Proposal for Distribution Centre

for

INSTALLATION OF A FULLY INTEGRATED WEIGHBRIDGE SYSTEM

MARCH 2008

Supplied by

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1 Executive Summary

We have pleasure in submitting our proposal for the **INSTALLATION AND MAINTENANCE OF A FULLY INTEGRATED ACCESS CONTROL AND WEIGHBRIDGE SYSTEM**, namely;…….. Through the rollout of the Access Control and Weighbridge Systems on offer in this proposal we will ensure a cost effective reliable and efficient solution with limited but effective maintenance and costs. Our optimal goal is to achieve availability beyond 99.95%.

…….. is committed to provide superior service to our clients. The leadership status we have already achieved in most sectors of industry is a result of our dedication to service excellence. With the combination of our extensive experience, knowledge and management skills in the industrial fields, and international affiliate and partner support available to us, ……. is well positioned to provide the most innovative and cost effective service to our clients. In developing this proposal we have comprehensively analysed the requirements for each site and ascertained that the following will be the correct solution;

We have selected the following three sites as reference sites and referrals:

1. Independent Freight Carriers – Pretoria
   Heavy Haulage & Transportation Sector

   Contact: Martin De Beer

   Consists of 2 weighbridges handling up to 250 payloads/day
2. Vriesland Saai Kudde – Vryburg
   Construction Sector

   Contact: Jop Fourie

   Consists of 4 weighbridges used for brick weighing
3. MC Engineering – Harrismith
   Diversified Agricultural Sector

   Contact: Mikkie Coetzee

   Consists of 13 weighbridges which are installed throughout South Africa, and are handling about 1000 transactions per day.

At all these sites we have obtained experience which could benefit, as volume flows over the weighbridges are very similar.

……. is a multifaceted company with global interests and support to accommodate this project. We have numerous projects which are ongoing at different locations with credible clients as MacDonald's Transport (R200k and ongoing), MBFI Mozambique (R1,2M and ongoing), ACSA (R4,5M), Wonderboom Airport (R2,7M), Jacobs Equipment, Blue Chip Snacks, Okiep Mine, Limpopo Scrap Metals, etc.. …….. has strategic partners in associated businesses wherein we are confident that we can improve the utilization of the current weighbridge systems. In addition and in the spirit of partnership, ……. jointly with , can facilitate third party work for HDI, BEE or similar entities, for example a cleaning service at the weighbridge sites, to name but one example.

…….. has identified the market requirement for specialized maintenance technology and services and we have grown this into one of our core businesses. …….. has become a leader in the field of providing "One-Stop-Maintenance" solutions in the weigh and mass sectors, and has affiliation and support from other scale companies as SASCO Africa, Scales Incorporated, etc.. for whom Sub Saharah Scales provide maintenance support and services. This market exposure has enabled …….. to continuously improve our experience base and provide us with the ability to measure our practices and procedures under "best practice principles". We are able to structure our services to harness this experience base and to provide our workforce with a growth and development path, international exposure and job security.

……. has found that the maintenance activities cannot be treated as a separate entity as it has direct influence on the effectiveness of the core business. In view of this we base our development of the maintenance on your business goals where your operational requirements are considered.

We guarantee that we will add value to your concern, which will result in a mutually beneficial partnership to both organizations.

The financial offering for the advanced weigh bridge solution is provided as:

- A once off capital amount and monthly fully comprehensive maintenance plan

  OR
- An alterative bid 1: rental option

  OR
- An alternative bid 2: cost per transaction solution

2 Description of Requirement

2.1 Background

has a number of facilities that accept a wide range of different products from both the local and extended area. The proposed solution is designed to log all transactions, obtain the required authority to allow entry and ensure the driver of the vehicle is allowed entry. The proposed System supplies a cost-effective means of managing and enforcing the legal operation of vehicles by:

- Using Automatic Number Plate Recognition ANPR to record the number of times a vehicle enters;
- Providing a central database that will store all vehicle records
- Providing an automated method of issuing permits/vouchers /short trip documents via the internet
- Providing an automated method for commercial companies to request deliveries or drivers to login via the Internet
- Freeing staff at sites from having to check the credentials of suspect vehicles - valid permit holders being alerted to staff via SMS message or equivalent
- Providing a 'Managed System' reducing cost and management overhead
- Giving the ability to share data between sites, preventing companies from illegally obtaining permits/vouchers
- Providing optional monitoring cameras for the detection of illegal operation
- Providing enforcement software for the prosecution of speeding vehicles on site

Figure 1 Typical Solution

will be provided with a fully functional, integrated weighbridge system which will:

Enrol existing & new customers / drivers / vehicles by name, access card, finger print, account no., short trip details, vehicle license plate, and tare weight. The proposed solution will provide electronically captured tare weights of vehicles, removing any manual intervention. A wide range of communication links (GPRS, Wireless, Ethernet and fibre) between the local weighbridge's and the other sites is provided, linking to 's HO IT systems.

These communication links allow over 99.95% availability to automated database update in real time for accurate and reliable verification purposes. This is essential for the provision for a block out system; ensure vehicles which are suspect prevented from exiting or having access.

The database integrates with ’s current Financial system which is ? . The database stores tare weights of the accountholder vehicles and allows real time update of all data as required. The ability to identify outside parameter tare weights and force the vehicle to be reweighed ensures no illegal tare weights are permitted (where a tare weight is obtained with a vehicle filled with water). The database allows for the determination of an unlimited number of vehicles and drivers, allowing a large number of operators. A wide range of automated reports for ease of analysis and reporting can be created and is demonstrated.

The fully automated boom gates are opened via license plate recognition or with an electronic access enabled once the customer has swiped the electronic access card reader or a PIN code or a finger print or entered the Short Trip number. All linked to tyre slashes preventing drive through and enabling an automatic operation, no manual intervention. The drivers facial details are recorded and displayed to the operator, along with recording real time tonnages (data) with tare weight deduction. The ability to operate each weigh bridge in both directions facilities weigh bridge access efficiencies, along with free exit once off loaded if required.

2.2 Scope

The integrated, comprehensive solution proposed includes license plate recognition, facial verification, and weigh in motion, integration to existing databases and real time monitoring and reporting.

SYSTEM OPERATION:

NEW USER

Enrol using the ’s web site or on arrival on site or at the HO. Provide billing details, license plate no’s of vehicles, name, contact details, no of vehicles etc. Person who is doing the enrolment selects how they want to receive the notification on use, on entry, exit, by SMS or via the web site or via E-Mail. Field created for an image of the vehicle, plus driver images, templates, vehicle weight, etc. User selects if they wish to use an access card (cost for this) or fingerprint (free) linked to a code or all 3 access control systems.

EXISTING USER

Obtains a unique numbers, possibly the Short Trip number either before or on entry. The short trip number links the load, type of goods and weight, vehicle authorised to transport (via license plate), driver, time allowed to collect and site items can be collected from. On entry, 6M from the boom vehicle license plate is captured from both front and rear. The license plate number is sent to the database. If no license plate is present, an image of the vehicle is sent to the database. Driver stops at the access control reader. If a car, uses lower point. If a truck, uses higher access reader. Driver could then, swipe a card OR enter a pin (account no) OR place his finger on the reader or do a combination of all three. If allowed to proceed (Short Trip number exits) boom opens, grippa bars retract and vehicle moves forward onto the site.

The vehicles will the approach the weigh bridge. Once the weight of the vehicle is captured the driver can enter the site to be loaded. On entry and exit, if the vehicle tare weight is in the system, deduction occurs automatically and the vehicle does not need to either entry or exit over the weigh bridge.

Once loaded the driver would approach the exit lane. 6M from the boom vehicle license plate is captured from both front and rear. The license plate number is sent to the database. If no license plate is present, an image of the vehicle is sent to the database. Driver stops at the access control reader. If a car, uses lower point. If a truck, uses higher access reader. Driver could then, swipe a card OR enter a pin (account no) OR place his finger on the reader or do a combination of all three. If allowed to proceed (Short Trip number confirmed) boom opens, grippa bars retract and driver moves forward and exits site.

DRIVER / VEHICLE NOT ALLOWED ON SITE

No access is granted and an alarm is generated.

3 BID AS REQUESTED: FIXED PRICING

In compiling this quotation we have endeavoured to provide you with the best value solution fit.

Products	Licensing	Pricing	Qty	Retail
B1 (T/A, 1500 F/P, TCP, RS232)	Per Device	R 2,505.24	0	R 0.00
Sabre LPR Parking 12 Lanes	Per Device	R 83,880.00	1	R 83,880.00
Sabre Device Communication Software - T&A and A/C	Per Device	R 1,200.00	4	R 4,800.00
1000 Employees / Tenants	Per Site	R 9,599.00	1	R 9,599.00
Access Control Basic Version only - Yearly Admin Fee	Unlimmited	R 250.00	0	R 0.00
BioPC Hardware Emulator PC Based Software	Per Seat	R 499.00		R 0.00
Thin ID Cards	Per Card	R 20.00		R 0.00
ZK 5V UPS - 6-8Hours	Per Device	R 295.00	0	R 0.00
L1000 Door Lock	Per Device	R 3,144.00		R 0.00
Upgrade from Basic to Premier Version **	Once	R 2,999.00	4	R 11,996.00
Export to existing Payroll Packages **	Once	R 479.00		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 959.00	3	R 2,877.00
Device Monitor and Management Module	Per 16 Devices	R 999.00	3	R 2,997.00
Live Data Collection (Server, Auto Download of Data) **	Once	R 1,199.00	4	R 4,796.00
Priemer Tracker with SMS & Email - single PC**	1 PC Only	R 1,499.00		R 0.00
Basic Tracker Software - Includes FREE Gateway	Per 10 Users	R 3,119.00		R 0.00
Premier Tracker with SMS & Email - Includes FREE Gateway	Per 10 Users	R 4,319.00	1	R 4,319.00
Cell Phone & Web Tracking Module	Unlimited	R 959.00	1	R 959.00
Remote Door Unlock Module	Per 10 Users	R 2,399.00	1	R 2,399.00
Siren Management including 220V Relay Interface for PC	Per Device	R 1,199.00		R 0.00
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 239.00		R 0.00
Off Site backup of data - Free with Software Cover	Per Month	R 150.00		R 0.00
Software Cover - Monthly R 150 by debit order	Per Year	R 2,400.00	4	R 9,600.00
Includes Telephone / Remote Desktop Support and Updates		Sub Total Cost for System		**R 138,222.00**
			VAT	R 19,351.08
Cost Per User	1000	**R 138.22**		**R 157,573.08**

Installation Cost per unit	Per Device	R 9,990.00	4	R 39,960.00
Onsite Warrantee per year ***	Per Device	R 999.00	4	R 3,996.00
Motorised 220V Siren - 500M	Per Device	R 599.00		R 0.00
Motorised 220V Siren - 1000M	Per Device	R 799.00		R 0.00
Door Closer - Medium duty	Per Device	R 280.00		R 0.00
SEP Maglock 300Kg Front Mount with Z-Bracket	Per Device	R 720.00		R 0.00
GooseNeck Pole	Per Metre	R 399.00		R 0.00
Waterproof Housing	Unlimited	R 1,299.00		R 0.00
Setup of Web Server with Apache	Once	R 9,990.00	1	R 9,990.00
Visitor Booth Wiring/ Relays and Switches	Per Door	R 999.00		R 0.00
FREE Training is available with purchase of onsite warrantee		**Sub Total**		**R 192,168.00**
*** First User/Device is FREE only charged for additional Users/Device**		**VAT**		R 26,903.52
**** Unlimited Devices covered with one payment**		**Total**		**R 219,071.52**
***Call out Fee per Visit R 250 after commissioning of hardware installation**				
Standard Call out Fee R 250 plus R 350 per hour without Onsite Warrantee Payment				
50% Deposit up front and final settlement on completion of installation of Hardware				R 109,535.76

4 ALTERNATIVE BID: COST PER TRANSACTION

4.1.1 Transaction Management

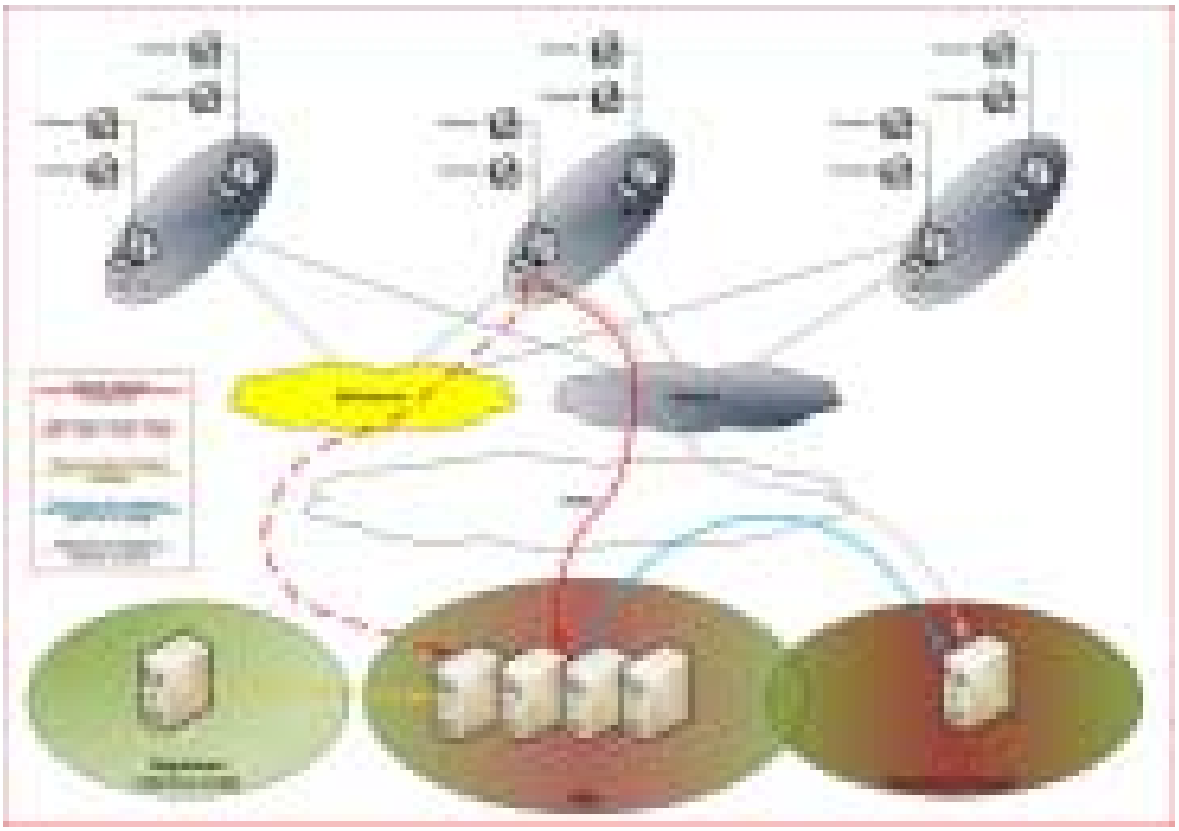
The concept of transaction management is one that this proposal is based on and consists of a basic underpinning approach that defines each assessment of a vehicle as a transaction. The transaction identifies the date, time, location, camera/lane, license plate number, instantaneous weight, associated type of weight image identifier, (and any other information that is assessed). The identification of the same vehicle at the exit location is a secondary transaction and the relevant weight relationship between these two transactions is assessed and determines the amount the customer is billed. Each of these transactions is sent through to the service centre and is then matched against any of the registered lists in the database. The matching of the vehicle to a list will result in the relevant entity being informed of the event through SMS or email or post or live on the web site with a secure link to the image for copying and processing of the necessary action, viz. payment, etc.

4.1.2 Weigh Bridge Processing System

The entity responsible for the processing of the transactions in as close to real-time as the networks will allow. The transaction, with the data that uniquely identifies the vehicle, driver and location will be passed through the broad based network in http format to the service that will record the transaction. The vehicle information will then be checked against the lists received from those enrolled. If a match is identified, the listed entity provider will be notified of the identification through and email with a link to the image on the PC on site. This gives the exception entity an opportunity to validate data captured and confirm that this is a valid transaction and will then trigger the necessary action relevant to the event.

The system will then wait for the vehicle to be next identified and will ascertain the vehicle weight. Once these have been identified the relevant entity will be notified via an email with a reference to the image for the entity to validate and then process the necessary amounts due. This can be done through our solutions, but it is assumed that the current incumbent would still be used for this.

4.1.3 Registered Reference Entity



This refers to the entity that provides information against which the identification of the vehicle or driver must be checked. In this instance it will be the provision of vehicles registered ti use the landfill site. If vehicles are identified that do not comply with the list then the ETA will be informed of the instance via email and would then have the opportunity to deal with the event as they see fit. Manual payment would then the allowed to proceed.

4.1.4 Reporting

Real-time reporting is possible via a web interface that will provide a dashboard of information that must be agreed and specified in consultation. Standard reports can also be extracted from the Database with a reasonable amount of flexibility.

Real time reporting is possible via a web interface that will provide a dashboard of information that must be agreed and specified in consultation with the WEIGH BRIDGE SITES. Standard reports can also be extracted from the Database with a reasonable amount of flexibility.

Figure 2 Dashboard

4.1.5 Financial Model

The financial model for this is based on transaction and a pre-paid service is being offered. The pricing model consists of a flat rate per month as well as a rate per transaction for normal assessment as well as for violation processing.

4.1.6 Transaction fee

A prepaid transaction fee will be payable in a pre-paid model and will entitle the processing of that number of transactions for the month.

COST PER TRANSACTION (software)	R 0.91
No of transactions per day	250

5 Solution Proposed

The purpose of this proposal is to log all vehicles passing over the weigh bridge and into and out of the distribution centre.

The objective of this proposal is to efficiently process by:-

- Reducing the number of transactions not being billed due to Weigh Bridge not working, maintenance and automatic systems.
- Nullify the number of overdue accounts due to exclusion from the site if an account is not paid. The system forces the operators to adhere to rules as pre set in the software. Warnings will appear to inform operators.
- Promoting awareness of payment of violations by using various means including sign boards at the sites, Call Centre, mail etc,.
- Introducing technology to support the weigh bridge processes;
- Empowering the local landfill sites by introducing equipment and software process to enforce the weigh in and out process.

5.1 Solution Components

5.1.1 Equipment

5.1.1.1 Access Control

(See Section **LPR Spec** Sheet on **page 43**)

Advanced features

Fingerprint reader designed specifically for the International high terminal Access Control market. It integrates seamlessly with access control software including our very own product Sabre. The F4 can be used as a standalone device or it can be utilised on a network with multiple readers.

Features

- **Transaction storage: 50,000 transactions Identification speed: less than 2 seconds Power supply: 12v DC Operating Temp: 0°C to 45°C Operating Humidity: 20% to 80% Communication: TCP/IP network Dimensions: 150 x 145 x 38.5mm Electronic Lock control: 10A / 12v DC Option: Web management interface Ideal for: Any access control environment**

5.1.2 Backroom Services

The backroom services is defined as the process starting from the point of receiving the motion detection from the camera system at the entrance to the weigh bridge to the point of issuing the invoice for the type and weigh of material dumped at the landfill site, enrolment of the users, preparing the daily / weekly / monthly logs per weigh bridge / site, to supplying the necessary documentation and information to the users.
An Internet enrolment and payment / viewing of billing / usage system is also part of the software product line.

5.2 Solution Design Considerations

5.2.1 Maintenance

The spares are carried locally thus ensuring fast turn around minimizing down time. Two people will be employed who will be based on the main sites and who will visit the sites as per our guidelines, repairs and preventative maintenance performed as per contract requirements.

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.

Figure 3 ISO 9001 Certification

On site support is charged at R7 500.00 per day.

Figure 4 Products certified to FCC15, CE, UL, GS and IEC60825-1

CERTIFICATION

5.2.1.1 SOFTWARE 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.

5.2.1.2 SPARES

Requires spares are indicated in the attached documents:

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

5.2.2 Digital Images

The images produced by the equipment shown are of the best in the equipment market. This is largely due to the physical cameras used in conjunction with the relevant software. The system uses a camera per lane with zoom facilities enabling number plate clarity with naked eye.

5.2.3 Data download

The permanent systems can be downloaded in a number of ways:

- Using Wireless download interlinked system
- Using Telkom lines via modem for data download
- Using GSM for data download.
- Removing and replacing one of the following storage devices from camera, using either : (depending on Camera or type)
    - WORM disk;
    - MOD drive;
    - Memory stick;
    - Removable hard drive (preferred);
    - SD disk.

5.2.4 Training

We have internationally trained personnel and attend yearly training. Keep staff up to date with technology and support issues. All training required will be provided.

A technician who has full training on all equipment will be available for daily training needs. On line training and help desk is available 7 days a week.

The training will allow the operator to do the following:-

- Classify the waste;
- Optimise the number of vehicles trough the site;
- Download the data automatically;
- Enrol new and existing users with vehicle, billing and waste details;
- Store any additional info required;
- Perform routine maintenance and trouble shooting;
- Generate required reports and billing information as required

5.3 Customer Responsibilities

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

A clean, consistent, source of Electricity is required at all the sites in the field. Delay of the provision of the electricity beyond that detailed in the project plan will delay the launch of the project.

Permission to work in the areas designated would be required from the relevant authorities. Any delay in obtaining the required permission would result in an unknown delay in the project.

The proposed solution will operate automatically however if PIKITUP are going to ensure the system operates to the best ability, trained operators and service personnel are required. The training period as detailed should be followed hence these personnel are required to start training early.

On site office at all sites

6 Implementation Schedule

The substantial experience developed from installing systems locally in South Africa and internationally will prove extremely beneficial during install of the proposed solution. Key to the successful installation and faultless operation is the initial design, based on a complete TCP/IP backbone, consisting of ADSL, wireless links and GSM connectivity. The connectivity allows any PC, database or camera to connect to any computer, ensuring maximum uptime. The ability to obtain feedback from the equipment in the field in real time, allowing proactive response to any issue ensures all challenges are resolved before they escalate.

A meeting will be arranged to discuss any modification to the system design, layout, identify the positions of the proposed install or if any of the options presented will be selected. A weekly meeting is requested for feedback on progress plus the ability to immediately identify any issues which might arise. Should any issue need to be addressed, all role players can be kept informed of the progress and decide on a suitable way forward. This is the ideal time for the operational staff to get involvement, so they understand the solution from an operational level. At each meeting additional reading material will be provided to the operational staff for study and prepare.

The systems will be pre-built before being installed, with substantial tests to limit any on site issues. This is the ideal time for the operational staff to get hands on involvement, so they understand the solution from a board level.
Once the systems are installed, extensive tests begin. As these are all done from the control room this is the ideal opportunity to continue the on the job training of the personal who will operate the system. Each stage of the process will be extensively tested: from loop detection, multiple image capture, OCR, transfer of the data (plate, lane, date, time, etc.), loading users and those plates where an alarm should be generated. Tests will be performed using dedicated vehicles travelling at specific speeds to ensure the entire system is fully operational, including the measured distance between sites.

The time critical nature of the project requires total commitment from a dedicated solution provider who has substantial local experience in providing this solution.

A project charter document will be drafted with clear agreement of the deliverables at the commencement of the project that will be signed to confirm the understanding of what is included, excluded, concerns, risks, etc. This will allow for a structured approach to any scope changes.

The progress review meetings will be minuted by the Project Manager. The meetings will be chaired by the Project Manager and attendance to these meetings by the designated Municipality representative is required. The project may be delayed, without penalty, if the required parties are not in attendance.

A formal Change Control process will be included should any deviations be requested from the original scope be necessary to provide opportunity for the impact on the project to be identified, motivated and agreed. This approval will be provided by the Municipality, the primary contractor and the Project Manager in a formalized signed change Request Form that will be supplied at the commencement of the project.

7 Additional considerations

7.1.1 Use of affirmative business enterprises

It is our policy to support and advance affirmative business enterprises.

7.1.2 Investment in the community

We will involve will involve the community in all areas of development. Members of the community will be fully consulted about the project being implemented and comments will be requested from the community by means of notices in the local news paper.

The community will be expected to make input in all stages of the implementation. Workshops will be conducted to bring awareness about landfill safety.

7.1.3 Local content

Equipment and accessories proposed:-

- over 70% locally designed and manufactured.

Equipment proposed:-

- over 20% locally designed and manufactured.

Backoffice software:-

- locally designed and maintained locally.
- Collect software is locally designed and maintained locally.

7.1.4 Use of SMMEs

It is our policy to support, promote and work with SMME companies.

8 Definitions, acronyms and 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 the 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 the 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.

9 Supporting documentation

9.1 Technology References

9.1.1 List of countries where the equipment is being used

- Spain
- Switzerland
- Italy
- Brazil
- United Kingdom
- Norway
- France
- Australia
- Canada
- Taiwan
- Hong Kong
- Tunisia
- South-Africa

9.1.2 List of users in Southern Africa

- Botswana Police Services
- Henties Bay Municipality
- Namibian Police
- Walvis Bay Municipality
- Swakopmund Municipality
- Ladysmith Municipality
- Metrorail Braamfontein
- Bloemfontein Municipality
- Kroonstad
- Pudjitjaba
- Sasolburg Prov
- Sasolburg T.L.C
- Zastron
- Germiston
- Brakpan
- Boksburg
- Port Shpestone
- Kwadukuza
- Kwasani
- Richards Bay/Empangeni
- Bethlehem Provincial
- Welkom Municipality
- Welkom Provincial
- Centurion
- Danhauser T.L.C
- Dundee
- Goodwood
- Prov Graaff-Reinett
- Pinetown
- Durban Metro
- Harrismith Provincial
- Krugersdorp T.L.C
- Kuruman Provincial
- Stutterheim Mun
- Ladybrand Provincial
- Kroonstad Provincial

- Margate
- Mandini T.L.C
- Metrorail
- Mooi river
- Modimolle
- Nkonkobe
- Newcastle Protection
- Kwazulu Natal Traffic Training College
- Orapa and Lethlakane Mines
- Phalaborwa
- Paulpietersburg
- Utrecht
- Vryburg
- Provincial Authority Bloemfontein
- Zeerust
- Quakeni
- Sasol Secunda
- National Road Safety Council Namibia
- Mangaung Local Municipality
- Orapa Mines – Botswana
- Kgatlopele Municipality
- Albert Lithuli
- Metrorail Durban
- Motor Vehicle Accident Fund Namibia

9.1.3 List of current users in South Africa

- Bela Bela Municipality
- Mosselbay Traffic
- Potchefstroom Municipality
- Emfuleni Traffic
- Govan Mbeki
- Ekurhuleni Metropolitan Local Municipality
- Kwadukuza
- Rustenburg Traffic
- Welkom Municipality
- Piketburg
- Beaufort West Municipality
- Caledon
- Kungwini
- Mangaung Local Municipality
- Jan Kemp Dorp
- Helderberg Traffic
- South Peninsula
- Blaauwberg
- Oostenberg
- Cape Town City Council
- Tygerberg
- Stellenbosch
- DOT Kwazulu Natal
- George Municiplaity
- Hopetown
- Kimberley
- Springbok
- Tshwane
- Madibeng
- Emnambithi
- Ezingolweni
- Ceres
- Mogale
- Hibiscus Coast

9.2 REFERENCE SITES: Record of Similar Projects Completed

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.

Figure 5 Trucks speeding on the M4 towards the airport

Figure 6 Visitors to Durban who obey the rules of the road

Figure 7 M4 Durban Demo of ASD

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

REFERENCE SITES:

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	R120 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 Services	Access Control & Logging	R75 000.00	2007
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.

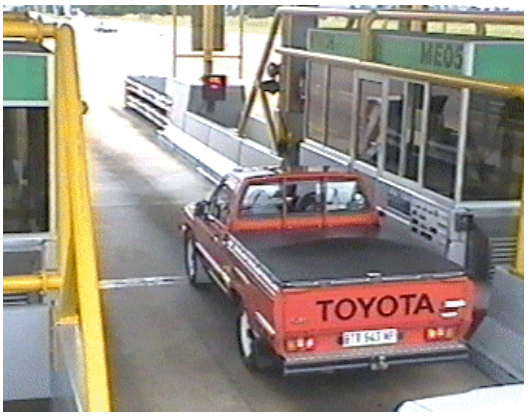
The system is also connected to a large outdoor display that shows the car number, the car type, the reason for arrest and the name of the driver. This display can be seen by the police officer down the road. All the officer needs to do is wait for the siren, then stop the car and verify the arrest details,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

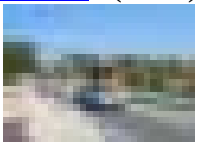
C3 Access Control (Israel)

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)

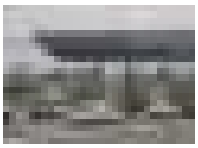
Site Security (Spain)

Gated Community (USA)

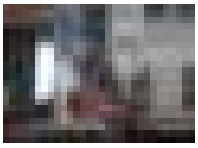
Toll station (Colombia)

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)

9.3 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)

CURRICULUM VITAE : Dr. M. F. MITCHELL,

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.

9.4 LPR Spec Sheet

9.4.1 Overview

The Traffic Logging System (TLS) Solution will be provided to WEIGH BRIDGE SITES 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 traffic movement and long term studies of traffic data. The road side portion of the solution proposed uses the See Lane DLL software.

The TLS will allow the Authority to

- improve safety on roads and eliminate "black spots";
- limit road closures and traffic delays associated with road works and unexpected events;
- manage the flow of traffic to minimise delays;
- provide effective signage;
- increase traffic capacity;
- provide better road user services such as information signs and systems.

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 WEIGH BRIDGE SITES servers will capture the data for further processing as required.

- **Flow estimation** – the number of vehicles and types of vehicles can be used for road conjunction analysis that can assist traffic planning.
- **On-line traffic report** – the roadside information can be reported on web sites in order to supply live reports from the freeway.
- **Monitoring** – the recognition information may be used for various security applications.
- **Average Speed** – using outputs of several sites, a back end program can be used to calculate the average speed of the vehicles, based on the time of journey.
- **Enforcement** - The license plate data can be used for a wide range of enforcement techniques, including outstanding traffic fines, warrants, etc. The average speed can be used to issue violation tickets.

9.4.2 System description:

The proposed system consists of a number of lanes, within the LANDFILL 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.

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.

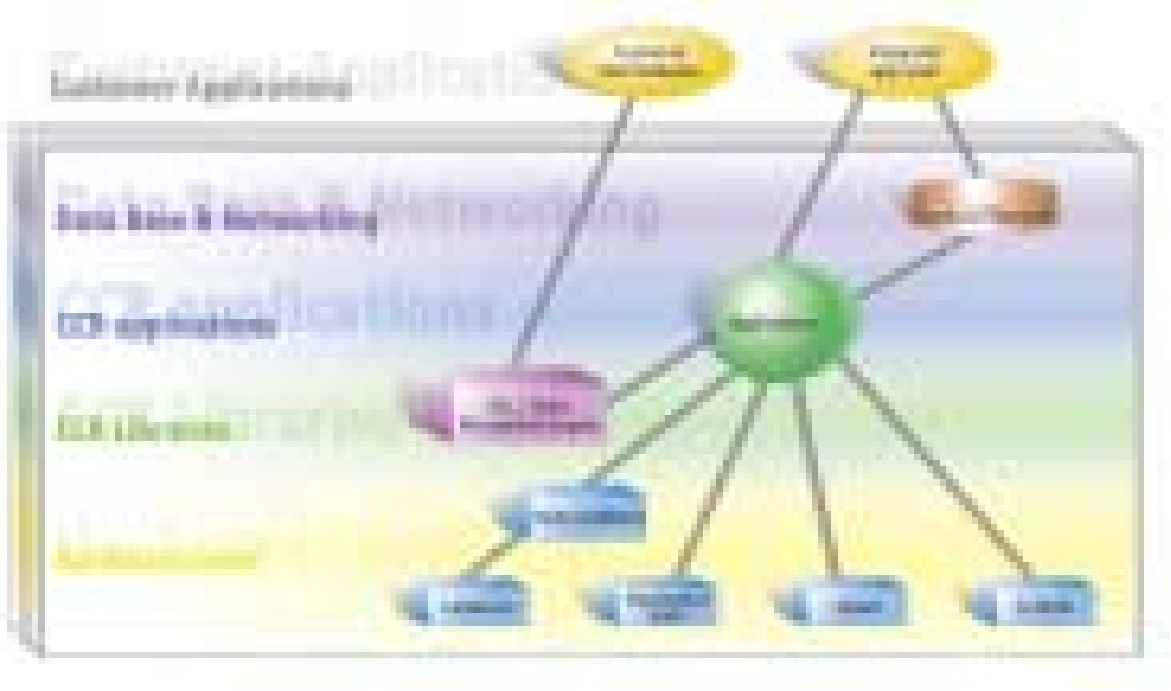


Figure 8 Elements making up See Lane

• **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.

9.4.3 Block Diagram

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

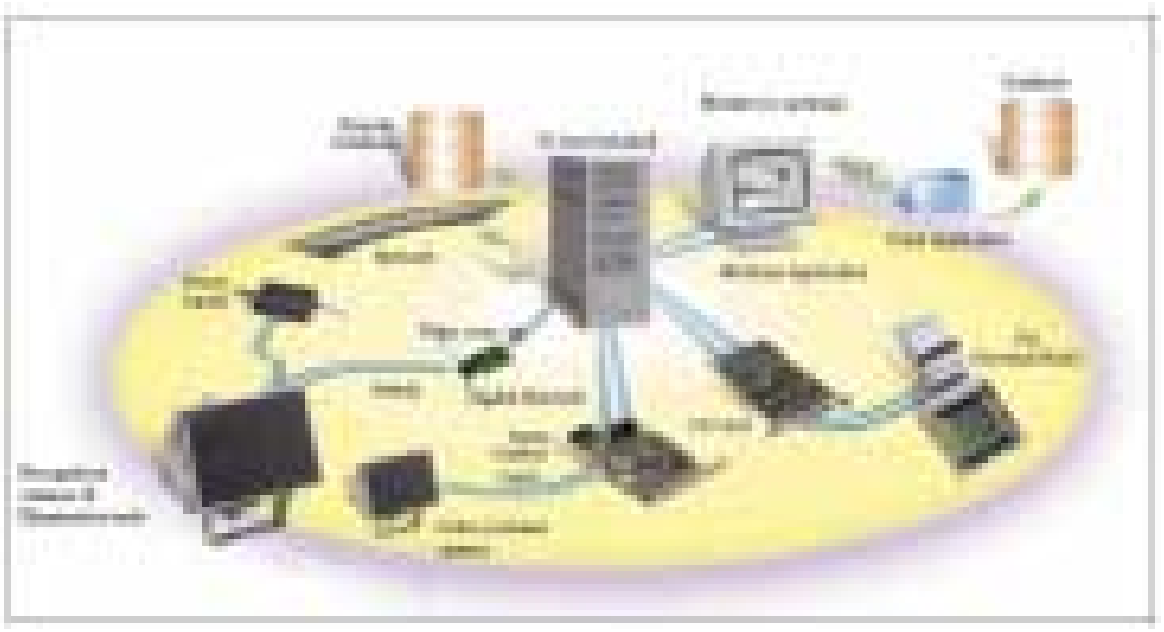


Figure 9 See Lane Connectivity

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 4 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.

9.5 SITE LOCATION

Figure 10 Site 1 Eastbound Lane Front Camera View

Figure 11 Site 7 Front Camera View

Figure 12 Site 8 Front Camera View

Figure 13 Site 8 A Front Camera View

Figure 14 Site 8 C Front Camera View

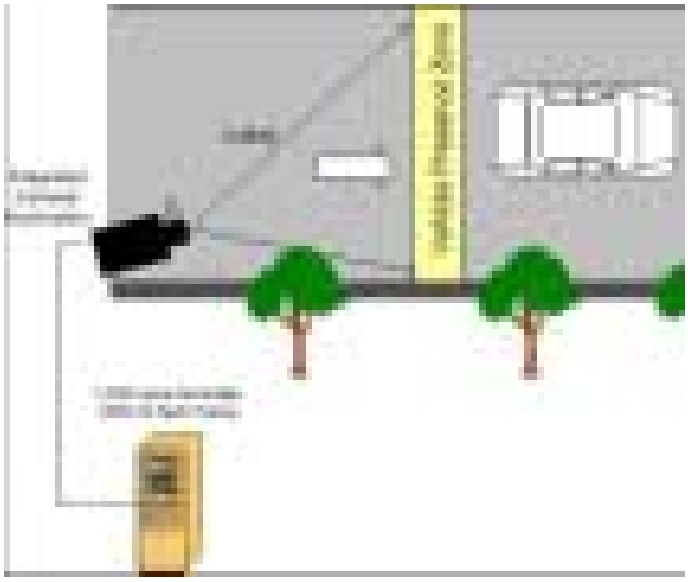
Figure 15 Site 8 D Front Camera View

9.5.1 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 16 Rear camera and Site PC layout

Figure 17 Rear camera wiring and layout



The effective field of view of each unit is about 12 meters in order to achieve the proper plate size. The SCH (See Car Head camera / illumination unit) is mounted at the side of the lane as close as possible to the edge (parameter C) and at height of about 5.1 meters. The range (parameter B in the figure) is 15.5 meters from the "loss of detection" point (where the rear of the vehicle leaves the detector) using a 60 mm lens.

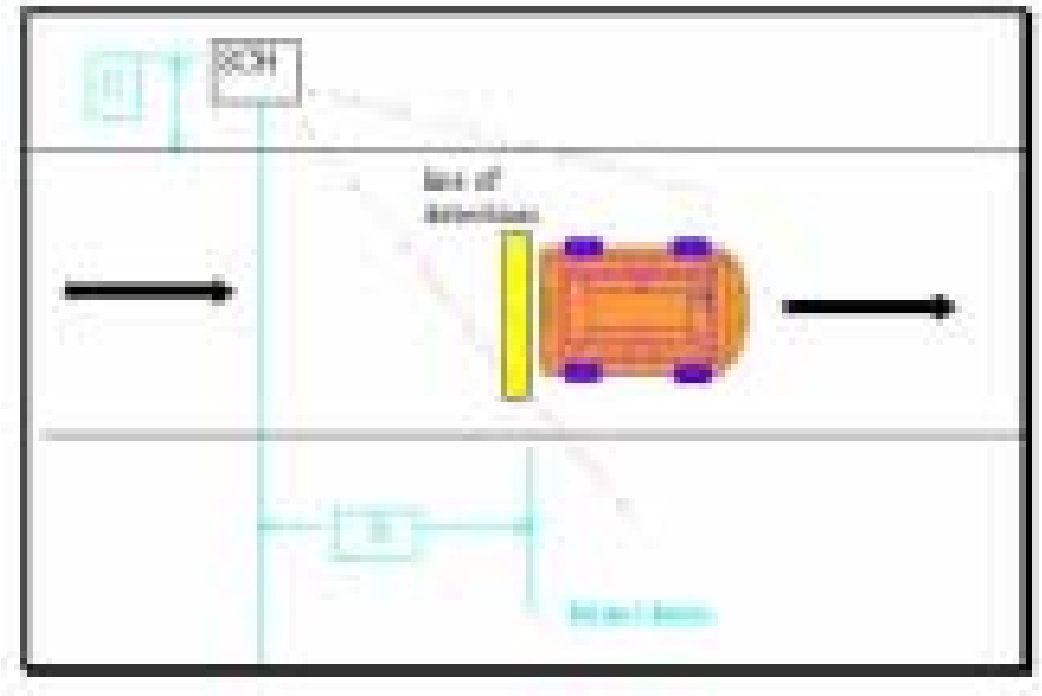


Figure 18 Layout for a rear camera

The following illustration shows a typical layout of the See Lane solution (Front Camera only):

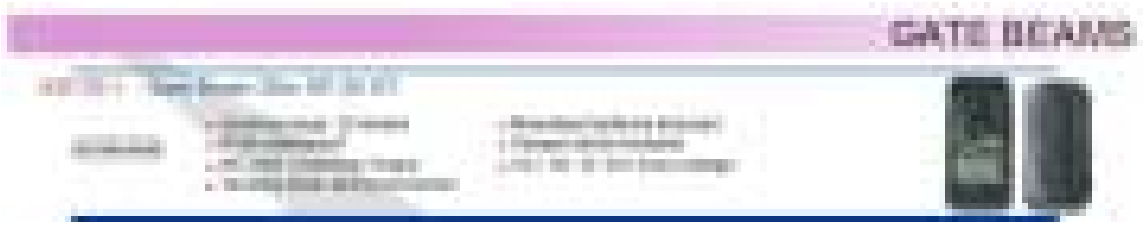
The SCH unit should be installed at about 15.5M from the loop detection line for standard lens. *See the illustration above, parameter B.* This translates to about 19 meters or more from the **front** of the car (for standard lens) since a typical vehicle is about 4 meters.

The side distance (parameter C) in this installation is identical – 0.0 to 0.5 meters.

Side of the Traffic lane: Install the SCH **as close as possible** to the traffic lane, within 0.0 to 0.5 meters. *See the illustration above, parameter C.*

9.5.2 ON WEIGH BRIDGE BEAMS

The trucks will be confirmed fully on the weigh bridge by using beams around the weigh bridge. If these beams are obstructed, then the weight from the weight bridge will not be obtained. Only once the beams are unobstructed will the weight be obtained from the weigh bridge.



9.5.3 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.

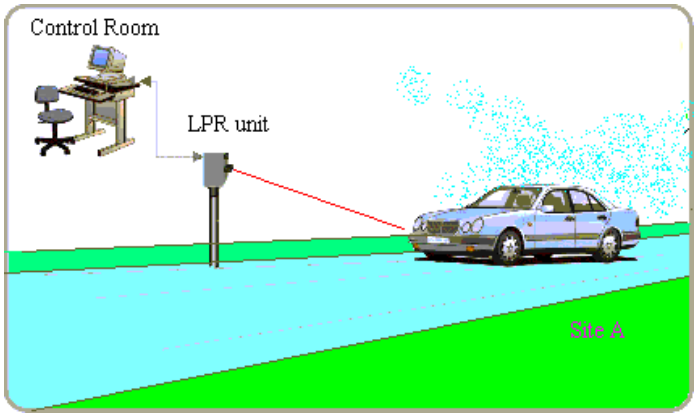


Figure 19 SeeCarFlow illustration (Site A of N sites, with control room)

9.5.4 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 in selected urban road routes (N3 and Smith Street) in the city. Each LPR system performs real-time recognition on passing cars 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 20 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.

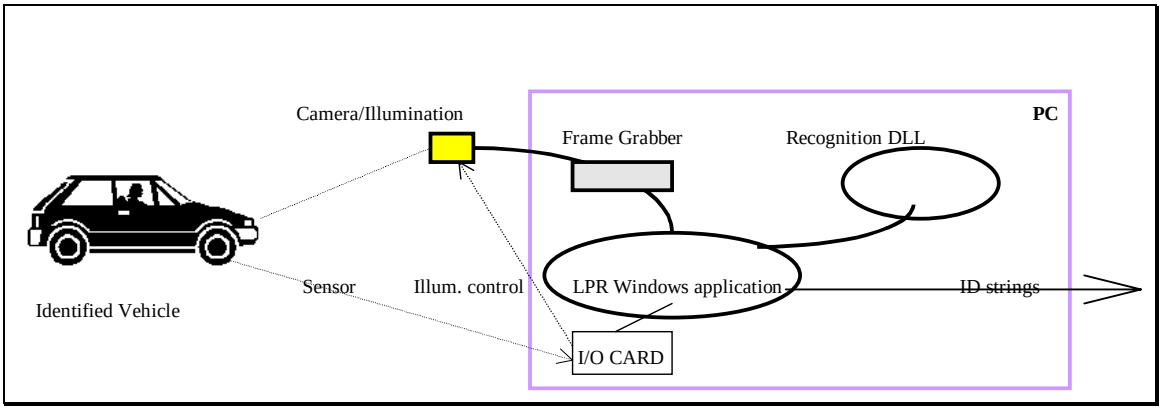


Figure 21 LPR unit Architecture

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 22 Example of LPR application main view

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

Figure 23 Personalised Plates are recognised using LPR

9.5.5 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.

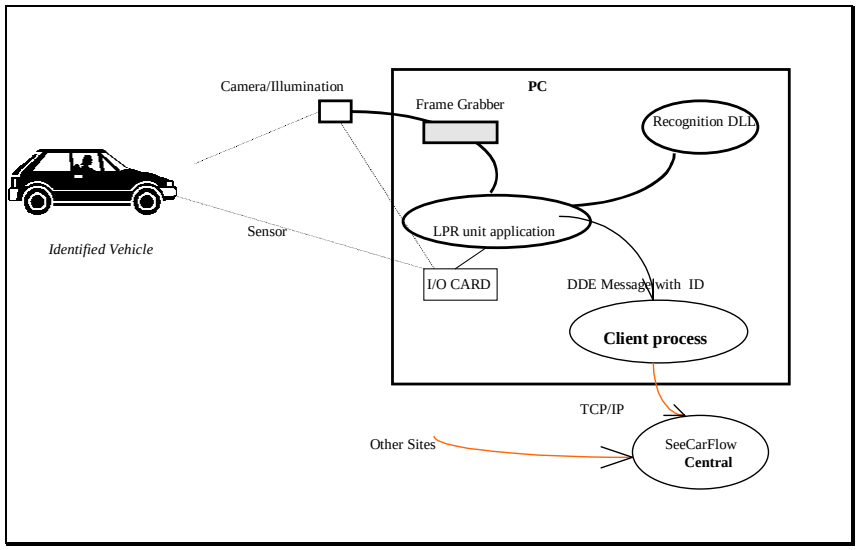


Figure 24 Data flow of the Recognition results

Network

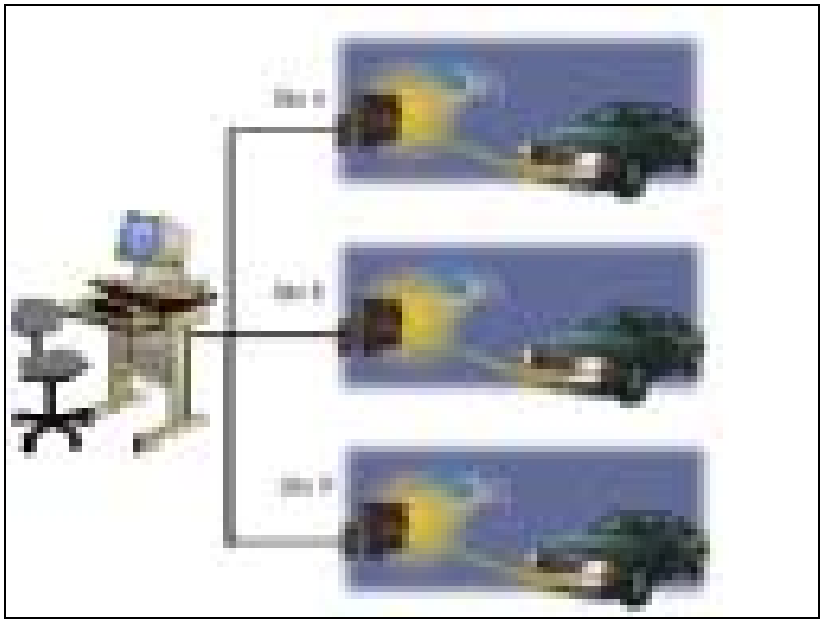


Figure 25 Networked LPR Sites

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 of busses and taxis, such as eNATIS, Durban Metro Database, etc.
- 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

9.5.6 Data Output

Data will initially be acquired and kept for every vehicle, and WEIGH BRIDGE SITES 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 26 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 WEIGH BRIDGE SITES 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 WEIGH BRIDGE SITES 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 WEIGH BRIDGE SITES server, then transmitted to the WEIGH BRIDGE SITES over the NCS via a dedicated transfer service running on the Trip Processing Server.

9.5.7 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 WEIGH BRIDGE SITES Project are specially trained to recognize license plates in Southern Africa, and focus on the local South African plates.

9.5.8 SEE DATA

SeeData is a software service application that connects a cluster of recognition systems (such as SeeLane or See Lane) together by a network. The networked units can thus report the recognition results to a Central server.

9.5.9 Client-Server Architecture

SeeData is a set of applications, which comprise of the following elements (see also the following illustration):

• **Remote** units (one or more) - also referred as client nodes, or front end units. Each unit has a LPR (License Plate Recognition) recognition system which generates recognition messages which report the results.

• **Central** server (single) The SeeData application is connected to one or more remote units, and collects their reports to a central recognition system.

It is also possible to send commands from the Server to the remote (front-end) recognition units, although this is not described in the diagram.

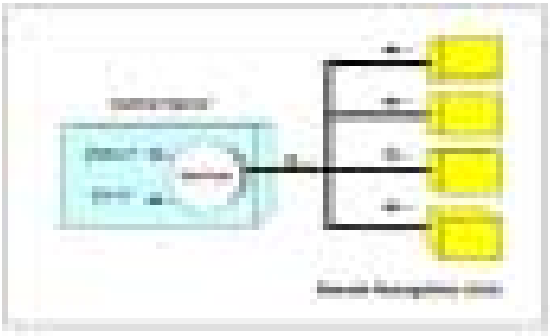


Figure 27 See Data

9.5.10 Events data

The See Data application, which runs on the Central server, communicates with front-end

OCR hosts by a protocol designed especially for HTS application. On this protocol the HTS recognition systems report the results to the central server.
The See Data protocol is based on TCP/IP. It allows to See Data to operate in cross OS environment. For example, See Data could receive recognition results from Windows (See Lane for example) and embedded Linux (C4, Compact Car Controller).

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 28 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

9.5.11 LOG OF EVENTS

The images below illustrate the data obtained from two lanes, from 12:57 to 13:17

Figure 29 Log of the data and images from each site

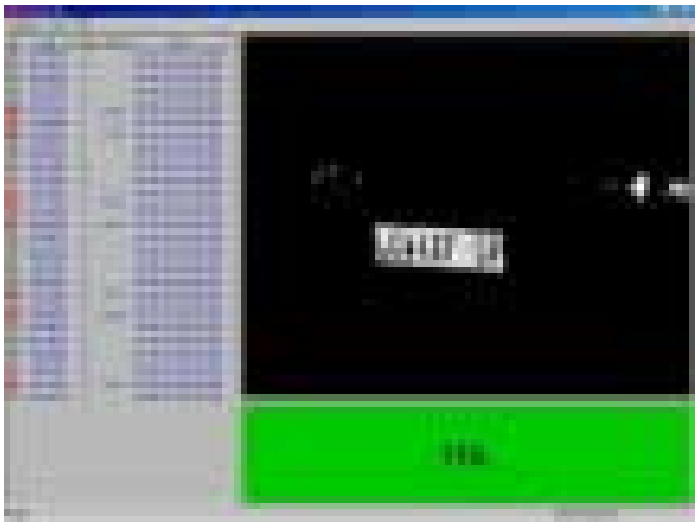


Figure 30 Vehicle Logged

9.5.12 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 31 Alarm on vehicle detected

9.5.13 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,

Nevertheless, additional mechanisms are used to ensure the stability of the systems. These are part of HTS utilities, which ensure that if the systems will fail, they will be reactivated and also report their failure to external monitor systems. These utilities include:

• **SeeService** – a watchdog utility that periodically checks the aliveness of the application. In case the application does not respond, the application will attempt to rerun the application. If this fails, the utility resets the PC. In any such case the event is written to the Windows event log.

• **SeeMonitor** – this tool resides on a central server, and monitors the state of each system – by checking the Windows event log. It will alert external systems in case of a fatal error. It can also show soft errors (warnings) status, and display a set of graphs of past recognition results, which is a very important diagnostic tool.

• **SeeCleaner** – This utility cleans the old images directories after a specified time has elapsed, and also cleans local diagnostics files. Thus, the system will not grow endlessly in size, a common source of problem in other Windows based systems (which will not happen here).

9.5.14 Redundancy

In See Lane systems there is a need to guarantee an absolute up time, i.e the systems always work, even in case of malfunction or required service.

The system is designed to work in an automatic redundancy mode, where the 2nd server automatically takes over the functions of the other down server.

The dual servers can be set to monitor each other through network messaging and revert to degraded mode if there is a fault in one of the servers. To support this mode, both servers should be connected to the same cameras. In the parameters each lane will be designated as “primary” normal connection, or “secondary” redundancy mode.During the redundancy mode the system is working in a degraded mode, and the performance may be lower than the normal mode in case of certain traffic patterns.

> Note that the See Lane system is limited to 4 concurrent cameras in the redundancy state. So a recommended configuration is to have one server normally connected to 2 lanes, the other server connected to a single lane, while in the backup mode one server will service the 4 lanes.

APPENDIX: ADDITIONAL INFO:

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

APPENDIX 1 PPT – A PowerPoint introducing license plate recognition, system design, showing the proposed site layout, how the system works and some example images of the solution.
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.

9.6 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

9.7 SA REFERENCE SITES

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 32 ASD on the N3

SOFTWARE

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

9.8 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: Company Profile.pdf leading international distribution business of security solutions and services with over 205 branch locations across Europe, the Middle East, Africa and America has over 50 years of experience in the specialist security sector.

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