETC) and essential fee processing activities.

The VES will improve customer service operations and reduce administrative overhead costs incurred in common toll booths and manual coin processing station lanes.

Record of Projects Completed in SA by I-Cube

Client	Nature of works	value of work for which the SUB-CONTRACTOR was directly responsible (excluding vat)	year completed
ACSA	3 Lane LPR system for Baggage access control and logging at Oliver Tambo	R180 000.00	2007
SPS	Vehicle Monitoring	R375 000.00	2006
Fourier Systems: N4 Toll Rd N3 Toll Rd	LPR Software	R67 000.00 R67 000.00 R67 000.00	2007 2006 2005
John Rupert	Access Control	R175 000.00	2002
SPOORNET HEAD OFFICE	2 Lane LPR system for access control and logging at SPOORNET head office	R220 000.00	2004
AVIS	6 site (multiple lanes per site) LPR for logging vehicles at JHB, DBN and Cape Town Airport's and AVIS service areas.	R1,2 million	2002
Digital Home Integration	Access Control & Logging	R75 000.00	2007

Services			
HIGHVELD Steel and Vanadium	6 lane Weigh Bridge Monitoring	R180 000.00	2006
FANG	Access Control	R105 000.00	2005
SEE Systems	Vehicle Logging	R125 000.00	2005

This system is installed in the gates of a South African University. It is used for gate control and theft prevention. The license plate of the cars entering is recorded along with the driver face. This data is compared to the information at the exit and the guard can see that the person at the entrance to the University was different than the person driving the car out. The system also provides statistics and data logging, as well as an on-line surveillance of the gates.

After the installation of this system the number of thefts decreased sharply. A sample actual record of an attempted theft is shown in the following animation.

The SeeCarTrap system is based on SeeLane recognition system and has special modifications for a roadside mobile system. This system is used for catching cars in cases of warrant of arrest, unpaid fines or taxes and stolen cars. It deals with a database of up to 0.5 million entries. The stand-alone real-time system automatically recognizes the car plate number then searches a database. It sounds an alarm when a car has been detected in the 'black' list, and displays the vehicle and arrest information contained in the record. This revolutionary system simplifies the roadblock operation and thus helps to increase selective enforcement.

The system is also connected to a large outdoor display that shows the car number, the car type, the reason for arrest and the name of the driver. This display can be seen by the police officer down the road. All the officer needs to do is wait for the siren, then stop the car and verify the arrest details, as seen in the film clip below.

The system is portable and installed in minutes by the police officer. It is installed in a battery powered lunch-box PC. It operates day and night on a free-flowing traffic at average speeds of 10-80 KMH. The system contains all the elements of a recognition system: hardware (frame grabber, optional IO card, and a special camera/illumination unit optimized for this application) and software (SeeRoad application and a client application). The application includes a special software trigger option which reduces the need to place a detector on the road, making the system portable and easy to install.

This system is installed in a traffic police violations processing center in Pretoria, South Africa (in conjunction with Labat Traffic Solutions using the Startrap Intelligence violation data processing system). It is used to automate the process of handling the fine processing (a fast turnaround from film to fine). The application reads both the license plate off the frame - together with violation information.

A sample violation is shown in the following photo. The frame, read from the film, includes the view of the car, the vehicle plate, and the violation information - which includes the date, location and speed, and is attached in the upper-right corner.

The system performs both access-control, parking and traffic-flow management functions. It provides solutions for a congested University entrance and enforces an overall traffic policy in its gates and parking lots.

The entrance display provides traffic guidance by displaying one of the 3 options (left 'Guests' for guest parking, middle 'GO' for entrance, and right for 'Inquiries'). The display is controlled by the management software which has multiple authorization lists. Faculty members can use an automated telephone Interactive Voice Response system which accepts requests for temporary passes. The security guards and officers can also change the permit lists on-line. The system keeps records of the traffic events. It also controls the access-control to internal parking lots.

The system consists of a cluster of LPR systems, a management software, and an outdoor traffic light display unit. Each of the camera/illumination units (SeeCarHead) is installed in a anti-vandalism metal cover. The LPR units are based on (SeeLane server application) which interfaces the hardware and performs the recognition process. It sends recognition messages to the client applications. Each of the client applications perform traffic management decisions and connect via network to a management software on a remote server.

This system is installed in the entrance to a new UK office compound and provides automatic access to authorized cars. The records of the entry and exit are recorded. The system automatically opens the gate for vehicles that match the authorized list. A large outdoor display greets the vehicles (as seen behind the gate).

This system part of a toll road system in South Africa. The license plate is read and used as a key to fetch the vehicle information from the toll database. The information is compared to a swipe card which is used by the driver. This integrated system reduces fraud and increases the toll income.

The toll system is based on a multi-lane (SeeLane) system which reads and verifies the plate data and sends a message to the toll control application. This

application uses the recognition information to obtain the vehicle data, which is matched to the swipe card information. The results are displayed to the operator and also sent to the control room for further processing of the frauds, and long-term data logging.

This

Vehicle Control & theft prevention (S.Africa)

Roadblock trapping system (S.Africa)

Violations Film Processing (S.Africa)

University Traffic management (Israel)

Office Access system (UK)

Toll station (S.Africa)

Border Control System (Hungary)

Parking System (Singapore)

Airport Parking (USA)

Bus station control (Colombia)

Average Speed Violation (Portugal)

C3 Access Control (Israel)

Double Security access Control (Israel)

University Security Control (Mexico)

Handheld license plate data entry (USA)

Parking Management (Korea)

Gated Community (Israel)

University Access (Korea)

Office Security (Israel)

Site Security (Spain)

Gated Community (USA)

Toll station (Colombia)

Shopping Center (Australia)

Casino Valet Parking (USA)

Port Gates (16 lanes) (Ghana)

Gated Community (Israel)

Shopping Center, 36 lanes (Chile)

Airport security, 8 lanes (Israel)

Shopping Center, 16 lanes (Hungary)

Toll Road, 54 lanes (USA)

ASD KEY COMPANY PERSONAL PROFILE

With over 78 sites in South Africa, the I-Cube LPR system is the leading software solution. I-Cube was the first company in Africa to implement real time (sub second), high speed (over 175 KM /H), multi-lane LPR solution in a free flow environment, incorporating average speed determination (on an average 35 000 vehicles a day).

Barry Fryer Dudley, the CEO of ASD is a committee member of the KZN Computer Society of South Africa.

Presentations: **Neural networks to enhance safety in local authorities: automatic identification, tracking and alarm** at TECHNOLOGY IN LOCAL GOVERNMENT RAISING LEVELS OF SERVICES DELIVERY THROUGH TECHNOLOGY 20-21 JUNE 2006 – MIDRAND

Education: MBA at the University of Natal, speciality: IT Information Management & E-Commerce. The MBA dissertation, **Casino Exclusion Technique Exploration - Framework Development,** examines the possible solutions to excluding problem gamblers from SA casinos.

University of Natal, Pietermaritzburg, Republic of South Africa – M.S. thesis (Cum Laude) in Microbiology (April 1999). Thesis Title: *"Application of Image Analysis in Microecophysiology Research: Methodology Development."*

Publications: The Industry Journal for Security and Business Professionals Volume 11 No. 2 Pg 34/35 DIVERSITY OF LICENSE PLATE RECOGNITION

APRIL SECURITY FOCUS (Vol 22, No. 4) Facts, features and benefits of facial recognition

A. Refereed Journals

Invited and Published

B.T. Dudley, C.A. du Plessis and E. Senior. **"Managing leachate in landfills through manipulation of soil cappings: Image analysis studies"**, *Binary - Computers in Microbiology*, Vol 6, 120-127. (1994)

Submitted and Published

B.T. Dudley, A.R. Howgrave-Graham, A.G. Bruton and F.M. Wallis. **"The application of digital image analysis to quantifying and measuring UASB digester granules",** *Biotechnology & Bioengineering*. 42, 279 - 283. (1993)

B. T. Dudley, A. R. Howgrave-Graham, H. Isherwood and E. Senior. "Laboratory-scale UASB digesters (with/without conditioning tank and recycle): efficacy to treat increased hydraulic loads", *Water SA*. 19, 313 - 318. (1993)

B. Papers Presented at Professional Meetings

Invited and Published

B.T. Dudley, C.A. du Plessis and E. Senior. "Managing leachate in landfills through manipulation of soil cappings: Image analysis studies. Image Analysis of Microbes in Their Habitats". Society for General Microbiology Meeting on Image Analysis at Warwick, United Kingdom, 5 - 7 January 1994.

Submitted and Published

B. T. Dudley, E. Senior, A. G. Bruton and F. M. Wallis. "Image analysis methodology development for use in microecophysiology studies of microbial associations in landfill cover soil". Seventh International Symposium on Anaerobic Digestion, Cape Town, 23 - 27 January. (1994)

Extract from

South African Police Service
Criminal Database

Host request reference:	21083
User reference:	1059
Search date / time:	2007/10/01 21:23:10
SA ID / Passport number:	6909195135088
First names:	BARRY THOMAS
Surname:	FRYER DUDLEY
Population group:	White
Gender:	Male
Date of birth:	1969/09/19
Country of birth:	SOUTH AFRICA
Address:	82 KLOOF FALLS
	KLOOF DURBAN
Previous charges declared:	NO
Search type:	INDIVIDUALS
Reason for enquiry:	
Fingerprints taken at:	DURBAN
Barcode number:	
Receipt number:	
Result:	*NO ILLICIT ACTIVITY IDENTIFIED*

The result is a reflection of the status of the applicant on the South African Police Service Criminal Database on the search date / time as indicated above and should be used accordingly. Illicit Activity after the search date / time will therefore not form part of this result. No Illicit Activity and Possible Illicit Activity reports can be authenticated on the www.AFISwitch.co.za website.

Printed on 2007/10/03 12:26:58PM

deco
unique identity management

CURRICULUM VITAE : Dr. M. F. MITCHELL,

CHAIRMAN OF ASD

1. Personal Details

Name	**Dr Malcolm F, MITCHELL**
Nationality	South African
Profession	Civil Engineering: Registered Professional Engineer.
Specialisation	Transportation Engineering and Administration.
Date of Birth	26.11.1935
Company	Consultant in single person Private Practice, following retirement from Department of Transport.

2. Key Professional Experience

Dr Malcolm Mitchell had a distinguished career in civil engineering and public administration spanning over 40 years before he retired as Deputy Director-General at the South African National Department of Transport in 1998. His Doctoral dissertation in Transportation Engineering related to a strategy for developing a road network in Southern Africa and extensively dealt with institutional and financing aspects of road administration, including road charging/pricing and fund allocation procedures. His thesis for the Master's Degree in Public Administration related to the development and management of a toll road system for South Africa.
He has had over 70 papers published, received the SAICE Transport Division Award for outstanding services to the Transportation Engineering Profession (1994) and served on both the S A Roads Board and the Board of Control of the S A Rail Commuter Corporation. He was the first Chairman of the South African Committee of Land Transport Authorities, and the "Roads Function" Committee, a Treasury body responsible for managing the allocation of all roads funds in South Africa, as well as many other government and professional committees. He was also an external examiner at several universities, the President of the Chartered Institute of Transport in Southern Africa and a Senior Fellow and Council Member of the South African Institution of Civil Engineers.
Key areas of experience include:

- Road Management and Toll Roads
- Quality Control of Road Construction
- Transport Policy Formulation and Implementation
- Civil Engineering Contract Documentation and Dispute Adjudication

- Road Design and Supervision of Road Construction and Contracts
- Geotechnical and Pavement Engineering
- Road Financing, Project Programming and Strategic Planning for Transport
- Urban Transport Planning and Management

3. Education and Qualifications

- B.Sc.Eng. (Civil): University of Natal, 1956; Won Certificates of Merit for various individual courses; Awarded status of "Scholar of University of Natal" Won final year civil engineering design thesis prize

- B.Admin (Hons): University of South Africa, 1986.

- M.Admin (Public Admin): University of South Africa, 1989; Distinction level passes in Advanced Public Financial Management and Advanced Public Policy Making. Dissertation : Administration of Toll Roads in South Africa with Special Reference to Policy Making, Organisation, Financing and Control

- D.Eng (Transportation): University of Pretoria, 1991; Dissertation : Contributions to Establishing an Appropriate Road System for Southern Africa

4. Some Professional Affiliations, during career.

Previously: -
President, Chartered Institute of Transport in South Africa
Member (and often acting Chairman) South African Roads Board
South African representative on World Road Association (PIARC) Permanent International Commission
Member of the Executive Committee of World Road Association
Chairman South African Civil Engineering Advisory Council
Member of Council, and Executive Committee Member, South African Institution of Civil Engineers
Member of Civil Engineering Joint Consultative Committee (JCC) comprising SAICE, SAFCEC and SAACE representatives
South African Representative on SATCC Committees
Chairman South African National Committee on Tunnelling
Member of Board of Directors of South African Rail Commuter Corporation
Chairman : Committee of Land Transport Officials and Committee of State Road Authorities
Deputy Chairman, National Road Safety Council
Chairman : Annual Transportation Convention Organising Committee
Chairman : Transportation Division, South African Institution of Civil Engineers
Member : CSIR Transportation Division, Research Steering Committees
Member : Various Metropolitan Transport Advisory Boards

Currently Member : Engineering Council for South Africa, Professional Advisory Committee for Civil Engineering

5. Experience Record

1998 to date Following retirement from Department of Transport, established a one person professional consulting practice, specialising in Transportation matters. Was Specialist Consultant to Transportek Division of the Council for Scientific and Industrial Research until the end of 2005, Chairman of the Dispute Adjudication Board for the Maguga Dam project in Swaziland, and has carried out work for the Development Bank of Southern Africa and some consulting engineering firms. He is currently Executive Director of the South African Road Federation and a member of the Civil Engineering committee of the Engineering Council of South Africa. He is currently registered with the Johannesburg University as a D.Phil. student, with a dissertation examining the development and impact of transport policy in South Africa during the 20th century.

1989 to 1998 **Department of Transport - Deputy Director-General**
Overall responsibility for central government activities in respect of all aspects of Land Transport in South Africa, including roads, urban transport, road traffic management and safety, transport policy formulation and strategic planning, research and development and freight and public passenger transport.

1984 - 1989 **Department of Transport (Chief Director of National Roads)**
Responsible for overall management of all National Roads in South Africa

1980 – 1984 **Department of Transport (Chief Engineer/Director)**
Overall responsibility at central government level for National Road financial management and project programming and strategic planning, as well as urban transport planning activities for all national roads and metropolitan transport areas in South Africa.

1972 – 1980 **Department of Transport (Assistant Chief Engineer)**
Head of Materials and Pavement Design Section and, responsible at central government level for supervision of road design, construction, quality control, geotechnical design, and pavement maintenance activities on all National Roads (including research).

1970-1972 **Department of Transport (Assistant Chief Engineer)**
National road design and supervision of construction and maintenance contracts at regional level.
Route location for new national road (N3) over the Drakensberg mountain range (100-km)

1966 – 1970 **Consulting Engineer (Senior Engineer to Associate Partner)**
National and provincial road design (Geometric and pavement),
Supervision of road contracts
Geotechnical engineering design and management of geotechnical and materials laboratory testing

1962 – 1966 **Natal Roads Department (Engineer Grade I to Principal Engineer)**

Quality control of road construction, geometric, pavement and geotechnical design of provincial and national roads, bridges and interchanges (200 km road and 5 interchanges) and management of materials testing laboratory.

1956 – 1962 **South African Railways and Harbours**
On site responsibility for construction of railway tunnels (five twin tunnels, including the current second longest railway tunnel in South Africa), approximately 50 km of new railway lines involving heavy earthworks various new stations and bridges and major mechanical workshops, as well as maintenance of 250 km of open line.

6. Selected Career Achievements

- Initiated, promoted and directed introduction of toll roads in South Africa as a road pricing financing mechanism.
- Initiated and administered the first two comprehensive National Transport Policy Studies between 1984 and 1996.
- Initiated, promoted and participated in research and development of procedures for road financing, fund allocation, project prioritisation, road needs studies and cost/benefit analysis for roads, in South Africa.
- Initiated, promoted and directed the extensive use of concrete pavements for heavy-duty roads in South Africa as well as drawing up of a design manual for concrete roads.
- Promoted the use of, and procedures for, statistical quality control for road construction.
- Introduced and promoted the first rational; planning approach to the provision of passenger transport services in Regional Service Council and Metropolitan areas in South Africa.
- Promoted the early development (circa 1973 – 1980) of road pavement management systems in South Africa.
- Initiated, promoted and directed developments in respect of revised approaches for road management in South Africa, i.e. the Road Agency concept.
- Involved in initial formulation and development of a project to draw up a Strategic Plan for Transport in South Africa.
- Promoted and directed initiation of Centres of Development in Transportation at selected South African Universities as well as Technology Transfer Centres for Transportation.
- Initiated and promoted first “Build, Operate and Transfer (BOT) National Road Project in South Africa (N1) in 1993.
- Recipient of CSIR award for “Contributions to Transportation Research”.
- Recipient of SAICE award for “Outstanding Contribution to the Transportation Engineering Profession.”

7. Publications

Has had over 70 refereed papers published, locally and overseas, primarily in the fields of Transport Policy and Institutional Arrangements, Road Management, Road Design and Road Financing, including Toll Roads and Road Concessions. Has won “Best Paper” awards at Conferences and in the SAICE Journal, as well as presenting papers, by invitation, at the World Bank.

OPTION: SUPPORT

HTSOL and the local partner, I-Cube provides a 7 year support program.

Free e-mail, telephone, remote login and live chat support is provided.


IQNet

THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

Quality Management System

ISO 9001:2000

Figure 49 ISO 9001 Certification

On site support is charged at R7 500.00 per day.

Figure 50 Products certified to FCC15, CE, UL, GS and IEC60825-1

CERTIFICATION

MAINTENANCE

All software upgrades will be provided free for the 1st year. After the 1st year software maintenance will cost 15% of the purchase price of the software. If the software maintenance option is not selected this can be purchased when required at market prices.

It is essential that the system is suitably maintained and cared for. A monthly visit to both sites is suggested, which would cater for a wide variety of preventative system checks.

SPARES

Requires spares are:

1.00	Wireless links
1.00	IP Colour Camera with mounting, lens, housing and power supply
1.00	P4, 3.4 GHz, 2048 MB RAM, Windows XP
1.00	SW dongle for LPR

DELIVERY PERIOD - The period within which deliveries will be made:

Initial order: One week for existing software (LPR & ASD), three days for hardware which is in stock, longer for items which are not in stock, 4 days for the solution proposed and longer periods for custom developed software.

Subsequent orders: One week for existing software (LPR & ASD), three weeks for hardware which is in stock, longer periods for items which are not in stock or require custom developed software.

GUARANTEE - 3 year guarantee on software. Hardware carries a one year guarantee.

APPENDIX:
ADDITIONAL LPR INFO:

Further details on the proposed LPR solution is provided in the following appendices and on the supplied CD.

APPENDIX 1 – A PowerPoint introducing license plate recognition, LPR system design, showing the proposed site layout, how the LPR system works and some example images.
Root directory of the enclosed CD.

APPENDIX 2 See Lane Manual (PDF) – This document provides a technical overview on See Lane, a state-of-the-art vision based recognition system for roadside installations. The application is supported by a full set of optical and hardware subsystems as well as software applications and utilities.
Directory of the enclosed CD: \Manuals

APPENDIX 3: "Overview (PDF)" – Contains a brochure of the LPR solutions available from ASD.
Root directory of the enclosed CD.

APPENDIX 4: "See Lane (PDF)" – Contains a brochure of the See Lane software on which See Way is based.
Root directory of the enclosed CD.

APPENDIX 5: "EQUIPMENT SCHEDULE (XLS)" – Full equipment and software list, capital, rental or cost per transaction amounts
Root directory of the enclosed CD.

MANUALS

APPENDIX 6: "See Car DLL (PDF)" – Contains a brochure of the See Car DLL software on which See Way is based.
Directory of the enclosed CD: \Manuals

APPENDIX 7: "See Data (PDF)" – Contains technical information on the See Data a software service application that connects a cluster of recognition systems (such as See Lane or See Way) together by a network.
Directory of the enclosed CD: \Manuals

APPENDIX 8: See Lane Install (PDF)" – technical information on the LPR software install, operation and design.

Directory of the enclosed CD: \Manuals

APPENDIX 9: See Utilities (PDF) – Contains technical details of the See Utilities software describes the set of utilities that support Hi-Tech Solutions' See$_x$ products (such as See Lane, SeeTruck, SeeCrane or SeeLane). These utilities enrich our products, ease the technical support and cut the time to market.
Directory of the enclosed CD: \Manuals

APPENDIX 10: See Lane Manual (PDF) – Contains technical details of the See Lane software on which See Way is based
Directory of the enclosed CD: \Manuals

Figure 51 LPR Recognition

SA REFERENCE SITES

APPENDIX 11: "ASD N3 RESULTS Sat Jan 06th (PDF)" – Contains the typical daily results from the N3 for a single day
Directory of the enclosed CD: \ SA Reference Sites

APPENDIX 12: "ASD N3 RESULTS SUN JAN 7th (PDF)" – Contains the typical daily results from the N3 for a single day
Directory of the enclosed CD: \ SA Reference Sites

APPENDIX 13 IT WEB ASD Article 31 Oct 2006.(PDF)" – Contains details of the N3 ASD 3 month demo as covered by IT web

The directory on the CD: **SA Reference Sites** contains images from the N3 ASD demo.

The directory on the CD: **SA ASD DEMOS** contains working demos from:

- N3 ASHBURTON images (run PLAYER.EXE to see the demo).
- See Car Speed Demo (run RunMe.bat to see the demo of the ASD software)
- I-CUBE LPR Demo of RSA Customised Plates (run PLAYER.EXE to see the demo of colour images being recognised).
- N3 Camperdown Player EX (run PLAYER.EXE to see the demo of 380 cars recognised at high speed).
- Hand Held Plate Demo (run PLAYER.EXE to see the demo of a hand held unit being used to recognise license plates).
- Colour LPR_Demo.wmv – Demo of the colour camera capturing and recognising license plates.
- DBN Metro CCTV Control Room – A 1 hour test of the use of LPR in combination with the existing CCTV cameras. Images of all vehicles captured.

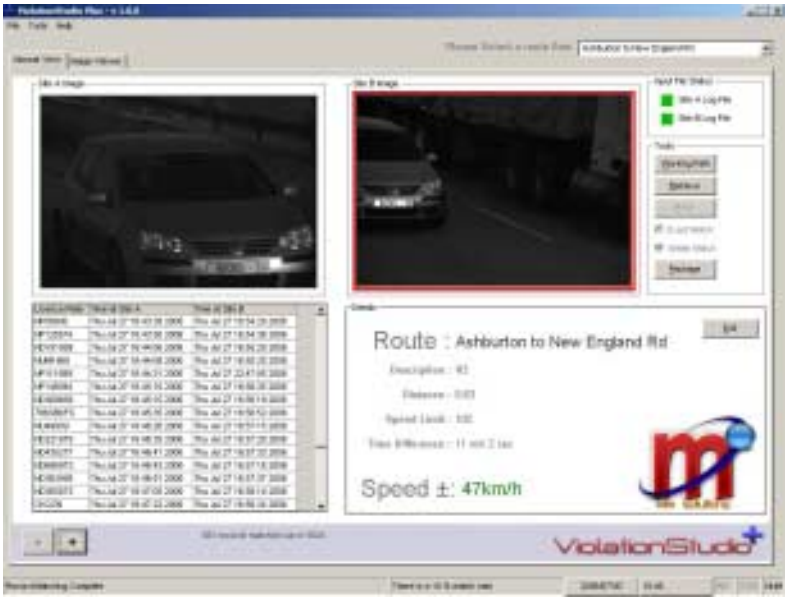


Figure 52 ASD on the N3

SOFTWARE

Drivers: Hasp – Contains the software for the Hasp (dongle) drivers

PRODUCT SPECIFICATIONS

APPENDIX 13: BEKA POLE_Spec.doc / BekaPole.pdf

APPENDIX 14: AXIS 223M Network Camera:
high performance camera, designed for demanding security installations. It delivers crisp and clear images disclosing every detail, thanks to its top quality 2.0 Megapixel progressive scan CCD sensor, Megapixel varifocal lens and advanced image processing.

APPENDIX 15: Duxbury_HSDPA_WirelessRouter.pdf Always on high speed internet connectivity

APPENDIX 16: Edge_Router-230M.pdf - Auto-sensing Ethernet Switch Equipped with a 4-port auto-sensing Ethernet switch. WAN type supported The router supports some WAN types, Static, Dynamic, PPPoE , PPTP ,L2TP, Dynamic IPwith Road Runner.

APPENDIX 17: quickbridge2_a4.pdf complete, user-installable wireless point-to-point bridging solution designed for reliable long distance and low latency voice and data connectivity. This high performance hop-in-a-box is available with 54 Mbps aggregate throughput.

APPENDIX 18: Swith.pdf The ProSafe FS108P provides power and data from a single point, using Power over Ethernet (PoE) over a single Cat-5 cable. The eight Fast Ethernet ports can be used for any 10/100/1 000 Mbps link and four of these ports can supply industry-standard IEEE 802.3af power

APPENDIX 19: ADI Company Profile.pdf ADI International is a leading international distribution business of security solutions and services with over 205 branch locations across Europe, the Middle East, Africa and America. ADI International has over 50 years of experience in the specialist security sector. We have built our business by developing personal partnerships with our customers, providing them with best of breed security solutions and bespoke support services to meet the ever changing demands of the market.

APPENDIX 20: AdleracEVRackDocument.pdf – Next generation environmental controlled racks.

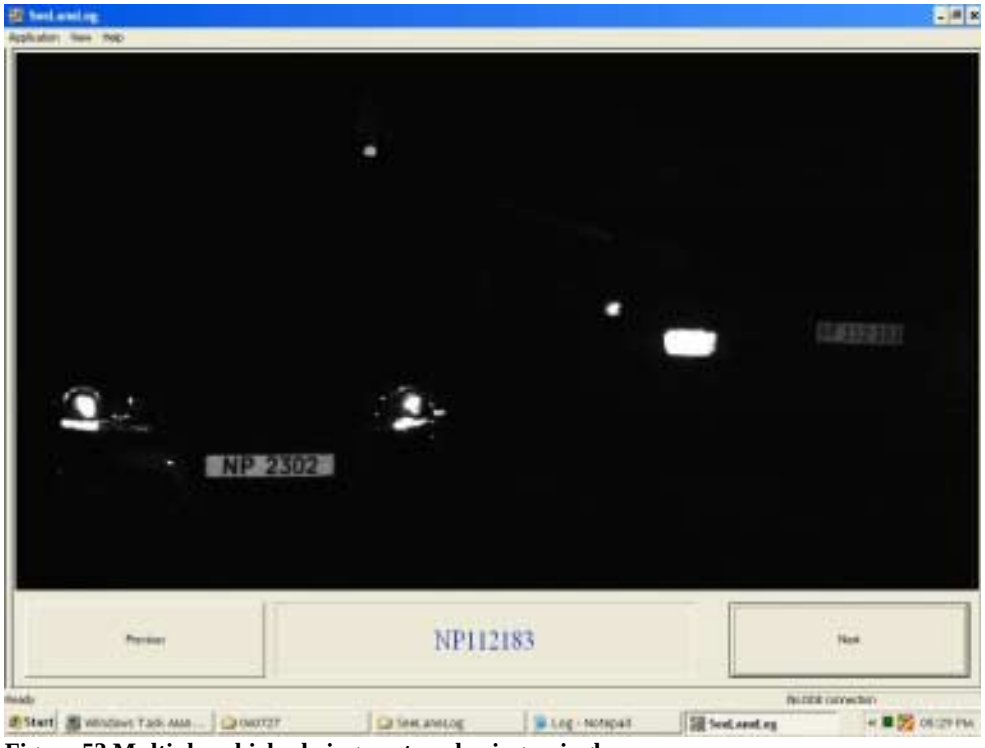


Figure 53 Multiple vehicles being captured using a single camera

AVAILABLE ON THE ENCLOSED CD OR FROM THE I-CUBE WEB SITE (www.I-Cube.co.za) ARE:

"SEE WAY DEMO" – Use the see way demo to see how the LPR software works over multiple lanes and watch as alarms are generated when the vehicle exceeds the set average speed above which alarms will be generated.

"PLAYER" – Use the PLAYER.EXE to watch the cars from the N3 & M4 being recognised using the LPR DLL

"SEE LANE" – Use the SEE LANE DEMO to see how the software works, enrol allowed cars, alarm on WANTED cars, see the log of all the vehicles and see a history of the vehicles.

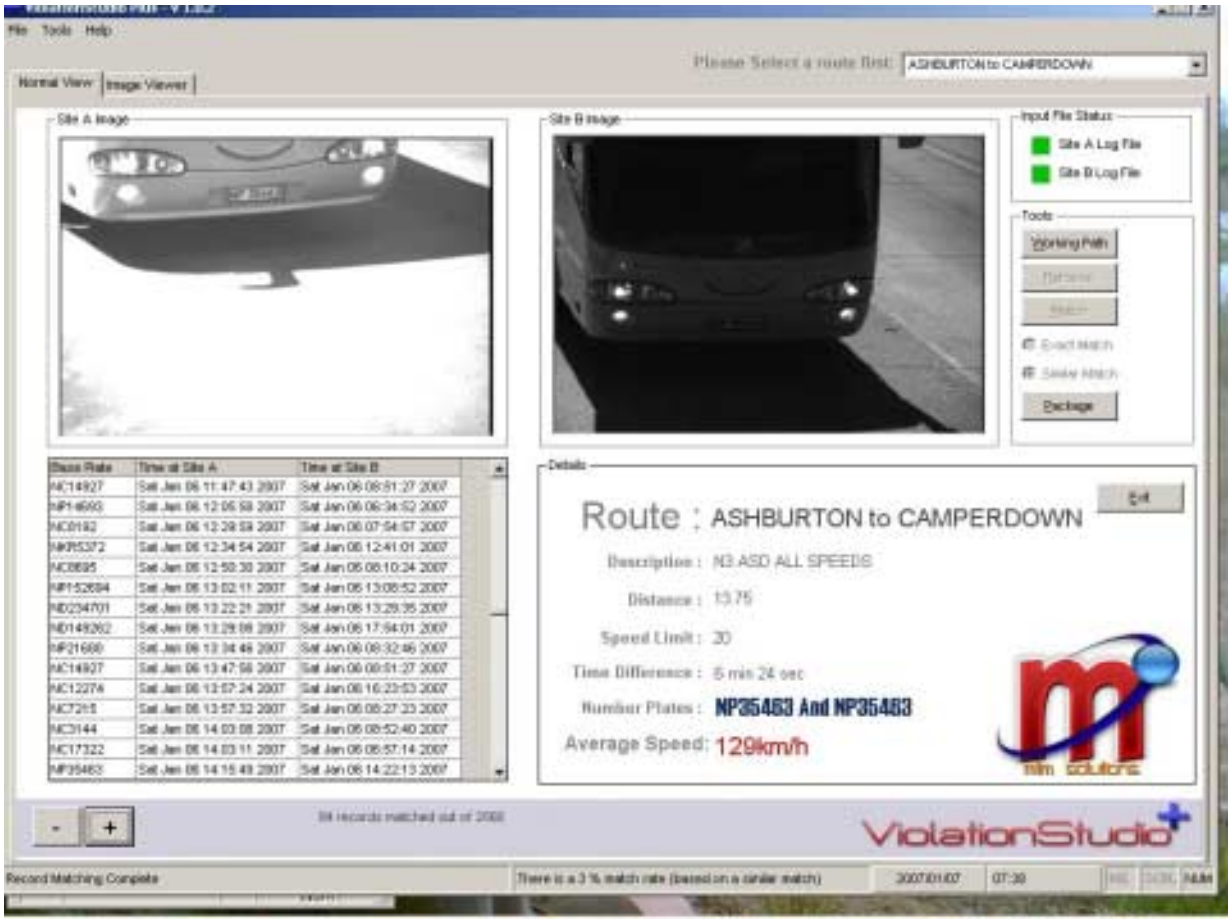


Figure 54 Bus logging at multiple sites

TO BE PROVIDED BY CLIENT

The following, non-exclusive, list of items would be required from in order for the project to proceed.

A clean, consistent, source of Electricity is required at all the sites in the field.

Permission to work in the areas designated would be required from the relevant authorities

The proposed solution will operate automatically however to ensure the system operates to the best ability, trained operators and service personnel are required.

An ADSL link is required for remote support and remote viewing of the data.

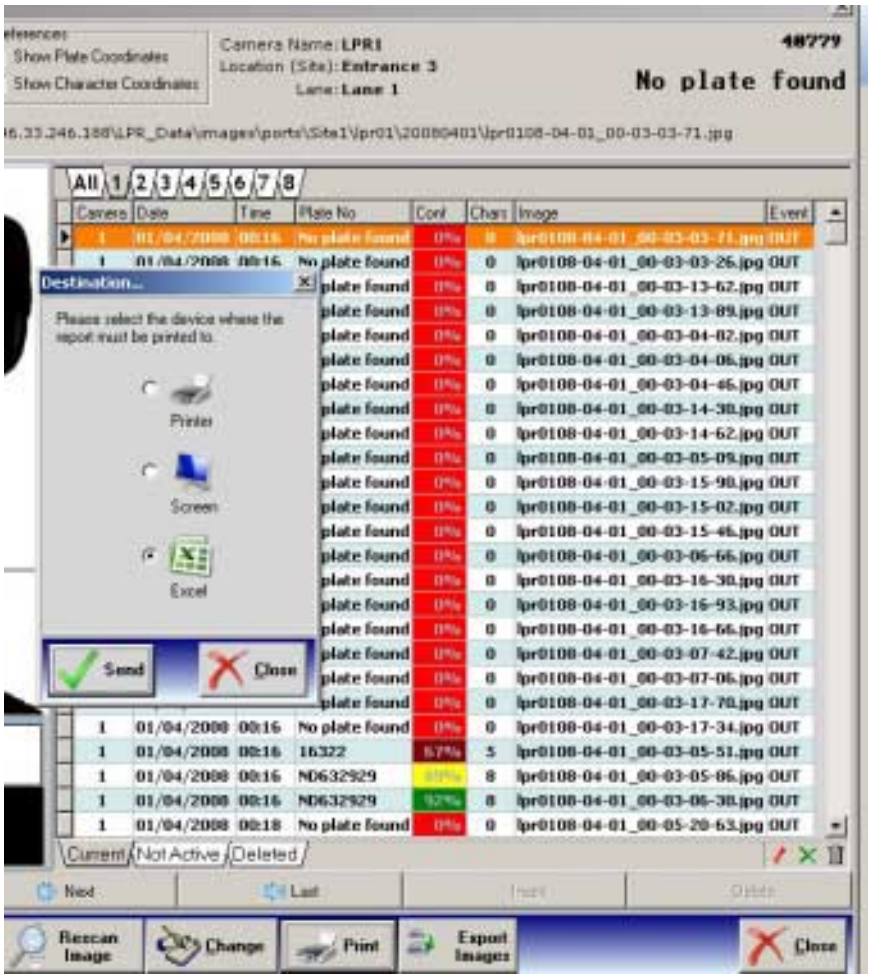


Figure 55 Time IN and Time OUT printed to excel, screen or the printer