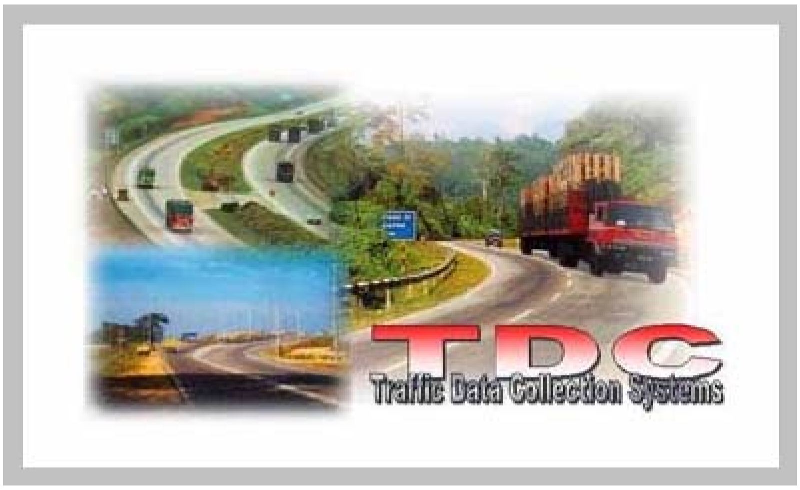
HI-TRAC® 100



HIGH SPEED WEIGH-IN-MOTION
DATA COLLECTION &
PRE-SELECTION SYSTEM

UTILISING
HI-COMM 100 SOFTWARE

System Overview

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1.

HI-TRAC® 100 SYSTEM OVERVIEW

1.1 Introduction

- The HI-TRAC® 100 is a medium or high speed traffic classification and weigh-in-motion (WIM) system. The HI-TRAC® 100 system provides a low-cost means of recording traffic data without interruption to traffic flow. The HI-TRAC® 100 will detect and record traffic at speeds from 5 to at least 180 kph.

- The system consists of road-installed items of two piezo-electric sensors and an inductive loop per traffic lane. The HI-TRAC® 100 electronic unit is installed in a protective roadside cabinet and connects to the road installed items. The signal from the piezo-electric sensors is monitored by the HI-TRAC® 100 and used to calculate the axle loading, vehicle speed and vehicle inter-axle separation as the vehicle passes over the road sensor array.

- The HI-TRAC® 100 electronic unit monitors the inductive loop signal to determine vehicle presence time over the road sensor array and hence provides an indication of the lane occupancy. The inductive loop signal is also used by HI-TRAC® to determine vehicle chassis length and as an end-of-vehicle detector to separate closely passing traffic. A 4-line by 20-character LCD located on the front panel displays the data recorded from the last vehicle and in conjunction with a 16-key membrane keypad facilitates localised setting of configuration parameters, calibration and other functions.

- The system may be linked via a modem and telephone line, a GSM modem or a data (RS485) cable link to a PC for downloading of data, administration and real time viewing of traffic. Additionally a laptop computer can be connected locally via a serial (RS232) port on the front panel of the HI-TRAC® 100.

- Data is stored internally on an SRAM memory card. The HI-TRAC® 100 is installed as standard with a 4Mbyte card, which will store up to 400,000 vehicle records when operating in the WIM mode. An upgrade to either a 6Mbyte or 8Mbyte memory card is available.

- The HI-TRAC® 100 electronic unit is housed in a weatherproof cabinet installed at the roadside. Power can be supplied by various means; continuous monitoring requires either AC mains or a solar panel/battery set-up, whereas temporary installations can be supplied by a battery of suitable size (dependant upon length of survey). A back-up battery is normally recommended if the system is powered via AC mains.

- The HI-TRAC® 100 system utilizes the *TDC Systems Neural Network Temperature Compensation Algorithm* to continually fine tune temperature compensation for optimum system performance and accuracy.

- The standard HI-TRAC® 100 system connects to 4 lanes of road-installed sensors but it is upgradeable to connect to a maximum of 8 lanes.

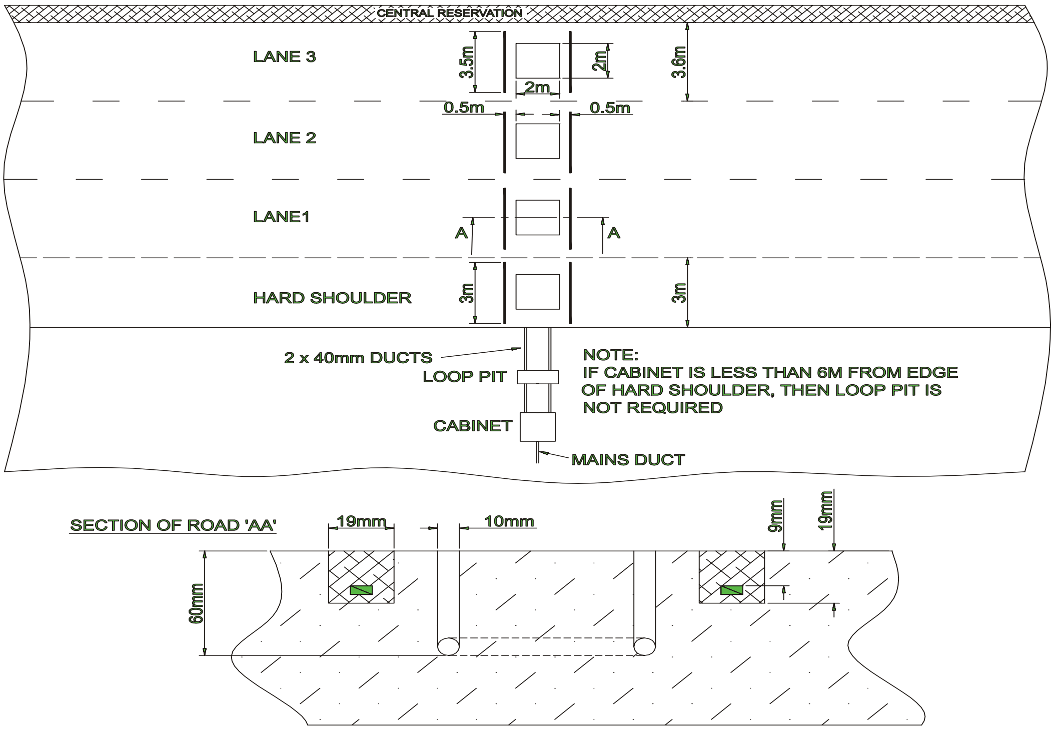
1.2 Remote Site Configuration

The HI-TRAC® 100 electronic unit is capable of interfacing to sixteen piezo-electric sensors and eight inductive loops. In the standard configuration of two piezo-electric sensors and one inductive loop, per lane of traffic measuring, this provides a maximum of 8 lanes of data recording.

For a weigh-in-motion (WIM system) installation of Class 1 piezo-electric sensors are preferred.

For an installation that is required to only count and classify vehicles (an AVC system) Class 2 piezo-electric sensors provide a more cost-effective solution.

With a WIM installation it is necessary to install an in-road thermistor to provide road temperature information to the HI-TRAC® 100 system. This is used for temperature correction of the recorded vehicle axle load data. The HI-TRAC® 100 system utilizes the *TDC Systems Neural Network Temperature Compensation Algorithm* to continually fine tune the applied temperature compensation for optimum system performance.



1.3 Operating Principles

The piezo-electric sensor outputs electrical charge proportional to the applied pressure of a vehicle axle or wheel passing over it. The electrical charge is converted into a voltage, by the HI-TRAC® 100 electronic unit. The voltage signal is monitored by HI-TRAC® 100 and used to determine axle detection times. The amplitude of the signal gives an indication of axle weight.

The piezo-electric sensors are installed a distance of 3 Metres apart in the road surface. The inductive loop is 2 Metres square. The loop is situated symmetrically between the sensors, in the lane. The time between the same axle being detected on both piezo sensors provides an axle speed measurement.

The separation between each axle pair on the vehicle is calculated from the axle detection times recorded on a single sensor and multiplying by the calculated speed. For improved accuracy this result is averaged over the two sensors.

The inductance value of the road-installed loop changes when a vehicle passes through the loop detection zone. This causes a change in the oscillation frequency of the loop detector circuitry inside the HI-TRAC® 100 electronic unit. This change in frequency is monitored by the loop detector and used to determine when vehicles are over the sensor array. The vehicle length is determined from the length of time the inductive loop was *activated* by the metal chassis of the vehicle.

The inductive loop signal is also used to distinguish between closely moving traffic. If the loop detector output deactivates it is assumed by the HI-TRAC® system that the final axle has been detected on the first piezo sensor (that is the first sensor in the direction of traffic). This is then determined to be the total number of axles on the currently detected vehicle.

Where two or more lanes are installed with sensors the HI-TRAC® 100 is capable of determining and recording vehicles that straddle adjacent lanes.

A typical installation is shown above, however alternative sensor configurations can be employed dependant upon the application. Drawings attached at the end of this document outline the variations available.

1.4 HI-TRAC® 100 Electronic Unit

The HI-TRAC 100 is a rack or shelf mount unit residing in a weatherproof roadside cabinet. The unit incorporates a 16-key membrane keypad and a 4-line LCD display to facilitate configuration and set-up. In addition an RS232 (Serial) connection is provided for laptop connection.

The HI-TRAC® 100 connections include:

- Piezo-Electric Sensor (x 16)
- Inductive Loop (x 8)
- RS232 Laptop Communication Port
- Modem Communication Port
- Modem Power Output (8V DC)
- Thermistor Input
- Relay Output
- RS485 Communication Port
- Battery Power Input (12V DC)
- AC Mains Input
- Cabinet Door Switch Input (x 2)
- Ticket Printer Output

The vehicle data recorded by the HI-TRAC® system can be retrieved into the HI-COMM 100 Traffic Data Collection software package via a laptop or modem connection. HI-COMM 100 is a powerful, multi-function software package developed in-house by TDC Systems Limited. The HI-TRAC® 100 continues to record vehicle data whilst HI-COMM is connected to and downloading to the laptop or remote PC.

All HI-TRAC® 100 configuration parameters can be programmed using the HI-COMM 100 user-friendly WINDOWS based software package and can be stored into a file on the computer. They can also be uploaded from the computer to reset the HI-TRAC® 100 settings back to the correct values if corruption of information has taken place.

A local (cable) connection can be extended over a distance of up to 1Kilometre using the RS485 communications port.

The system is designed to work via the telephone network using any number of different manufacturer's modems. A DC powered modem is recommended for operation with the HI-TRAC® 100 system. The HI-TRAC® 100 provides the DC power output to the modem. This has the advantage of the HI-TRAC® providing power cycling to the modem each hour (switching the modem off and on again and then re-initialising the modem) to prevent modem latch-up problems.

Additionally a GSM modem with a vandal proof antenna can be installed where the system is installed in a location with no available telephone landlines.

The HI-TRAC® 100 is capable of driving up to two external 12V DC relays. These can be used for a variety of applications including switching traffic signals or activating external alarms when vehicles are detected as being illegally loaded.

The door switch input connects to the cabinet door switches mounted internally on the front and rear roadside cabinet doors. When a door is opened the HI-TRAC® 100 system records an entry into a log (the Malfunction Management File) stored in its internal battery-backed memory. This log can be recalled and displayed within the HI-COMM 100 software package providing a record of when and where HI-TRAC® cabinets have been accessed.

The HI-TRAC® 100 runs from an AC mains supply with a wide input voltage and frequency tolerance (85-264V, 47-400Hz). The HI-TRAC® 100 internal power supply unit (PSU) is a universal input AC/DC converter. The output voltage of the PSU is approximately 13.8V. With a 12V sealed lead-acid rechargeable battery connected to the HI-TRAC® battery input connector the PSU trickle charges to provide a constantly topped up back-up battery. In the event of mains power failure the system continues to operate uninterrupted – in the case of a DC powered modem the system also continues to communicate uninterrupted. A mains power failure fault is recorded to a log stored in the HI-TRAC® 100 battery-backed memory.

Alternatively where AC mains power is not available the HI-TRAC® 100 can be powered by a solar panel and battery set-up. Solar panels from 20-80W and 12v battery sizes from 32-80Ah may be employed, dependant upon local conditions.

For relatively short duration surveys the HI-TRAC® 100 electronic unit may be powered by a rechargeable sealed lead-acid battery. The HI-TRAC® 100 will remain powered for more than 7 days hours from a 38 AH battery.

1.5 System Calibration

Calibration procedures and Temperature Non-Linearity set-up procedures are fully explained in a separate documentation but basic calibration consists of passing a number of vehicles (normally three different types) over the sensors in each lane and recording each axle and gross vehicle weight on each pass.

Each vehicle is loaded to known axle and gross vehicle weights and checked at a calibrated static weighbridge prior to calibrating the HSWIM system. Wherever possible it is recommended that three vehicles are used:

i) 2 Axle Rigid Vehicle Loaded to 16,000kg (approx.)
ii) 3 Axle Rigid Vehicle Loaded to 25,000kg (approx.)
iii) 5/6 Axle Articulated Vehicle Loaded to 35,000kg (approx.)

Where these vehicles are not available it is recommended that at least one vehicle with 3 or more axles is used.

The recorded axle and gross vehicle weights are compared to the weights recorded on the static weighbridge and corrections are made to ensure results are to an acceptable level of accuracy.

Note that weight results are subject to variation due to a number of parameters that are independent of the electronic system; to this end site selection is paramount to system accuracy. These parameters include:

i) Road condition and smoothness of the surface
ii) Geometric parameters (road is on an incline or curve)
iii) Vehicle change of speed (accelerating or braking)

To provide the most accurate results a HI-TRAC system should be installed, commissioned and left collecting data for approximately one or two weeks after which corrections utilising the temperature non-linearity functions are made prior to the actual calibration.

System re-calibration should be carried out on a 6-8 month basis.

1.6 Maintenance

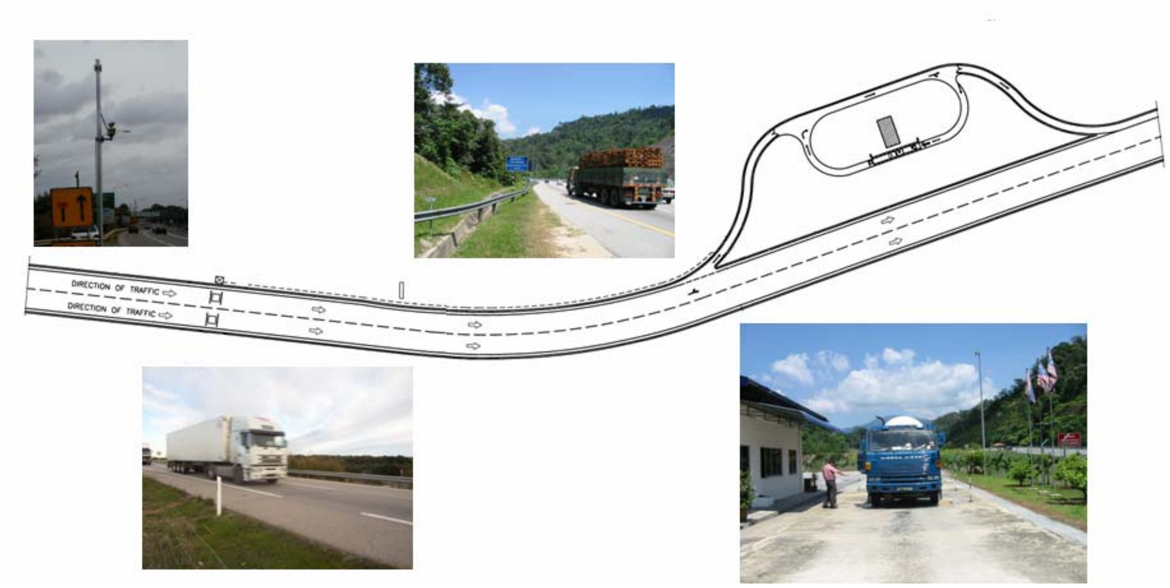
Maintenance procedures with piezo electric sensor weigh-in-motion systems are fairly minimal when compared to other systems utilising bending plates and single load cells. Regular inspections (monthly) are recommended and consist of:

i) Visual inspection of the road condition around the sensors
ii) Measurement of the capacitance and resistance of the piezo electric sensors
iii) Measurement of the resistance (and inductance if possible) of the inductive loop sensor
iv) Check of battery condition and state of charge
v) Check of system functionality via the front panel keypad and display
vi) Check of vehicle record via the front panel display and visible passing traffic

If the road conditions around the sensors show signs of cracking and break-up immediate repairs utilising epoxy or bituminous repair material is recommended.

1.7 WIM Pre-Selection Operation

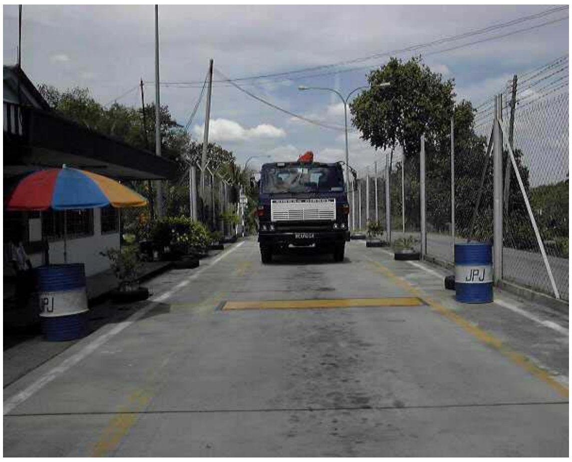
The HI-TRAC® 100 can be configured to pre-select vehicles for more accurate low-speed or static weighing enforcement. A typical configuration would include a medium or high speed HI-TRAC® system located in the highway up stream of a low speed/static LO-TRAC® Axle Weighbridge Enforcement Station.



- HI-TRAC® 100 WIM pre-selection of overloaded vehicles
- Automatic Number Plate Recognition or CCTV and Text Insertion options
- Diversion sign to send overloaded vehicles to Weigh Station
- LO-TRAC® Axle Weighbridge for Enforcement

If the HI-TRAC® system identifies a vehicle as being overloaded it can activate a Divert to Weighbridge sign.

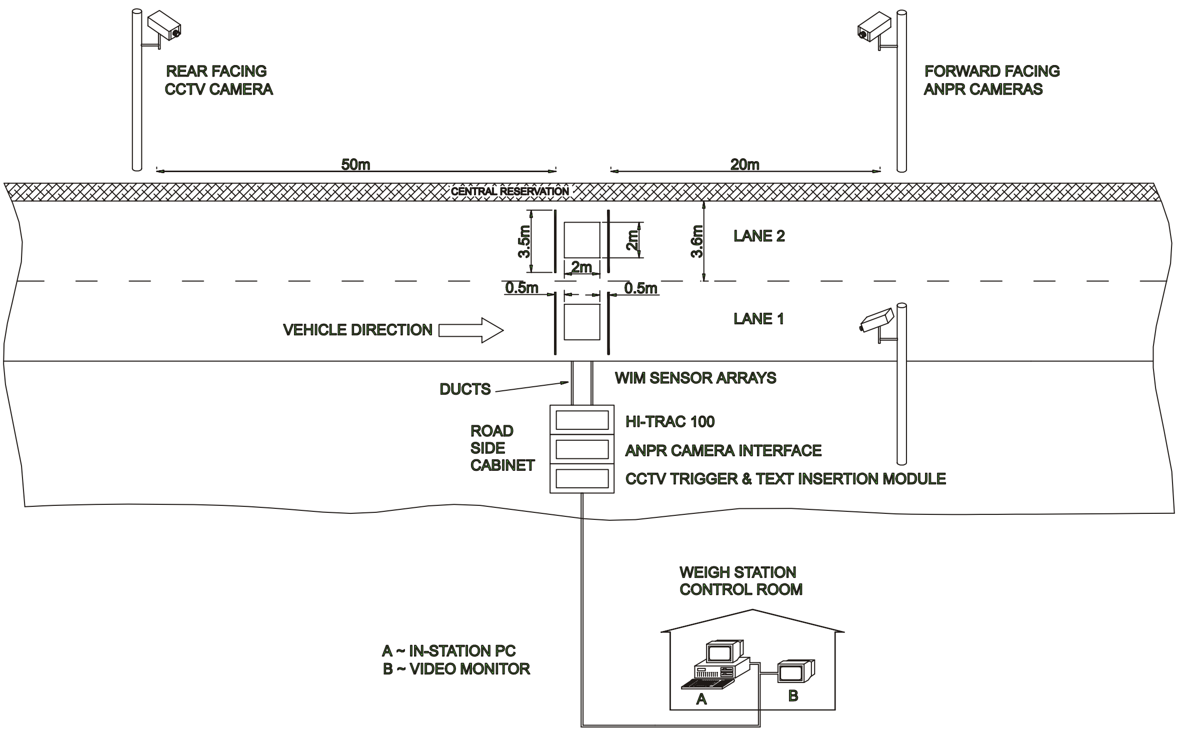
The vehicle diverts to the LO-TRAC® weighbridge where it is weighed to typically ±1% accuracy.



The HI-TRAC® system interfaces directly to the LO-TRAC® weigh station electronics by means of an RS485 communication cable. The LO-TRAC system communicates the HI-TRAC® data to the weigh station PC for user display.

The HI-TRAC® system can be equipped with CCTV. Text can be inserted onto the camera image by the HI-TRAC® 100 system by means of a text insertion module installed at the HI-TRAC roadside cabinet. The output can then be stored onto a time-lapsed VCR and/or displayed on a monitor at the weigh station office.

Additionally a number plate recognition system may be interfaced with the HI-TRAC® for identification of infringing vehicles.



1.8 HI-TRAC® 100 Front Panel Display

The HI-TRAC® 100 displays each vehicle that is detected on the front panel LCD dialogue box. An example of the information displayed is as follows:

```
Cat 61:4,L1
35KPH,Axles 2
Time 10:20:02
T4,ID4
```

This is the normal weighing/recording display mode of the HI-TRAC® 100 electronic unit.

The displayed data is defined as follows: -

Cat 61:4	The vehicle detected was classified as having a class index number of 4 and a class name 61 (this is the vehicle category or classification of a bus).
L1	The lane number in which the vehicle was detected.
35KPH	The speed the vehicle was travelling at in kilometres per hour (KPH).
Axles 2	The total number of axles detected on the vehicle.
Time 10:20:02	The time the vehicle was detected.
T4	The total traffic count for the day.
ID4	The unique identifying code (serial number) assigned by HI-TRAC® 100 to the vehicle record stored in the system battery-backed memory.

NOTE: The Classification Index Number is a unique identifying number for a type of vehicle defined by the number of axles on the vehicle, the spacing between axles on the vehicle and the overhang of the vehicle. A Category or Vehicle Classification or Class Name is an identifier for a group of unique vehicle types that fall under the same identity (e.g. A “BUS” is a category which may include several unique sub-classes defining a 2-axle bus, a 3-axle bus and a mini-bus. These sub-classes are identified by their respective class index numbers assigned by HI-TRAC).

1.9 HI-TRAC® 100 Menu

The HI-TRAC® 100 front panel incorporates a 16-key membrane keypad, which is used in conjunction with the LCD to locally set system parameters. Menu options 1-9 can be selected directly by pressing the corresponding key number; the additional options are selected via the up and down arrows on the keypad.

The menu options are shown on the following page.

Option 1	Set Time Sets the local time
Option 2	Set date Sets the local date
Option 3	Set ATMS Interval The ATMS time interval determines the interval over which the ATMS data file parameters are calculated and recorded.
Option 4	Set lane Layout Configuration Sets the loop length, loop factor and sensor spacing for each lane
Option 5	Select Piezoelectric Sensor Type Selects the manufacturer of the piezoelectric sensor installed into each lane
Option 6	Edit Vehicle Classification Table Enters/edits existing classification detail for each class including a unique identification number, number of axles, inter-axle spacing and overhang
Option 7	Set Communication Baud Rate Selects the communication baud rate, there are five settings between 2,400 and 192,000
Option 8	Configure Communications Port Selects the port to connect to a remote device for downloading data
Option 9	Configure Lane Type – Lanes 1-4 Sets the type of monitoring for each lane: WIM, AVC, CYC (Cycles) or optionally turns monitoring off for that lane
Option 10	Configure Lane Type – Lanes 5-8 Sets the type of monitoring for each lane: WIM, AVC, CYC (Cycles) or optionally turns monitoring off for that lane
Option 11	Configure Thermistor Sets temperature coefficient and calibrates the thermistor
Option 12	System Voltage Monitor The HI-TRAC® 100 monitors the supply voltage and reports supply failures
Option 13	Modem Power Reset & Initialisation Manually resets the modem by turning off its power then turns it on again
Option 14	Cabinet Door Switch Status Indicates the status of the door switches
Option 15	Set Lane Direction – Lanes 1-4 Sets the traffic direction: North/South/East/West
Option 16	Set Lane Direction – lanes 5-8 Sets the traffic direction: North/South/East/West
Option 17	Set WIM Calibration Factor Sets the calibration factor for each lane

2.

PERFORMANCE AND ACCURACY CRITERIA

General Performance Data:

Speed Range	:	5 to at least 200 KPH
Storage Capacity	:	4 Mbytes (Upgrade 6M, 8M)
Vehicle-by-Vehicle Storage	:	400,000 WIM records (4Mbytes)
Lane Capacity WIM/AVC	:	8 Lanes
Statistical File Storage	:	150 days
ATMS File Storage	:	50 Intervals
BINNED Data Storage	:	8 Bins, 1400 Intervals
Telemetry Options	:	GSM, PSTN, GPRS
Temperature Range	:	-20C to +65C
Classification	:	EURO 6 (default)
User Configurable	:	110 Vehicle Classes

WIM/AVC Accuracy:

Piezo-Loop-Piezo	:	±10% GVW
Piezo-Loop-Piezo	:	±15% Axle Group
Piezo-Loop-Piezo	:	±20% Axle Weight

Weight accuracies stated to 95% Confidence or Probability of Conformity.
(NOTE: Weight accuracies of <10% GVW are often achievable)
Axle weight accuracy assumes road sensors installed into a smooth flat road surface with minimal rutting and curvature, as per COST 323 recommendations and ASTM 1318-02 specification.

Speed Range	:	5 to 200 kph
Length	:	±8%
Headway	:	±7%
Speed	:	±1.5%

Classification Accuracy (based on DfT Scheme):

		Loop + Piezo
Class 0:	Motorbike	95%
Class 1:	Cars	97%
Class 2:	Vans	97%
Class 21:	Car/Van + Trailer/Caravan	97%
Class 31:	2 Axle Rigid Truck	98%
Class 32:	3 Axle Rigid Truck	98%
Class 33:	4 Axle Rigid Truck	99%
Class 41:	3 Axle Drawbar Trailer	99%
Class 42:	4 Axle Drawbar Trailer	99%
Class 43:	5 Axle Drawbar Trailer	99%
Class 44:	6 Axle Drawbar Trailer	99%
Class 51:	3 Axle Articulated Truck	99%
Class 52:	4 Axle Articulated Truck (1+1+2)	99%
Class 53:	4 Axle Articulated Truck (1+2+1)	99%
Class 54:	5 Axle Articulated Truck (1+2+2)	99%
Class 55:	5 Axle Articulated Truck (1+1+3)	99%
Class 56:	6 Axle Articulated Truck	99%
Class 61:	Buses and Coaches	97%
Class 7:	7 or More Axle Vehicle	99%
Class CY:	Bicycles (separate sensors required)	95%

2.1 Road Sensor Configurations

There are many different road sensor configurations for traffic classification, counting and weigh-in-motion recording. Each configuration has its own accuracy criteria. The sensor configuration selected for a particular installation should be based on the accuracy requirement, site of installation, ease of installation, maintainability, reliability and cost.

TDC Systems Limited recommends the Piezo-Loop-Piezo installation for the highest quality vehicle classification, speed and axle weight data.

Loop-Piezo-Loop configuration provides for AVC and WIM functionality with only a single piezo sensor for axle weight measurement.

NOTE: Accurate axle weight data can only be acquired if the installation site is located in a smooth, flat road surface with minimum curvature and no rutting for 50 metres before and 20 metres after the installation, with respect to direction of traffic flow.

2.2 Piezo-Loop-Piezo

The piezo-loop-piezo system incorporates two piezo-electric sensors, installed in a lane, 3 Metres apart with a 2 Metre square inductive loop symmetrically between them.

Vehicle speed measurement is performed by measuring the axle detection times on the two piezo-electric sensors. This technique gives an absolute speed measurement of each axle on the vehicle.

Similarly the axle separation is calculated from axle detection times on the same sensor. This is the most accurate axle space measurement technique of all the different road sensor configurations.

Speed accuracy for the piezo-loop-piezo sensor array is quoted at better than ±1.5%.

For a HI-TRAC® 100 AVC Counting/Classifying system either full-size or half-size sensors can be employed. Full-size sensors span the entire width of the traffic lane (typically 3.35Metres). Half-size sensors span a sufficient portion of the lane to cover a single wheel track (typically 1.8Metres). For the AVC system there is a small improvement in vehicle detection for the full-size sensor array.

For a HI-TRAC® 100 WIM system it is recommended that full-size Class 1 piezo-electric sensors are used. With full-size sensors, each wheel on the vehicle passes over the piezo sensor, giving an output proportional to the weight of the wheel. This provides complete axle load information to the HI-TRAC® 100 system. With the half-size sensor solution the HI-TRAC® 100 has to assume that the wheel weights on the same axle are the same and effectively double the wheel weight to attain the axle weight.

For a full-size Class 1 piezo sensor installation with a piezo-loop-piezo configuration (on a smooth road surface as defined above) axle weight accuracy of ±7% are achievable with a 95% confidence limit.

2.3 Loop-Piezo-Loop

The loop-piezo-loop system incorporates two inductive loops, installed in a lane, 2.5 Metres apart with a piezo-electric sensor located symmetrically between them.

Vehicle speed measurement is performed by measuring the vehicle detection times on the two inductive loops.

Similarly the axle separation is calculated from axle detection times on the sensor.

Speed accuracy for the loop-piezo-loop sensor array is quoted at ±1.5%, providing the vehicle travels centrally in the lane.

For a HI-TRAC® 100 AVC Counting/Classifying system utilising the Loop-Piezo-Loop configuration either full-size or half-size sensors can be employed. Full-size sensors span the entire width of the traffic lane (typically 3.35Metres). Half-size sensors span a sufficient portion of the lane to cover a single wheel track (typically 1.8Metres). There is a small improvement in vehicle detection with the full-size sensor array.

For a HI-TRAC® 100 WIM system it is recommended that full-size Class 1 piezo-electric sensors are used. With full-size sensors, each wheel on the vehicle passes over the piezo sensor, giving an output proportional to the weight of the wheel. This provides complete axle load information to the HI-TRAC® 100 system. It is not recommended to use half-size sensors in a WIM application

For a full-size Class 1 piezo sensor installation with a loop-piezo-loop configuration (on a smooth road surface as defined above) axle weight accuracies of ±15% are achievable with a 95% confidence limit.

2.4 Vehicle Classification

Vehicle classification is determined from the number of axles on a vehicle, the separation between each pair of axles on the vehicle and the overhang of the vehicle. The axle separation is calculated to within ±2% with both piezo-loop-piezo and loop-piezo-loop configuration.

The piezo-loop-piezo system accurately detects and classifies vehicles that straddle the sensor array, i.e. vehicles that are travelling between lanes.

Vehicle length accuracy is measured with an accuracy of ±8%.

2.5 The Piezo Sensor

The piezo sensor recommended by TDC Systems Limited is the Roadtrax BL sensor. The specification is as follows:

Output Uniformity:	< ±7% for Class I (WIM) < ±20% for Class II (AVC)
Output Temperature Range	-40 to +80°C
Temperature Sensitivity	±0.1% per °C
Product Life	40,000,000 Equivalent Standard Axle Load's (dependent on installation)

The unique construction of the BL sensor allows it to be installed directly into the road in a flexible format so that it can conform to the profile of the road.

The flat construction of the sensor gives an inherent rejection of road noise due to the road bending effect of an approaching axle and signal detection from adjacent lane activity.

The small cut size (19mm by 19mm slot) in the road minimises the damage which is done to the road, speeds up the installation time and reduces the amount of epoxy that is used for the installation.

For the Weigh-in-Motion installation temperature compensation of the piezo-electric output signal is required for most accurate weight measurement. This is achieved by means of a road-installed temperature sensor probe. The temperature probe is monitored by the HI-TRAC® 100 electronic unit.

The HI-TRAC® 100 system is calibrated with a selection of vehicles whose static axle weights are accurately recorded at a low-speed (or static) weighbridge.

2.6 Bicycle Sensors

The HI-TRAC®100 can be configured to connect to bicycle detection sensors. Two piezo-electric sensors are installed 1 metre apart per bicycle lane.

The bicycle sensors can also be installed in a normal traffic lane. The HI-TRAC®100 filters the normal traffic and only detects bicycles. The filtering function measures the signal size of passing axles to distinguish between bicycles and normal traffic. The speed and axle spacing provide a further distinction.

If bicycle sensors are installed in a normal traffic lane the HI-TRAC®100 is programmed to filter out simultaneous detections of bicycles, mopeds and motorbikes so not to record the same vehicle twice.

2.7 Why Use Piezoelectric Sensors?

TDC recommends the BL® piezoelectric sensor for most WIM applications including pre-selection for enforcement and data collection. The BL sensor gives accuracy of ±10% for 95% of vehicles providing the sensor is installed in a smooth flat road surface.

The installation is simple and can be carried out in 3 hours per lane, meaning minimal road closure times.

The sensors are fully encapsulated in resin and do not exhibit the problem of flush mounted sensors, where resin break up in the wheel track areas causes the sensor to work free over a period of time. These sensors require regular maintenance in the form of resin repairs and cause break up of the road surface around the array.

The sensor cost, installation cost and associated maintenance costs are considerably lower than other proven WIM technologies available now.

3.

HI-TRAC® DATA STORAGE CAPACITY

3.1 Vehicle-by-Vehicle Data Storage

Vehicle-by-Vehicle (VBV) data refers to data stored in the HI-TRAC battery-backed memory for each individual vehicle that is detected by the system. The system stores data on every vehicle detected by the system for 8 days. At the start of the next day (9th day), data recorded on the first day is overwritten hence there is always 7 full days data stored and available for download.

The HI-TRAC electronic unit provides 4 Megabytes of Vehicle-by-Vehicle (VBV) data storage. An average of 10 bytes (WIM or 6 bytes (AVC) required to store all of the recorded data for a vehicle with all VBV parameters selected for storage the total capacity of the system is approximately 400,000 (WIM) or 600,000 (AVC) vehicles. Parameters stored on a vehicle-by-vehicle basis include:

- Date
- Time
- Serial Number (unique ID number)
- Number of Axles
- Vehicle Classification Index
- Vehicle Category
- Lane Number
- Direction
- Vehicle Straddling
- Validity Code
- Road Surface Temperature
- Individual Axle Weights (ESA)
- Gross Vehicle Weight
- Inter-Vehicle Spacing (Gap)
- Headway (time between subsequent vehicle detections on same lane)
- Vehicle Length

The parameters stored with each VBV data record are configurable, by lane, from within the HI-COMM 100 software package. This provides a means of optimising the memory storage inside the HI-TRAC®100 for the vehicle data of interest. To help the operator determine memory allocation and number of days of required storage a HI-TRAC®100 memory map is graphically displayed from within the HI-COMM 100 software.

3.2 Statistical Data Files

The HI-TRAC®100 stores in battery-backed memory statistical data files for the previous 150 days of HI-TRAC®100 operation. These data files include the following information:

- Average Speed per Vehicle Category per Lane per Day
- Traffic Volume per Vehicle Category per Lane per Day
- Traffic Volume per Hour per Lane per Day
- Average Gross Weight per Category per Lane per Day
- Axle Volume per Weight Band per Lane per Day

A vehicle category is a group of vehicle classifications, for example all buses may fall under the title “BUSES” (or Class “61”) whether they are 2 axle, 3 axle, mini-buses or coaches.

3.3 ATMS Data Files

ATMS (Advanced Traffic Management System) data files store vehicle data and fault monitoring information over a configurable time period from 1 minute to 12 hours. The data stored in each ATMS file includes:

- Start Date of ATMS interval
- Start Time of ATMS interval
- Period of ATMS interval
- Diagnostic Code for ATMS interval
- Occupancy per Lane for ATMS Interval
- Average Speed per Category per Lane for ATMS Interval
- Traffic Volume per Category per Lane for ATMS interval

The HI-TRAC® 100 stores 50 ATMS files for the previous 50 ATMS intervals. The oldest data file is overwritten at the start of a new ATMS interval.

A diagnostic code is stored with each ATMS file. This gives an indication of any system errors that may have occurred during the ATMS interval. To view the definition of diagnostic code, from within the HI-COMM 100 software package, click on the ATMS record of interest and press CTRL and F1 simultaneously. A window appears with definitions of the code.

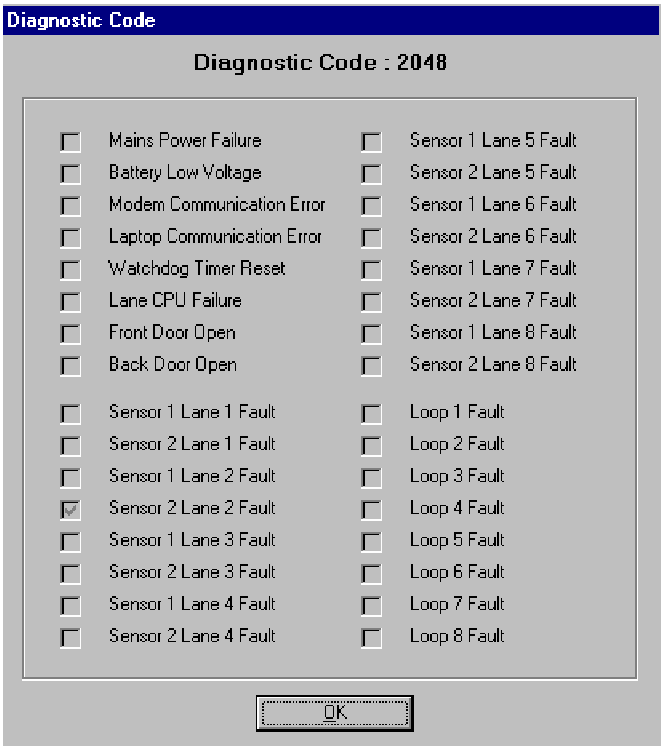
The diagnostic code is 4 bytes in size. Each bit within the diagnostic code has a definition:

3.4 Malfunction Management Data Files

Malfunction management data files are stored on the HI-TRAC® for the previous 8 days (the 8th data file being overwritten at the start of a new day).

The malfunction data file contains information on mains power failures, communication errors, sensor failures, loop failures and cabinet doors opening.

When HI-COMM 100 connects to a HI-TRAC® 100 system it downloads this file. If a new error condition is detected in the malfunction management file a fault log database (Fault.mdb) on the PC located in the application directory is updated with the fault condition. The ‘View Malfunction Management’ icon illuminates to indicate a new fault has been detected.



Diagnostic Codes

4

EXAMPLE REPORTS & SCREEN DISPLAYS

4.1 Examples of HI-COMM 100 Software Screen Displays

Typical software screen displays to help illustrate the functionality and comprehensive features of the HI-COMM 100 software package are portrayed on the following pages.

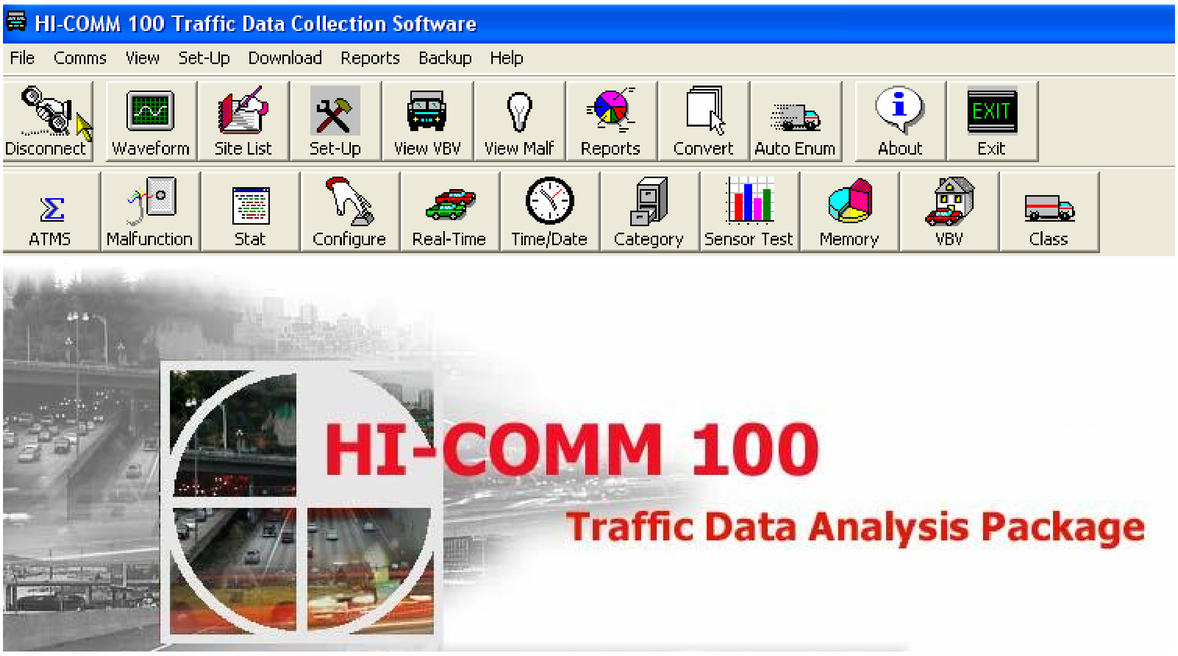
- HI-COMM 100 Opening Screen (Connected to HI-TRAC® 100)
- Communications Parameters
- HI-TRAC® 100 Configuration
- VBV Data Retrieval
- VBV Real Time Traffic Display
- VBV Real Time Display Configuration
- Diagnostic Functions – Sensor Test, Waveforms & Codes
- Axle Weight & Speed Band Limits
- Vehicle Classification Configuration & Weight Limits
- ESA Parameters
- VBV Memory Allocation & Data Conversion

4.2 Examples of Reports

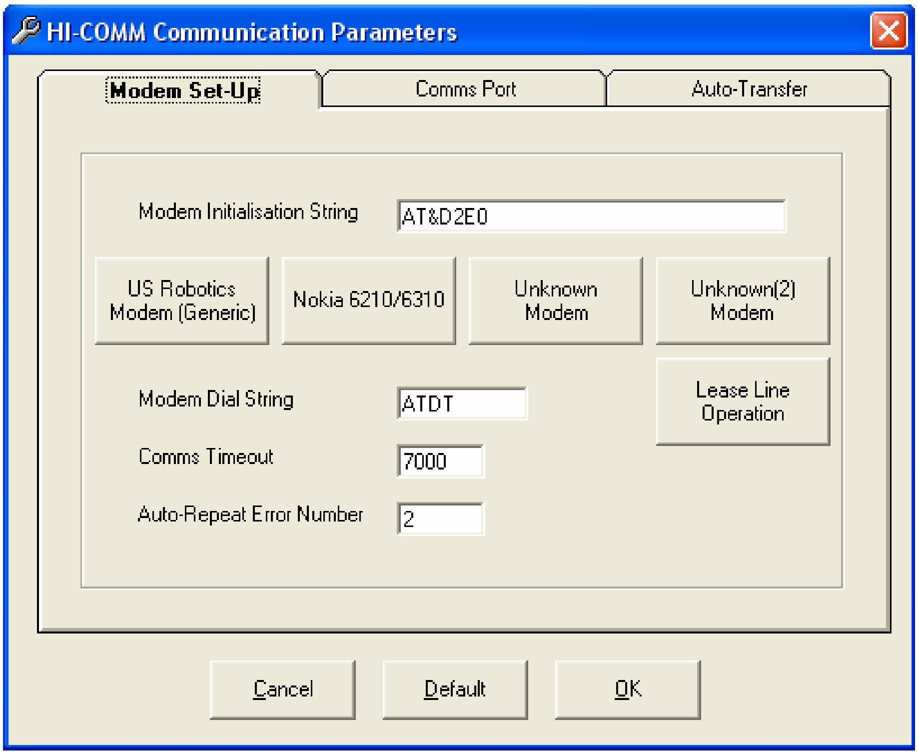
The following pages portray examples of just some of the reports currently available in the **HI-COMM 100** software package.

- Reports Selection, Configuration & Criteria
- Report Sample:- Volume per Class per Lane
- Report Sample:- Average Speed per Class per Lane
- Report Sample:- Volume per Lane per Time Band
- Report Sample:- AEF & ESA per Weight Band per Lane
- Report Sample:- Damage Factor
- Report Sample:- Volume per Speed Band per Lane
- Report Sample:- Volume per Speed Band per Time Band including Percentile Speed
- Report Sample:- Overloaded Vehicles per Class per Lane
- Statistical Report Sample:- Average Speed per Category
- Malfunction Management Report Sample
- ATMS Report Sample:- Traffic Volume by Category by Lane

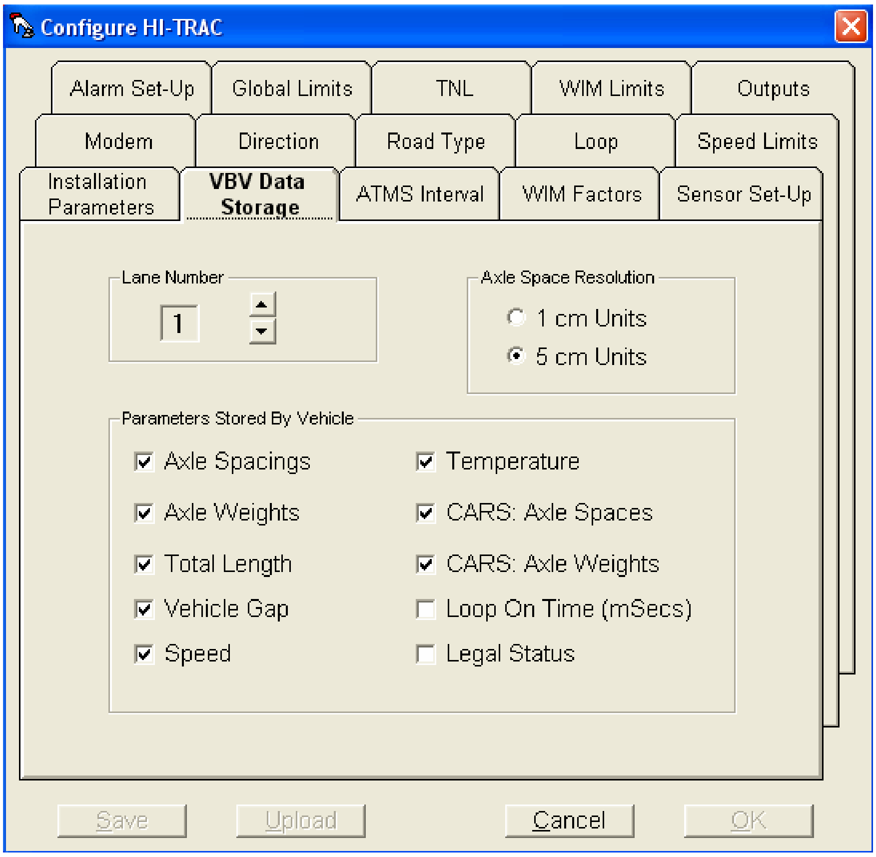
HI-COMM 100 SET-UP & CONFIGURATION



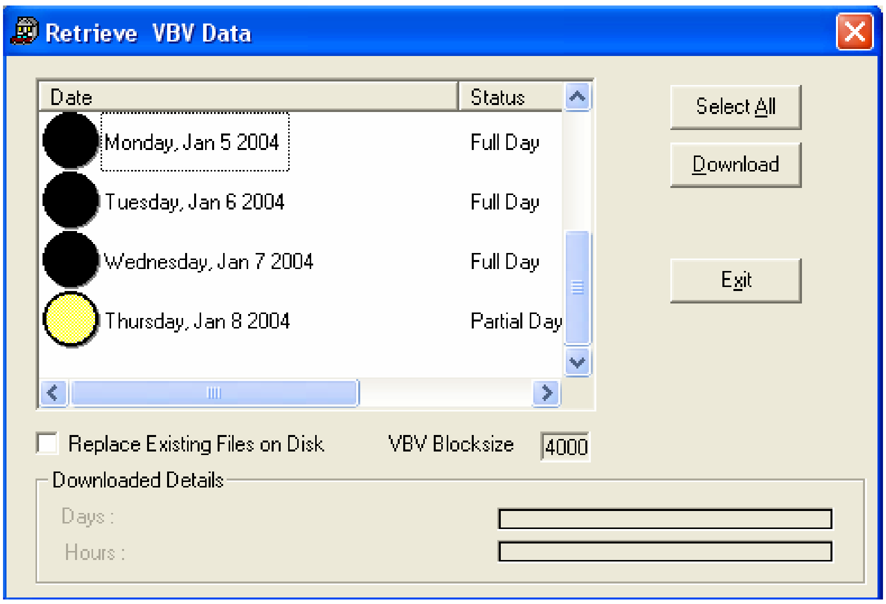
HI-COMM 100 Software
(HI-TRAC® Connected)



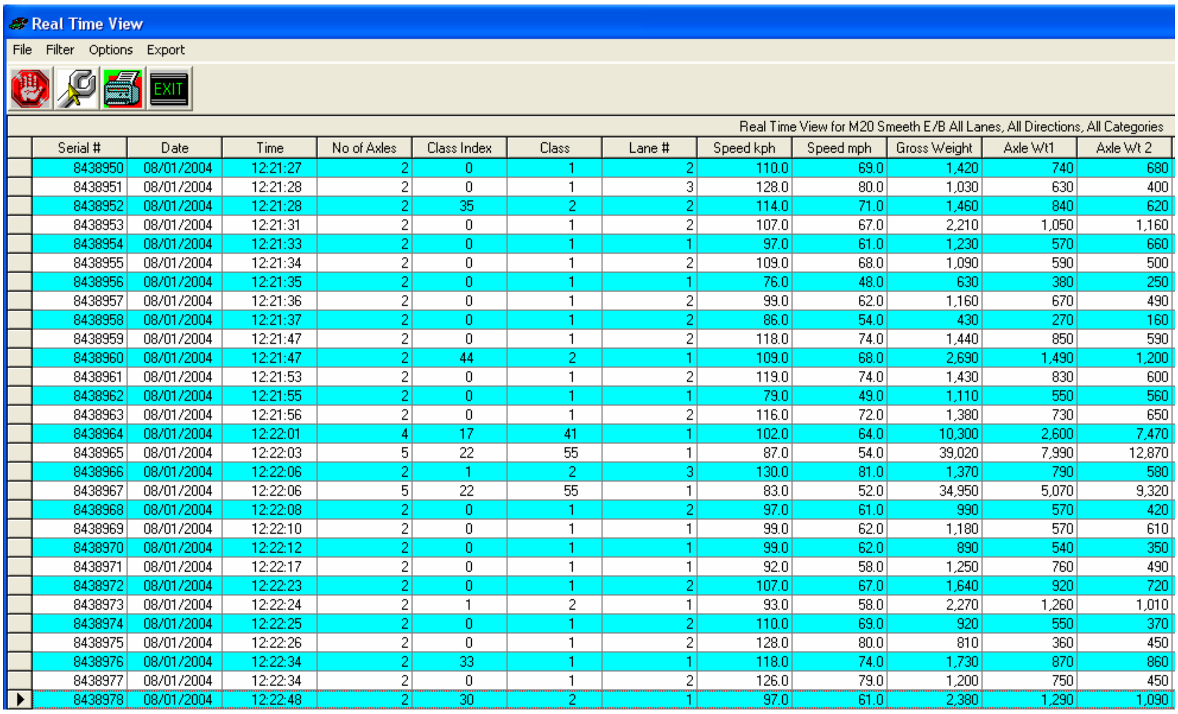
Communications Parameters



HI-TRAC® 100 Configuration
(VBV Data Storage Configuration)

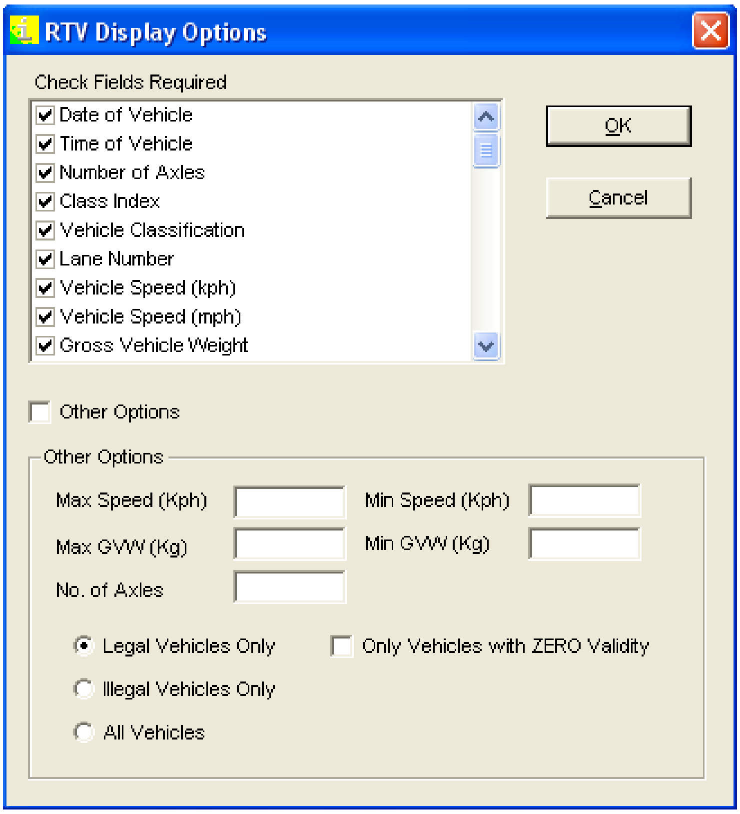


VBV Data Retrieval

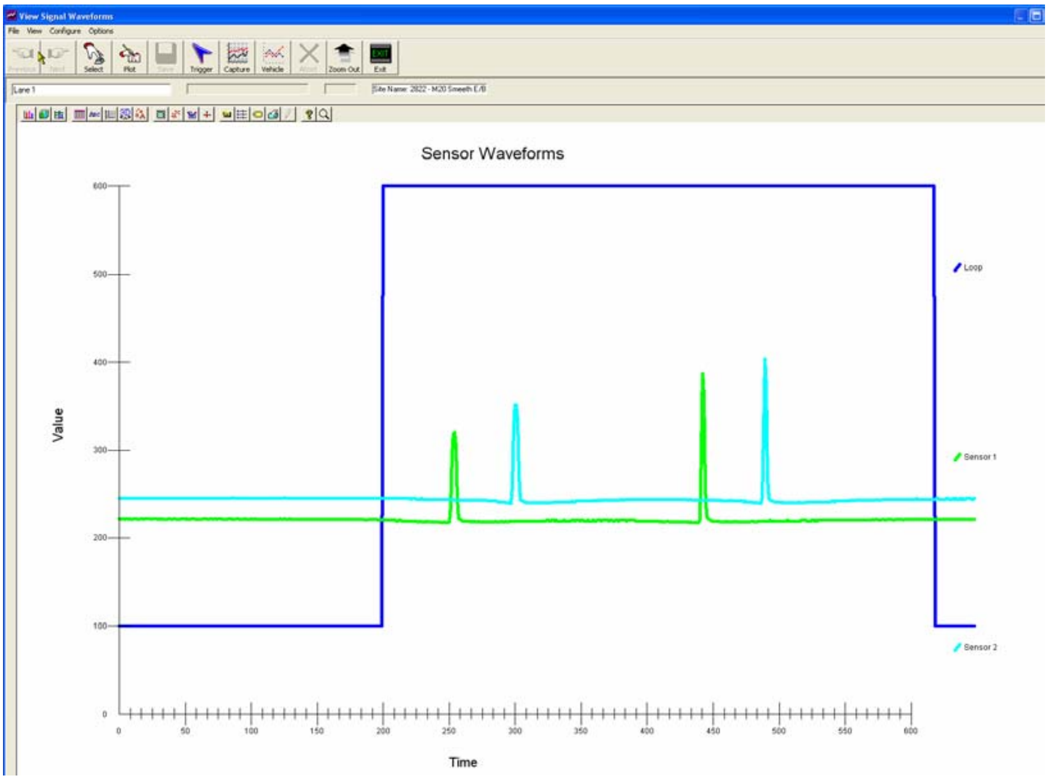


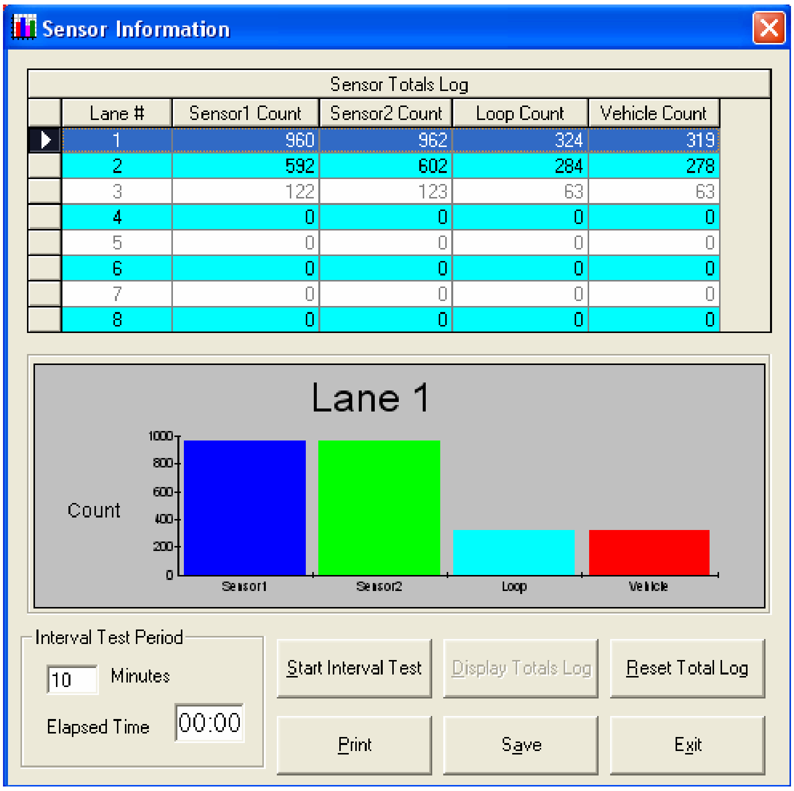
Serial #	Date	Time	No of Axles	Class Index	Class	Lane #	Speed kph	Speed mph	Gross Weight	Axle Wt1	Axle Wt 2
8438950	08/01/2004	12:21:27	2	0	1	2	110.0	69.0	1,420	740	680
8438951	08/01/2004	12:21:28	2	0	1	3	128.0	80.0	1,030	630	400
8438952	08/01/2004	12:21:28	2	35	2	2	114.0	71.0	1,460	840	620
8438953	08/01/2004	12:21:31	2	0	1	2	107.0	67.0	2,210	1,050	1,160
8438954	08/01/2004	12:21:33	2	0	1	1	97.0	61.0	1,230	570	660
8438955	08/01/2004	12:21:34	2	0	1	2	109.0	68.0	1,090	590	500
8438956	08/01/2004	12:21:35	2	0	1	1	76.0	48.0	630	380	250
8438957	08/01/2004	12:21:36	2	0	1	2	99.0	62.0	1,160	670	490
8438958	08/01/2004	12:21:37	2	0	1	2	86.0	54.0	430	270	160
8438959	08/01/2004	12:21:47	2	0	1	2	118.0	74.0	1,440	850	590
8438960	08/01/2004	12:21:47	2	44	2	1	109.0	68.0	2,690	1,490	1,200
8438961	08/01/2004	12:21:53	2	0	1	2	119.0	74.0	1,430	830	600
8438962	08/01/2004	12:21:55	2	0	1	1	79.0	49.0	1,110	550	560
8438963	08/01/2004	12:21:56	2	0	1	2	116.0	72.0	1,380	730	650
8438964	08/01/2004	12:22:01	4	17	41	1	102.0	64.0	10,300	2,600	7,470
8438965	08/01/2004	12:22:03	5	22	55	1	87.0	54.0	39,020	7,990	12,870
8438966	08/01/2004	12:22:06	2	1	2	3	130.0	81.0	1,370	790	580
8438967	08/01/2004	12:22:06	5	22	55	1	83.0	52.0	34,950	5,070	9,320
8438968	08/01/2004	12:22:08	2	0	1	2	97.0	61.0	990	570	420
8438969	08/01/2004	12:22:10	2	0	1	1	99.0	62.0	1,180	570	610
8438970	08/01/2004	12:22:12	2	0	1	1	99.0	62.0	890	540	350
8438971	08/01/2004	12:22:17	2	0	1	1	92.0	58.0	1,250	760	490
8438972	08/01/2004	12:22:23	2	0	1	2	107.0	67.0	1,640	920	720
8438973	08/01/2004	12:22:24	2	1	2	1	93.0	58.0	2,270	1,260	1,010
8438974	08/01/2004	12:22:25	2	0	1	2	110.0	69.0	920	550	370
8438975	08/01/2004	12:22:26	2	0	1	2	128.0	80.0	810	360	450
8438976	08/01/2004	12:22:34	2	33	1	1	118.0	74.0	1,730	870	860
8438977	08/01/2004	12:22:34	2	0	1	2	126.0	79.0	1,200	750	450
8438978	08/01/2004	12:22:48	2	30	2	1	97.0	61.0	2,380	1,290	1,090

VBV Real Time View



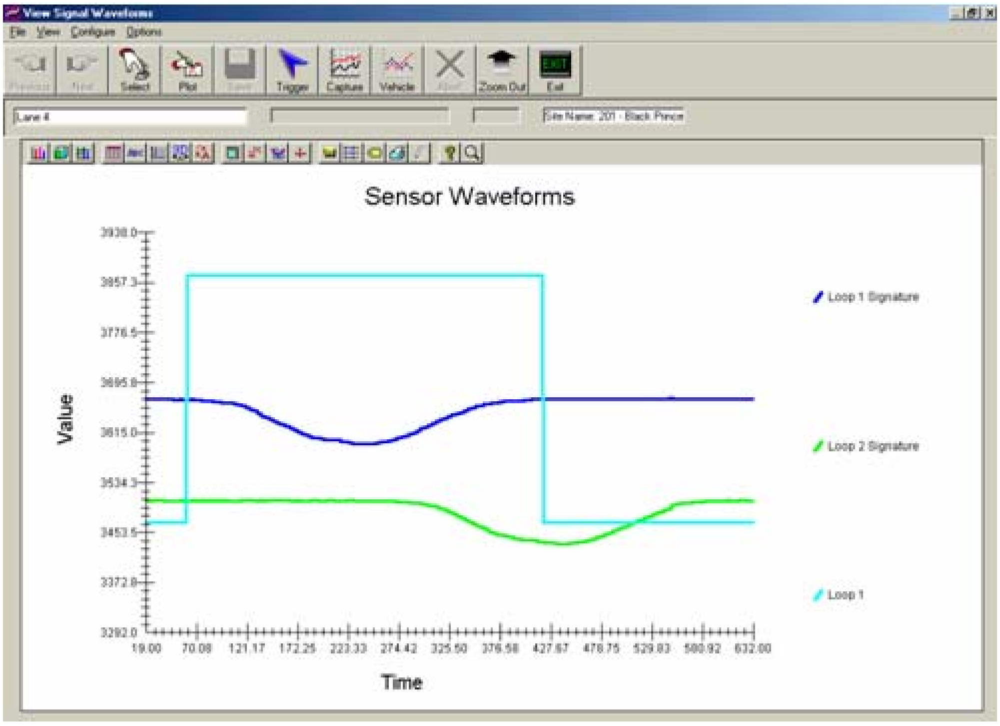
VBV Real Time Display Options



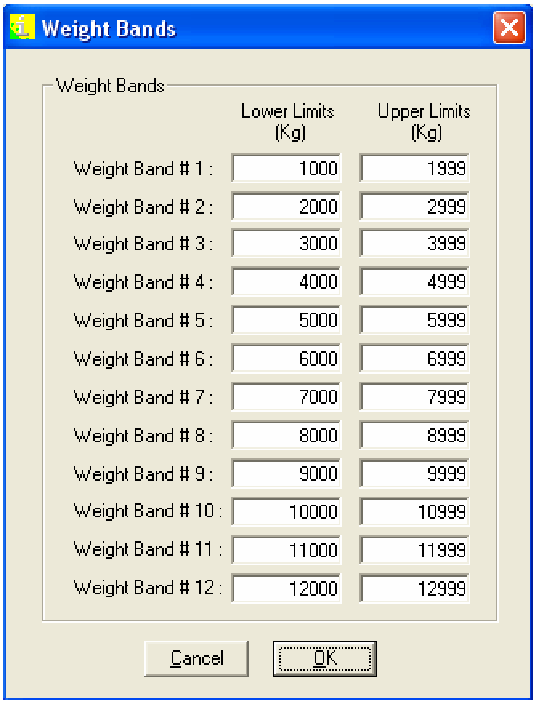


Lane #	Sensor1 Count	Sensor2 Count	Loop Count	Vehicle Count
1	960	962	324	319
2	592	602	284	278
3	122	123	63	63
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0

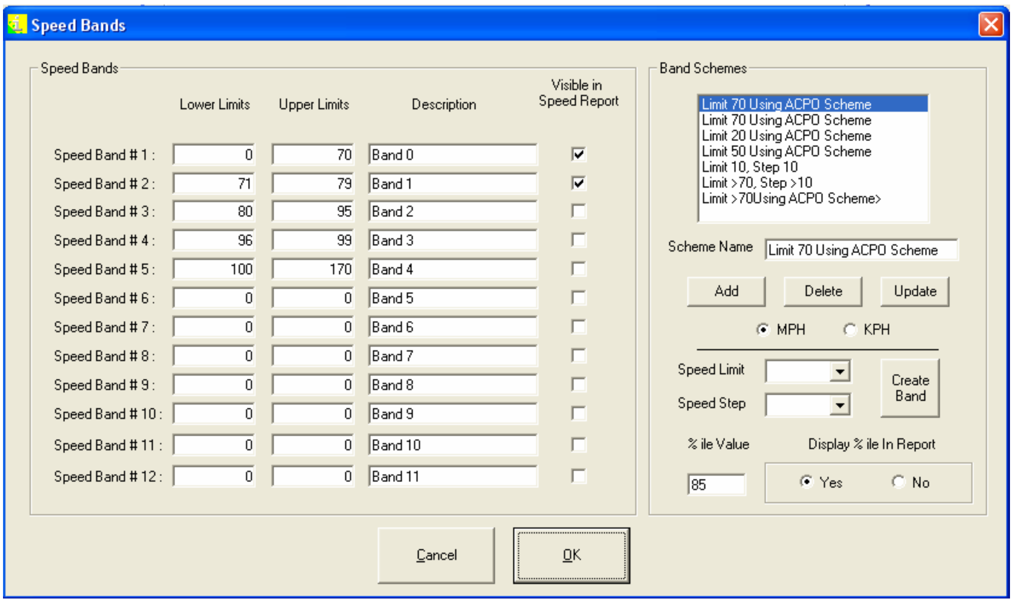
Diagnostic Functions
Sensor Waveform & Sensor Test Functions



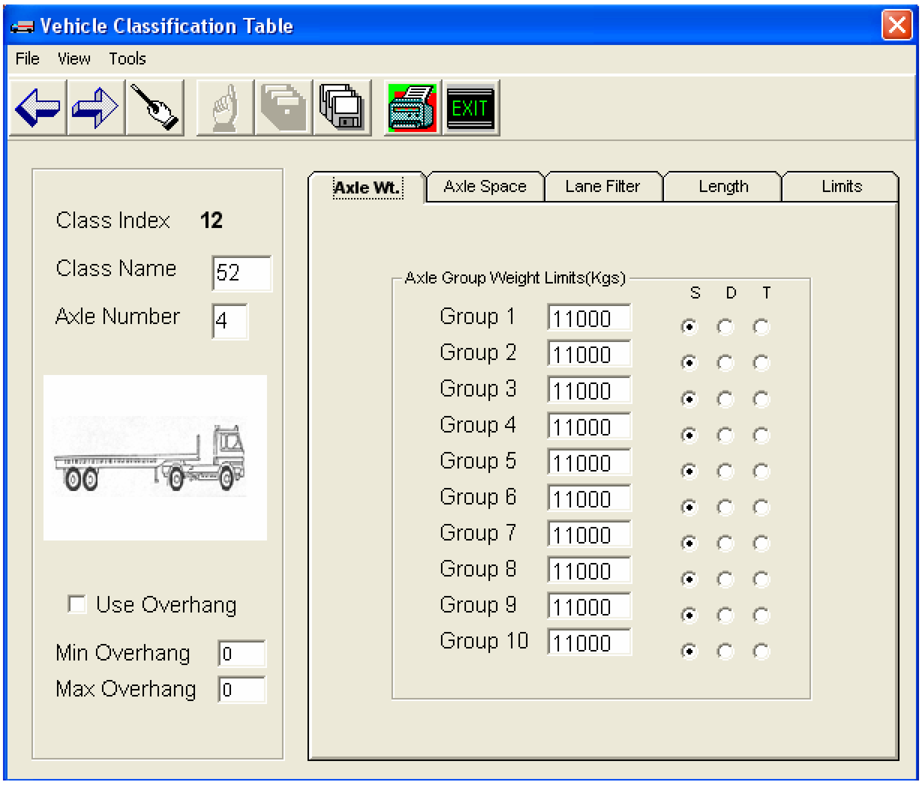
Diagnostic Functions
(Loop Signature – Car)



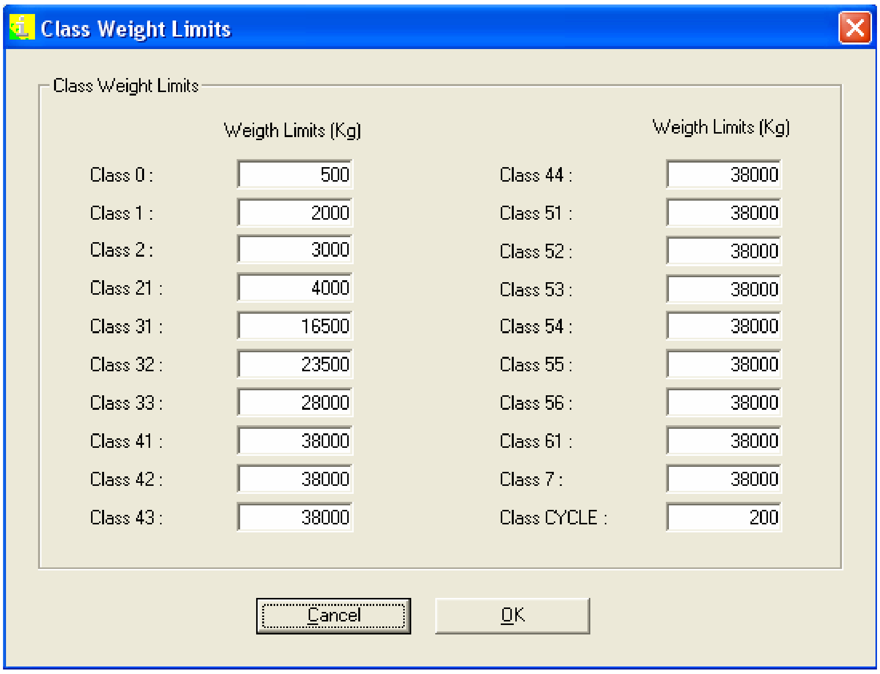
Axle Weight Band Limits



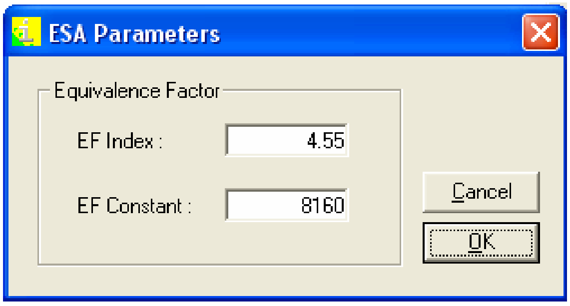
Speed Band Limits



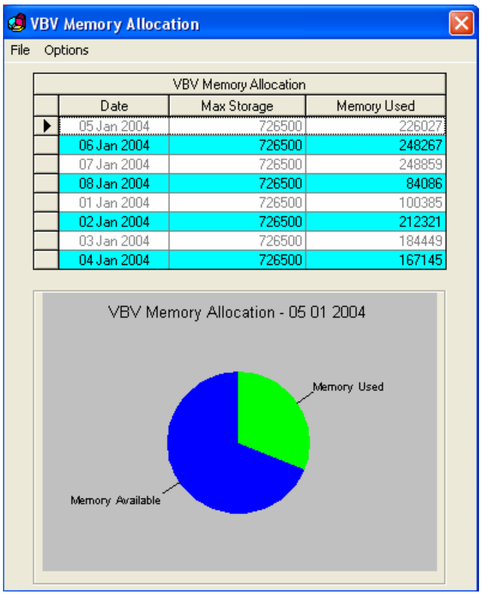
Vehicle Classification Table
(Axle Weight Limits Per Class)



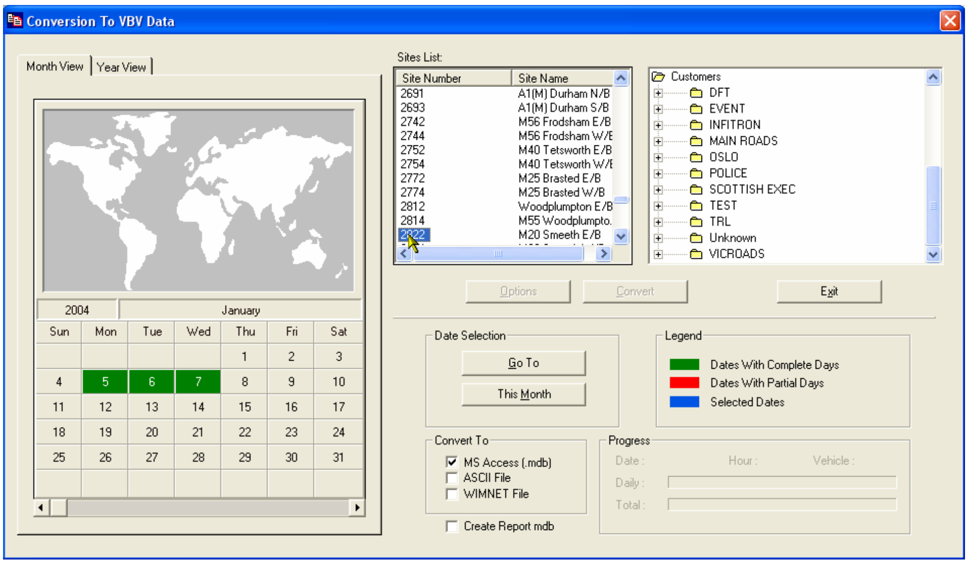
Class Gross Weight Limits



ESA Calculation Parameters

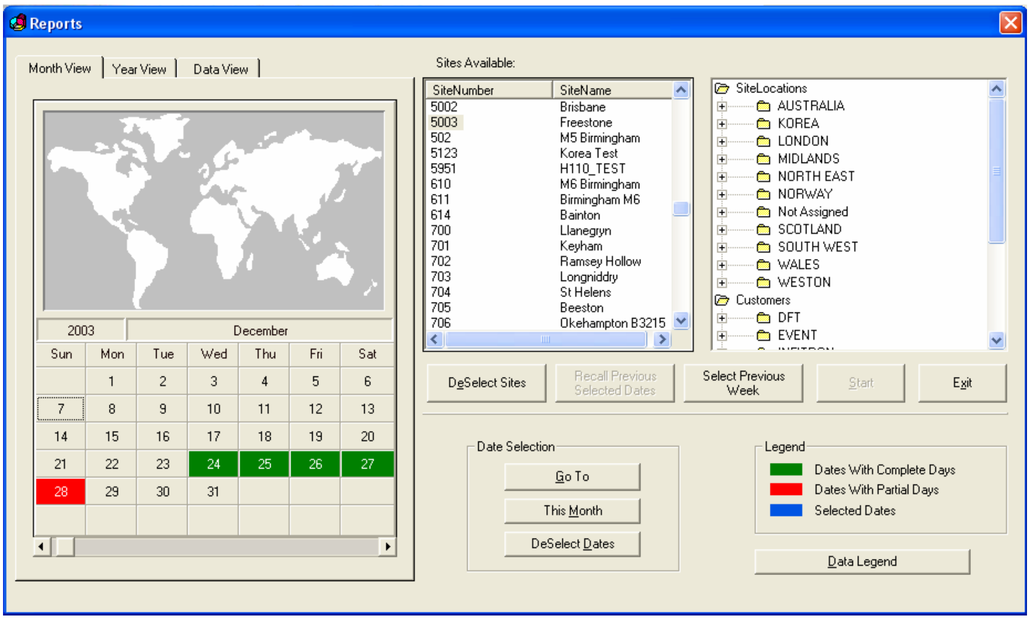


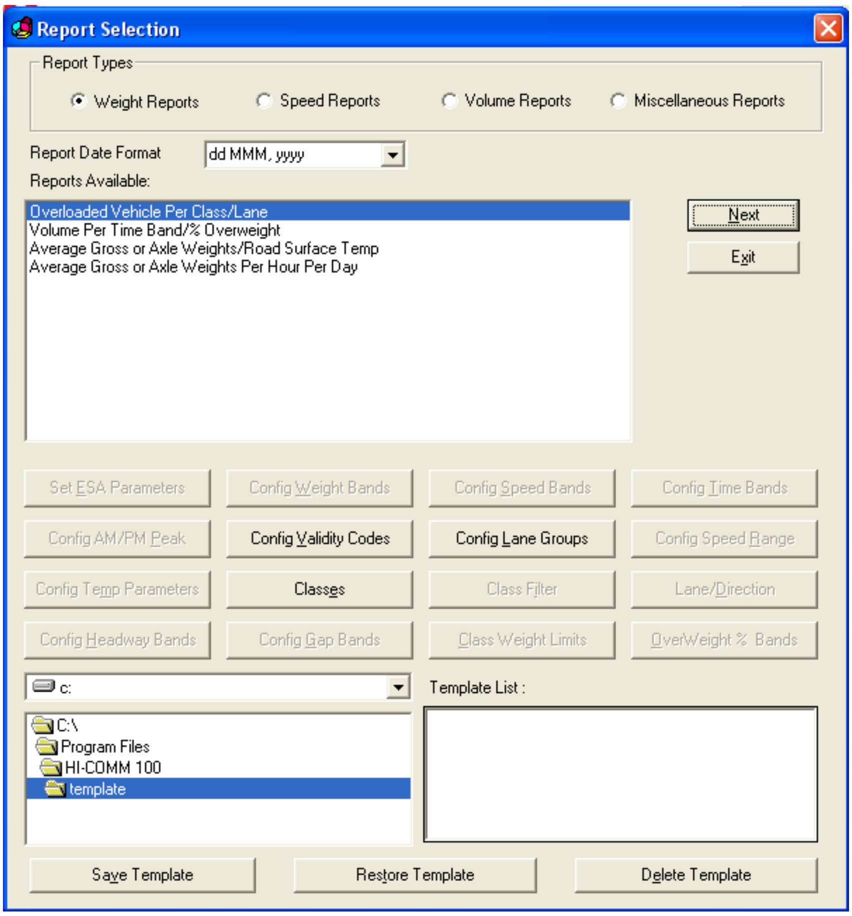
VBV Memory Allocation



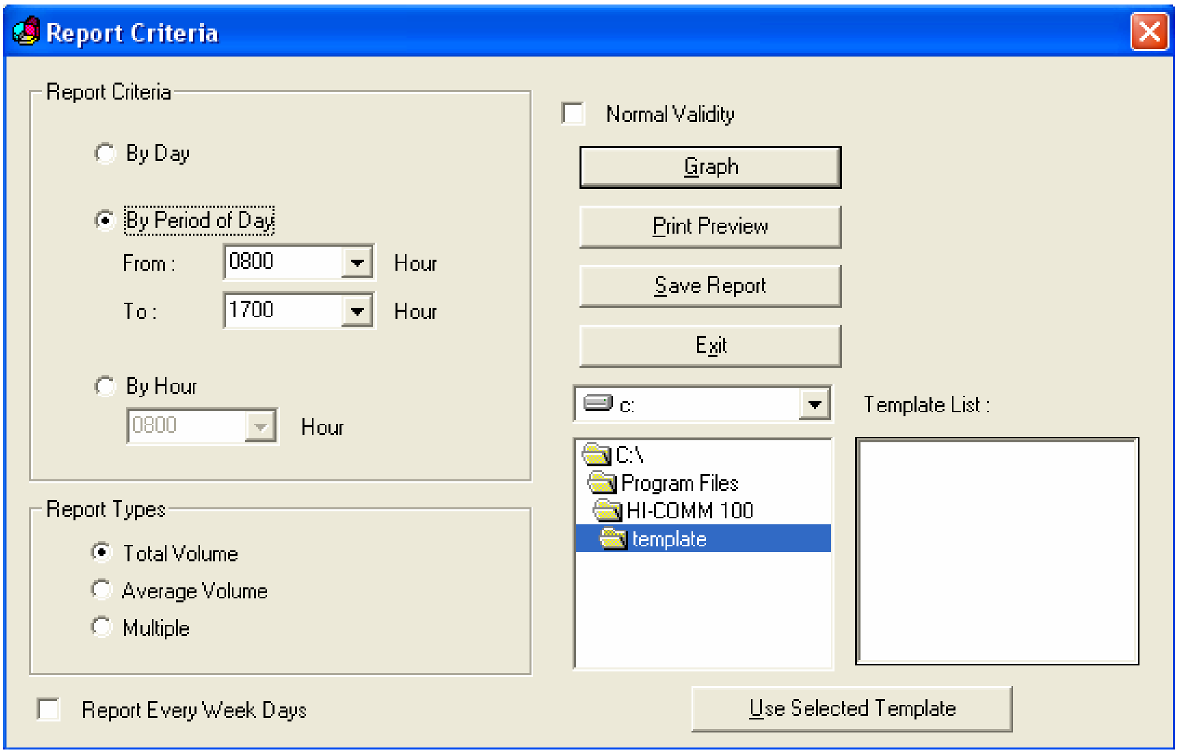
VBV Data Conversion

HI-COMM 100 REPORT SAMPLES





Reports Selection



Reports Criteria
(Selectable Time Periods)

Report Date : 08/01/2004
Report Time : 15:44

Volume/Class/Lane - 2822 - M20 Smeeth E/B (3 Days)

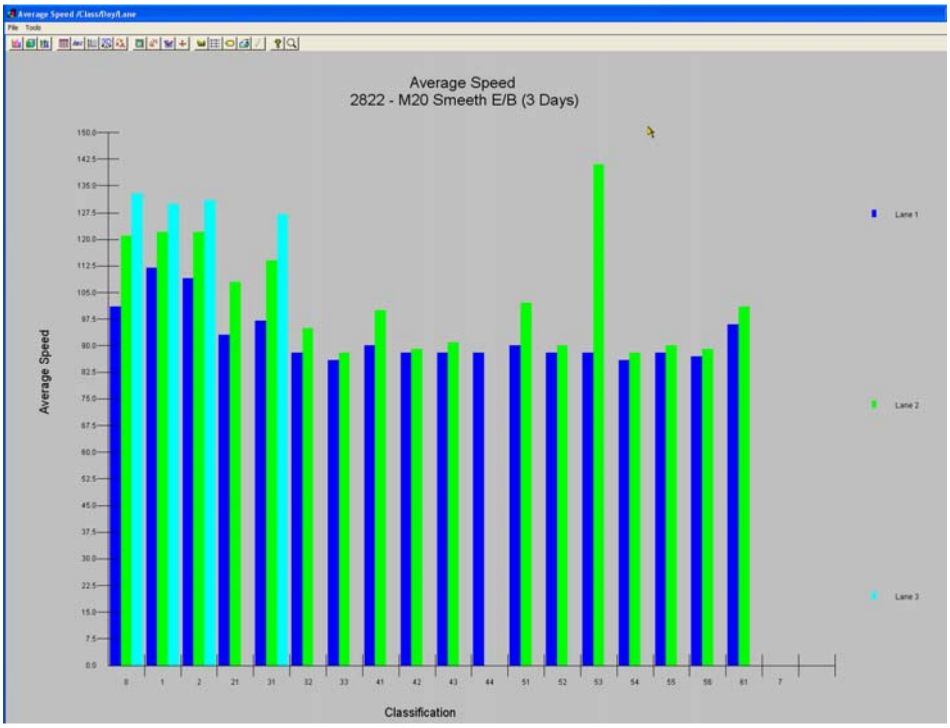
Class	Lane 1	Lane 2	Lane 3	Total
Class 0	93	94	32	219
Class 1	15078	22158	6137	43373
Class 2	2286	2589	644	5519
Class 21	123	26	0	149
Class 31	1517	542	90	2149
Class 32	180	10	0	190
Class 33	207	6	0	213
Class 41	347	41	0	388
Class 42	97	11	0	108
Class 43	271	20	0	291
Class 44	13	0	0	13
Class 51	74	7	0	81
Class 52	1207	108	0	1315
Class 53	4	1	0	5
Class 54	36	3	0	39
Class 55	8073	623	0	8696
Class 56	746	35	0	781
Class 61	251	54	0	305
Class 7	0	0	0	0
Class CYCLE	0	0	0	0
Total:	30603	26328	6903	63834

Volume Per Class Per Lane

Report Date : 08/01/2004
Report Time : 15:49

Average Speed/Class/Lane - 2822 - M20 Smeeth E/B (3 Days)

Class	Lane 1	Lane 2	Lane 3	Total
Class 0	101	121	133	118
Class 1	112	122	130	121
Class 2	109	122	131	121
Class 21	93	108	0	100
Class 31	97	114	127	113
Class 32	88	95	0	92
Class 33	86	88	0	87
Class 41	90	100	0	95
Class 42	88	89	0	88
Class 43	88	91	0	90
Class 44	88	0	0	88
Class 51	90	102	0	96
Class 52	88	90	0	89
Class 53	88	141	0	114
Class 54	86	88	0	87
Class 55	88	90	0	89
Class 56	87	89	0	88
Class 61	96	101	0	98
Class 7	0	0	0	0
Class CYCLE	0	0	0	0
Total:	92	103	130	

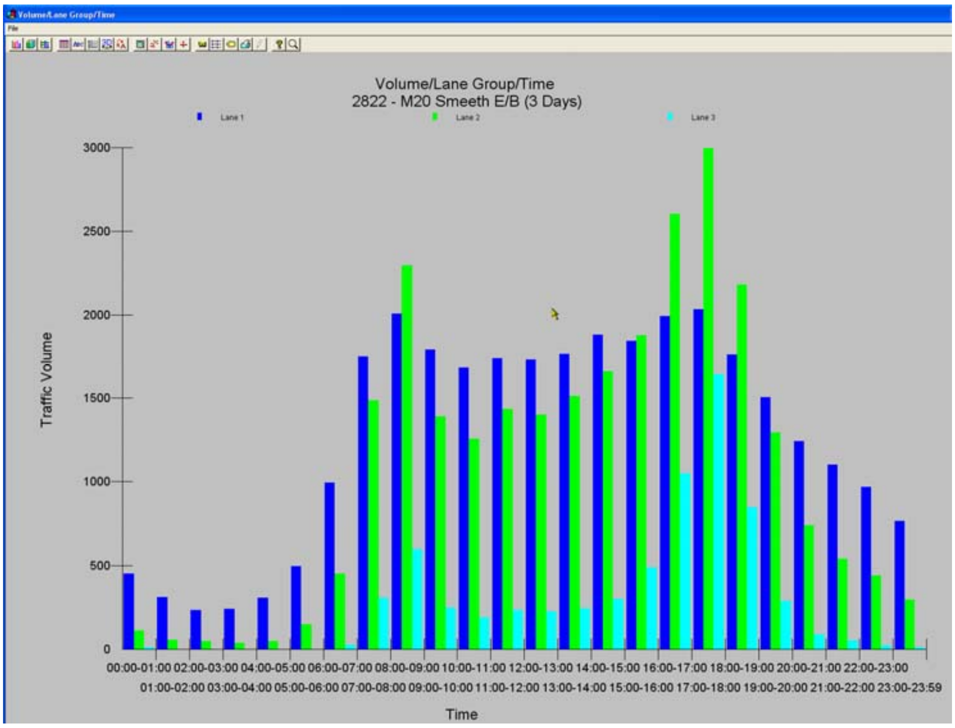


Average Speed Per Class Per Lane

Report Date : 08/01/2004
Report Time : 15:52

Volume/Lane Group/Time - 2822 - M20 Smeeth E/B (3 Days)

Time of Day	Lane 1	Lane 2	Lane 3	Total
Selected Class: All				
00:00-01:00	457	112	12	581
01:00-02:00	313	58	1	372
02:00-03:00	235	48	0	283
03:00-04:00	244	39	1	284
04:00-05:00	307	48	3	358
05:00-06:00	498	151	1	650
06:00-07:00	994	453	27	1474
07:00-08:00	1754	1489	307	3550
08:00-09:00	2012	2293	599	4904
09:00-10:00	1797	1391	248	3436
10:00-11:00	1688	1256	189	3133
11:00-12:00	1745	1435	236	3416
12:00-13:00	1739	1404	226	3369
13:00-14:00	1772	1516	247	3535
14:00-15:00	1885	1660	303	3848
15:00-16:00	1850	1877	492	4219
16:00-17:00	1997	2603	1050	5650
17:00-18:00	2043	2998	1643	6684
18:00-19:00	1761	2181	846	4788
19:00-20:00	1516	1295	290	3101
20:00-21:00	1248	740	93	2081
21:00-22:00	1108	544	52	1704
22:00-23:00	971	443	25	1439
23:00-23:59	764	296	13	1073
Total:	30698	26330	6904	63932



Volume Per Lane Group Per Time Band

Report Date : 08/01/2004
Report Time : 16:14

AEF And ESA/Weight Band/Lane - 2822 - M20 Smeeth E/B (3 Days)

Selected Class: All

Lane 1

Weight Bands (Kg)	Axle Volume	Total Axle Weight (Kg)	AEF	ESA
1000~1999	10,668	16,203,150	0.0006102	6.509989
2000~2999	10,297	24,730,320	0.0042848	44.1202914
3000~3999	7,567	25,972,500	0.0206768	156.2542407
4000~4999	7,717	34,525,800	0.0671458	518.1637547
5000~5999	10,664	58,249,300	0.1644668	1753.874292
6000~6999	8,263	52,908,000	0.3370891	2785.367231
7000~7999	2,943	22,186,400	0.7017231	2065.171061
8000~8999	1,741	14,601,800	1.1435435	1990.909152
9000~9999	1,032	9,729,000	1.9438144	2006.016504
10000~10999	669	6,956,500	3.0322122	2028.549959
11000~11999	386	4,398,100	4.5903719	1771.883535
12000~12999	182	2,249,700	6.6423243	1208.903025
Total:	62,119	272,710,570	18.6482629	16335.72303

Axle Volume / Total Axle Weight / ESA

Report Date : 08/01/2004
Report Time : 16:14

AEF And ESA/Weight Band/Lane - 2822 - M20 Smeeth E/B (3 Days)

Weight Bands (Kg) Axle Volume Total Axle Weight (Kg) AEF ESA
Selected Class: All

Lane	Damage Factor
Lane 1	0.5320216
Lane 2	0.0572821
Lane 3	0.0003231

Damage Factor

Report Date : 08/01/2004
Report Time : 16:13

Volume/Speed Band/Lane - 2822 - M20 Smeeth E/B (3 Days)

Selected Class : 0, 1, 2, 21, 31, 32, 33, 41, 42, 43, 44, 51, 52, 53, 54, 55, 56, 61, 7, CYCLE

Speed(MPH)	Lane 1	Lane 2	Lane 3	Total
0~70	22571	6862	424	29857
71~79	5853	11646	2391	19890
80~95	2082	7434	3788	13304
96~99	76	282	231	589
100~170	21	104	69	194
0~0	0	0	0	0
0~0	0	0	0	0
0~0	0	0	0	0
0~0	0	0	0	0
0~0	0	0	0	0
0~0	0	0	0	0
0~0	0	0	0	0
Total:	30603	26328	6903	63834

Volume Per Speed Band Per Lane

Report Date : 08/01/2004
Report Time : 16:17

Volume/Speed Band/Time - 2822 - M20 Smeeth E/B (3 Days)

Page : 1/2

Selected Lanes : L1(NSEW), L2(NSEW), L3(NSEW)
Selected Class: All

Time of Day	Legal (0~70)	Warning (71~79)	Fine (80~95)	Summons (96~99)	Disqualify (100~170)	Total	85% ile
00:00~01:00	296	139	132	9	5	581	83
01:00~02:00	237	65	61	4	5	372	81
02:00~03:00	172	47	59	4	1	283	81
03:00~04:00	194	47	38	2	3	284	79
04:00~05:00	245	66	40	4	3	358	79
05:00~06:00	373	151	115	7	4	650	81
06:00~07:00	814	388	255	10	7	1474	80
07:00~08:00	1710	1169	642	25	4	3550	80
08:00~09:00	1750	1787	1315	45	7	4904	83
09:00~10:00	1333	1121	925	41	16	3436	84
10:00~11:00	1313	997	762	48	13	3133	83
11:00~12:00	1517	1076	762	43	18	3416	83
12:00~13:00	1521	975	816	41	16	3369	83
13:00~14:00	1601	1108	774	41	11	3535	83
14:00~15:00	1780	1144	859	51	14	3848	83
15:00~16:00	1911	1344	903	47	14	4219	83
16:00~17:00	2702	1907	1016	18	7	5650	80
17:00~18:00	3328	2303	1038	13	2	6684	80
18:00~19:00	2105	1587	1051	34	11	4788	81
19:00~20:00	1527	881	656	34	3	3101	81
20:00~21:00	1161	516	367	28	9	2081	81
21:00~22:00	975	426	281	13	9	1704	80
22:00~23:00	799	383	240	8	9	1439	80
23:00~23:59	594	264	194	18	3	1073	81
Total:	29958	19891	13301	588	194	63932	
AM Peak Time	08:00-09:00	08:00-09:00	08:00-09:00	08:00-09:00	09:00-10:00	08:00-09:00	
AM Peak Vol.	1750	1787	1315	45	16	4904	
PM Peak Time	17:00-18:00	17:00-18:00	18:00-19:00	15:00-16:00	15:00-16:00	17:00-18:00	
PM Peak Vol.	3328	2303	1051	47	14	6684	

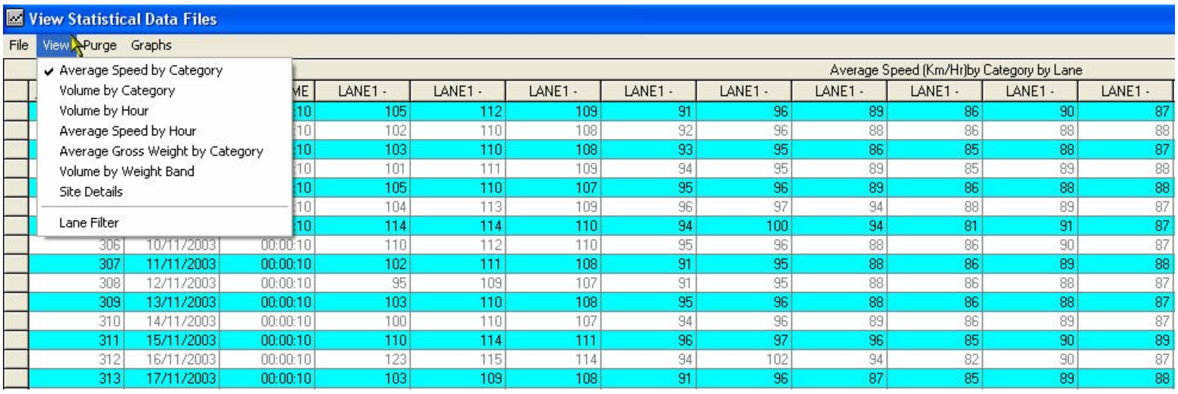
Traffic Volume Per Speed Band Per Time
(Including Percentile Speed)

Report Date : 08/01/2004
Report Time : 14:59

Overloaded Vehicle/Class/Lane - 2822 - M20 Smeeth E/B (3 Days)

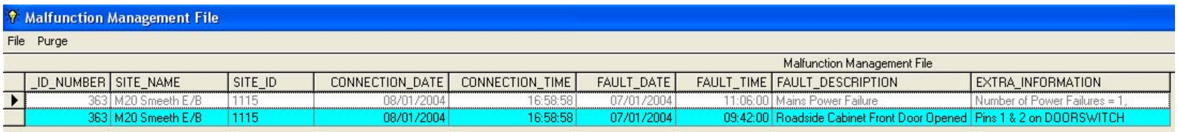
Class	Lane 1	Lane 2	Lane 3	Total
Class 0	1	0	0	1
Class 1	5	17	0	22
Class 2	1	1	0	2
Class 21	0	0	0	0
Class 31	4	1	0	5
Class 32	2	0	0	2
Class 33	1	1	0	2
Class 41	11	0	0	11
Class 42	8	4	0	12
Class 43	11	0	0	11
Class 44	2	0	0	2
Class 51	0	0	0	0
Class 52	5	0	0	5
Class 53	0	0	0	0
Class 54	1	1	0	2
Class 55	850	88	0	938
Class 56	184	8	0	192
Class 61	9	4	0	13
Class 7	0	0	0	0
Class CYCLE	0	0	0	0
Total:	1095	125	0	1220

Overloaded Vehicles Per Class Per Lane



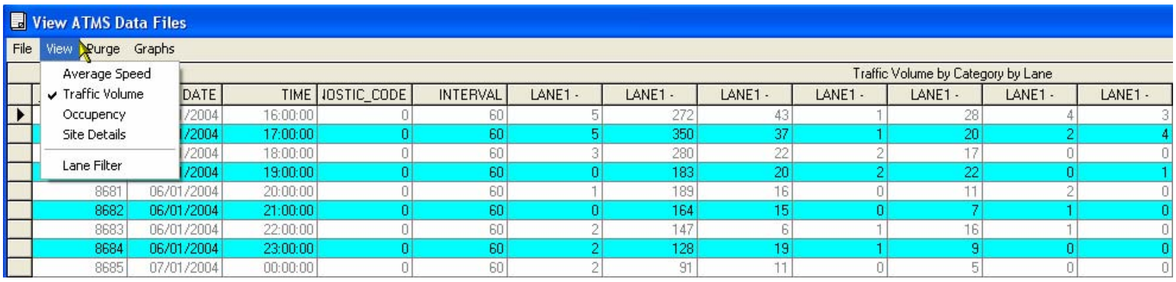
		ME	Average Speed (Km/Hr)by Category by Lane								
			LANE1 -	LANE1 -	LANE1 -	LANE1 -	LANE1 -	LANE1 -	LANE1 -	LANE1 -	LANE1 -
		:10	105	112	109	91	96	89	86	90	87
		:10	102	110	108	92	96	88	86	88	88
		:10	103	110	108	93	95	86	85	88	87
		:10	101	111	109	94	95	89	85	89	88
		:10	105	110	107	95	96	89	86	88	88
		:10	104	113	109	96	97	94	88	89	87
		:10	114	114	110	94	100	94	81	91	87
306	10/11/2003	00:00:10	110	112	110	95	96	88	86	90	87
307	11/11/2003	00:00:10	102	111	108	91	95	88	86	89	88
308	12/11/2003	00:00:10	95	109	107	91	95	88	86	88	87
309	13/11/2003	00:00:10	103	110	108	95	96	88	86	88	87
310	14/11/2003	00:00:10	100	110	107	94	96	89	86	89	87
311	15/11/2003	00:00:10	110	114	111	96	97	96	85	90	89
312	16/11/2003	00:00:10	123	115	114	94	102	94	82	90	87
313	17/11/2003	00:00:10	103	109	108	91	96	87	85	89	88

Statistical Data File



Malfunction Management File								
_ID_NUMBER	SITE_NAME	SITE_ID	CONNECTION_DATE	CONNECTION_TIME	FAULT_DATE	FAULT_TIME	FAULT_DESCRIPTION	EXTRA_INFORMATION
363	M20 Smeeth E/B	1115	08/01/2004	16:58:58	07/01/2004	11:06:00	Mains Power Failure	Number of Power Failures = 1,
363	M20 Smeeth E/B	1115	08/01/2004	16:58:58	07/01/2004	09:42:00	Roadside Cabinet Front Door Opened	Pins 1 & 2 on DOORSWITCH

Malfunction Management File

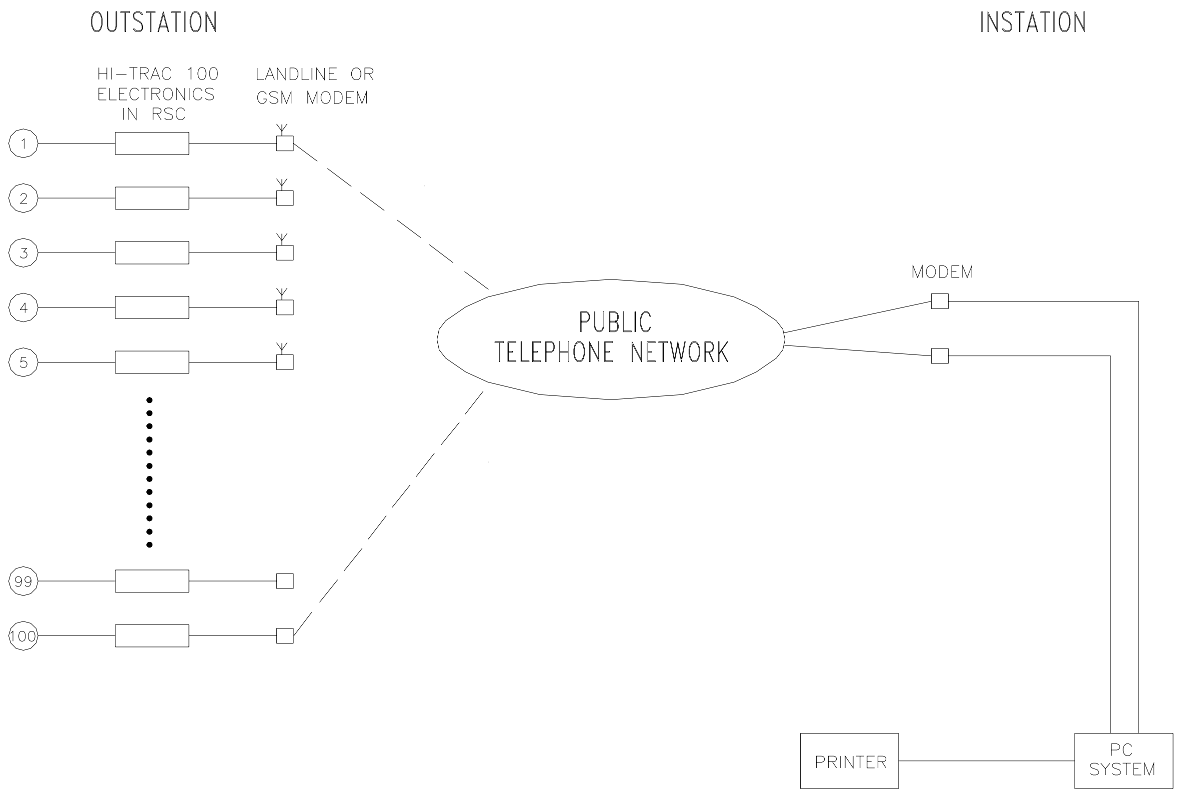


					Traffic Volume by Category by Lane						
	DATE	TIME	IOSTIC_CODE	INTERVAL	LANE1 -	LANE1 -	LANE1 -	LANE1 -	LANE1 -	LANE1 -	LANE1 -
	/2004	16:00:00	0	60	5	272	43	1	28	4	3
	/2004	17:00:00	0	60	5	350	37	1	20	2	4
	/2004	18:00:00	0	60	3	280	22	2	17	0	0
	/2004	19:00:00	0	60	0	183	20	2	22	0	1
8681	06/01/2004	20:00:00	0	60	1	189	16	0	11	2	0
8682	06/01/2004	21:00:00	0	60	0	164	15	0	7	1	0
8683	06/01/2004	22:00:00	0	60	2	147	6	1	16	1	0
8684	06/01/2004	23:00:00	0	60	2	128	19	1	9	0	0
8685	07/01/2004	00:00:00	0	60	2	91	11	0	5	0	0

ATMS Data File

5

DRAWINGS



LEGENDS :

- HI-TRAC 100 ELECTRONICS
- GSM MODEM
- LANDLINE MODEM
- RSC ROADSIDE CABINET

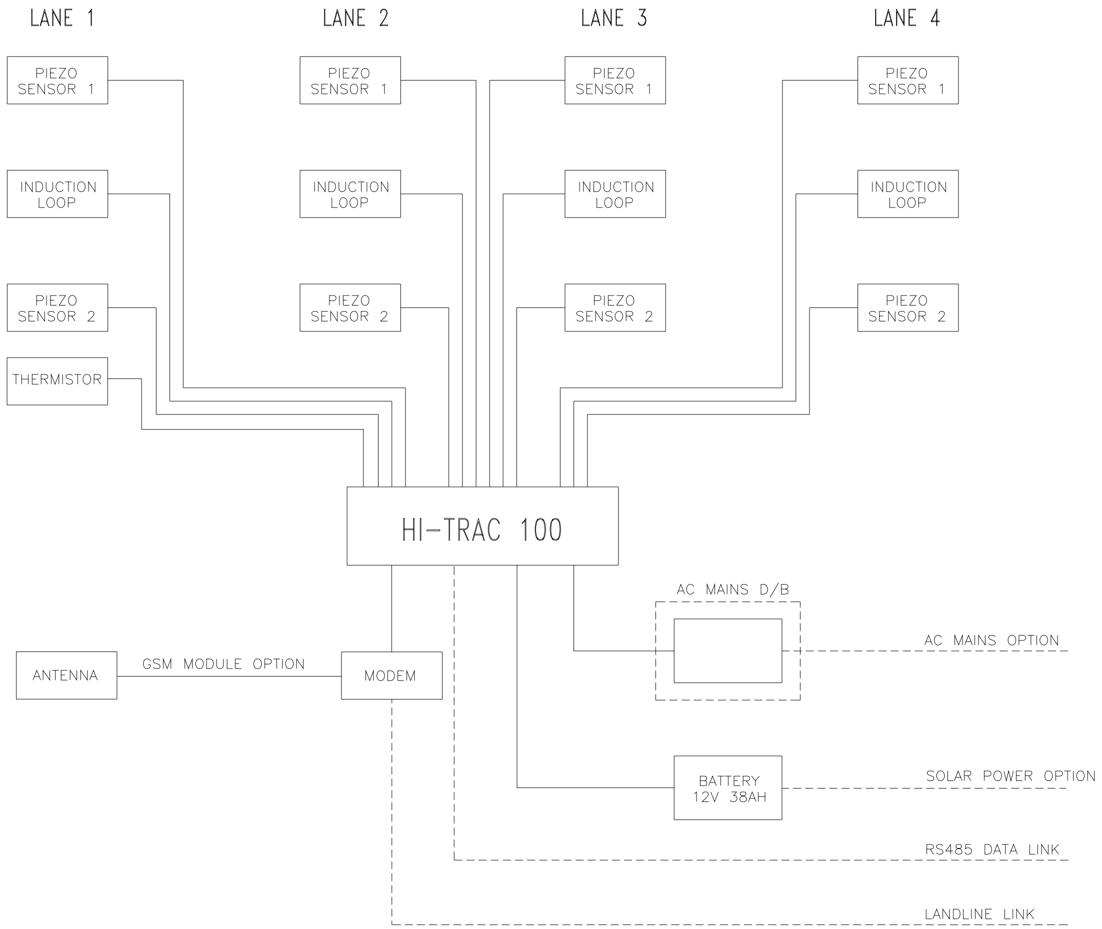
Rev No	Date	Amendments

CLIENT :

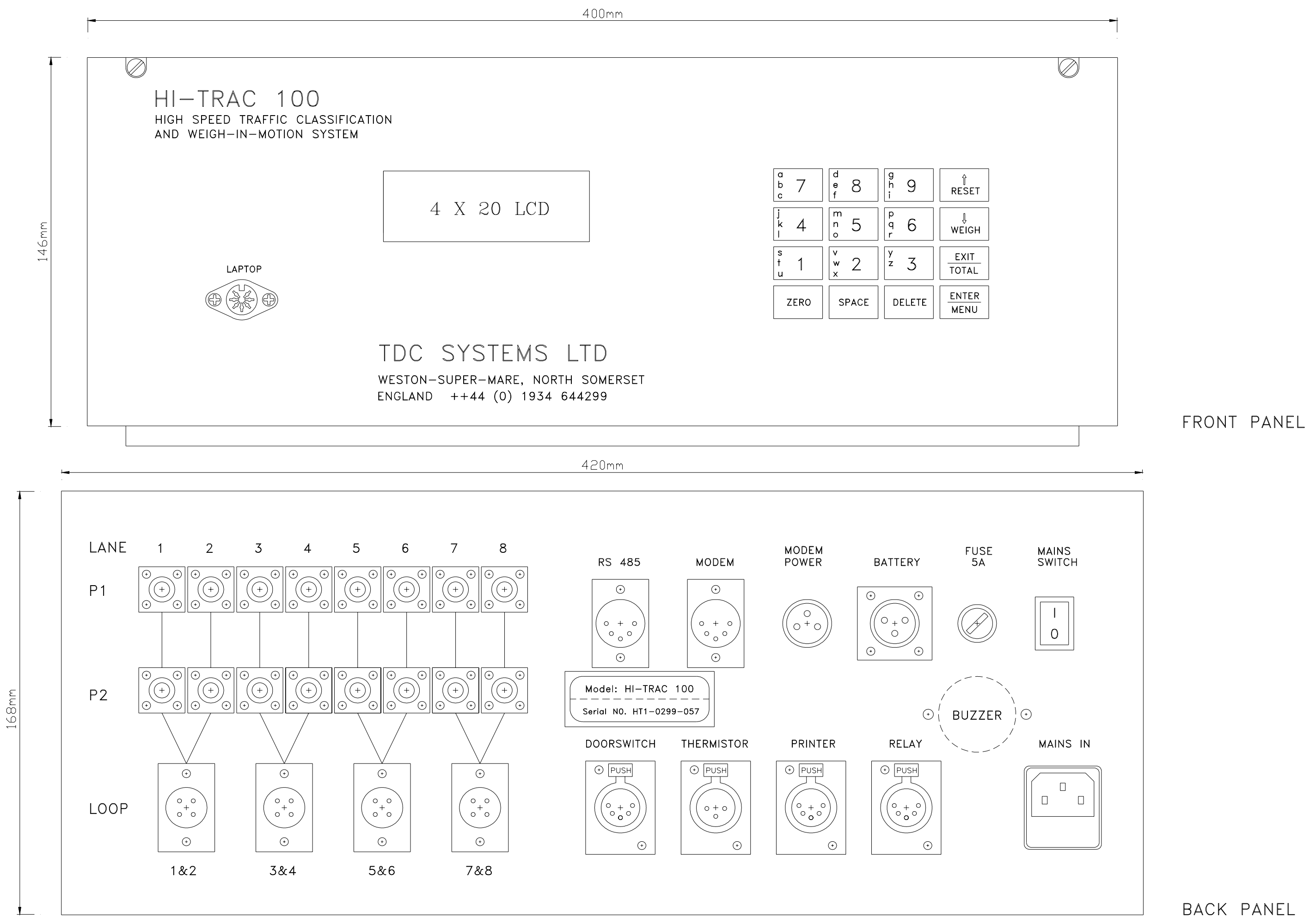
DESIGN BY :
TDC SYSTEMS LIMITED
WESTON-SUPER-MARE
ENGLAND

DRAWING TITLE :
MULTIPLE HI-TRAC VIA GSM
AND/OR LANDLINE MODEM
OVERALL SYSTEM CONFIGURATION

DRAWN BY	M. ROSSITER	REF NO	
CHECKED BY	M. PHILLIPS	DATE	17/12/2003
SCALE	NTS (A4)	CAD REF	
DRAWING NO	10-1003	SHEET	1/1

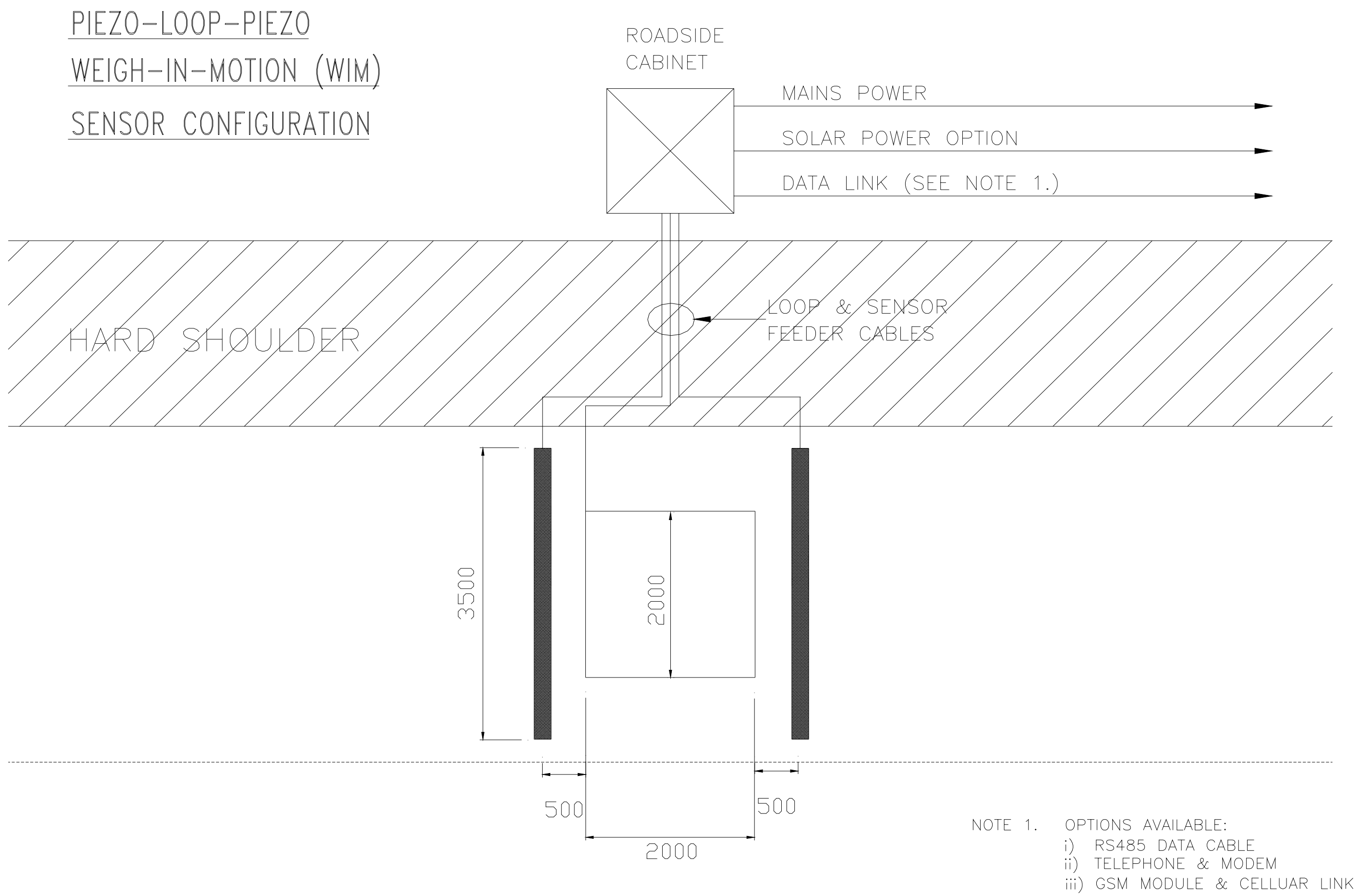


	TITLE	CLIENT				
TDC SYSTEMS LTD WESTON–SUPER–MARE ENGLAND	OUTSTATION SYSTEM CONFIGURATION (4–LANE HI–TRAC SITE)		DRAWING No	10–1004		
			CHECKED BY	M. PHILLIPS	SHEET	
			DRAWN BY	M. ROSSITER	CAD REF	
			DATE	18/12/2003	SCALE	N.T.S.

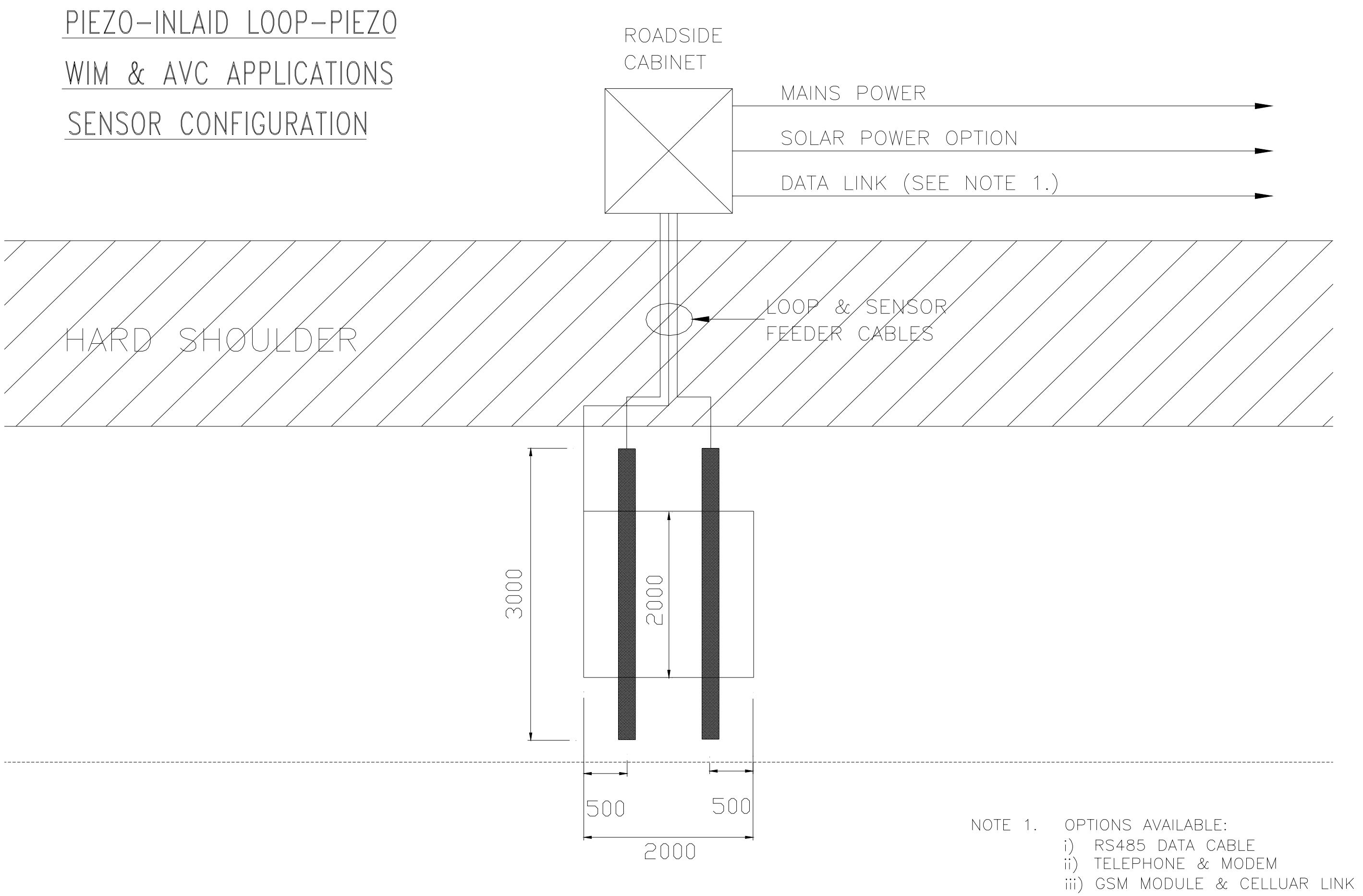


TDC SYSTEMS LTD WESTON-SUPER-MARE ENGLAND	TITLE HI-TRAC 100 FRONT & BACK PANELS	CLIENT	DRAWING No	10-1006
			CHECKED BY	M. PHILLIPS
			DRAWN BY	M. ROSSITER
			DATE	18/12/2003

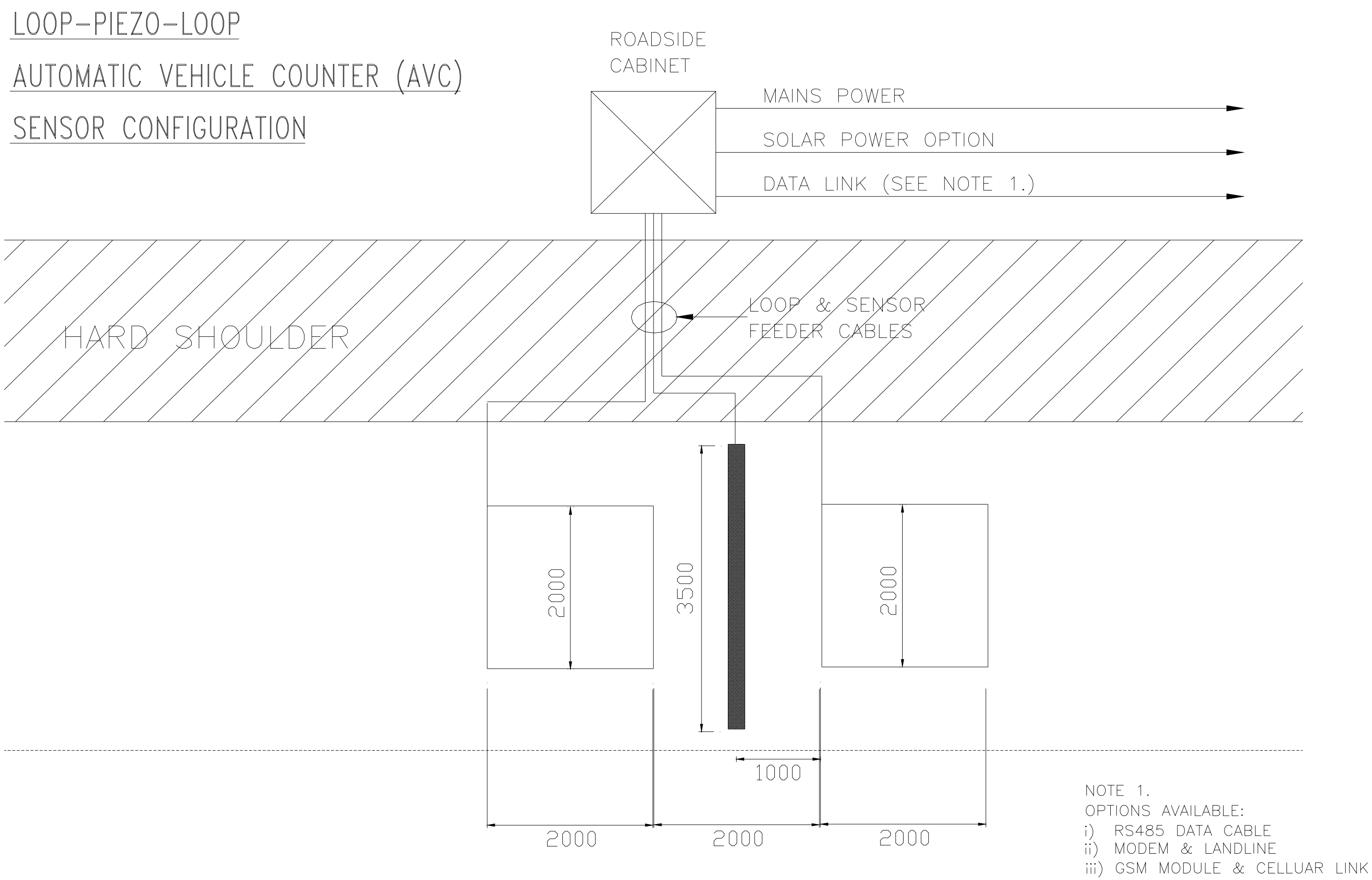
SHEET	
CAD REF	
SCALE	N.T.S.



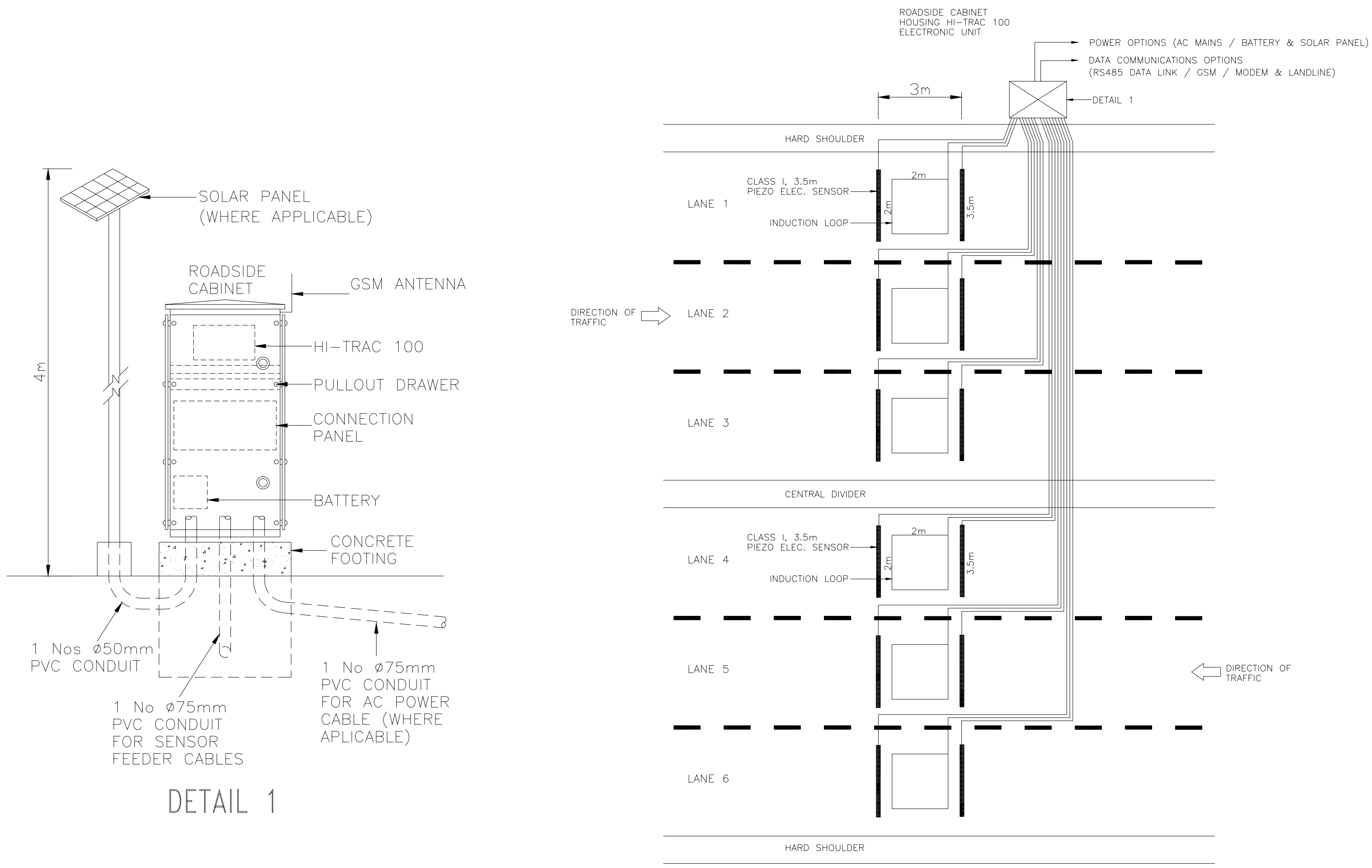
TDC SYSTEMS LTD WESTON–SUPER–MARE ENGLAND	TITLE HI–TRAC 100 WIM SENSOR INSTALLATION GENERAL LAYOUT	CLIENT	DRAWING No	10–1009		
			CHECKED BY	M. PHILLIPS	SHEET	
			DRAWN BY	M. ROSSITER	CAD REF	
			DATE	19/12/2003	SCALE	N.T.S.



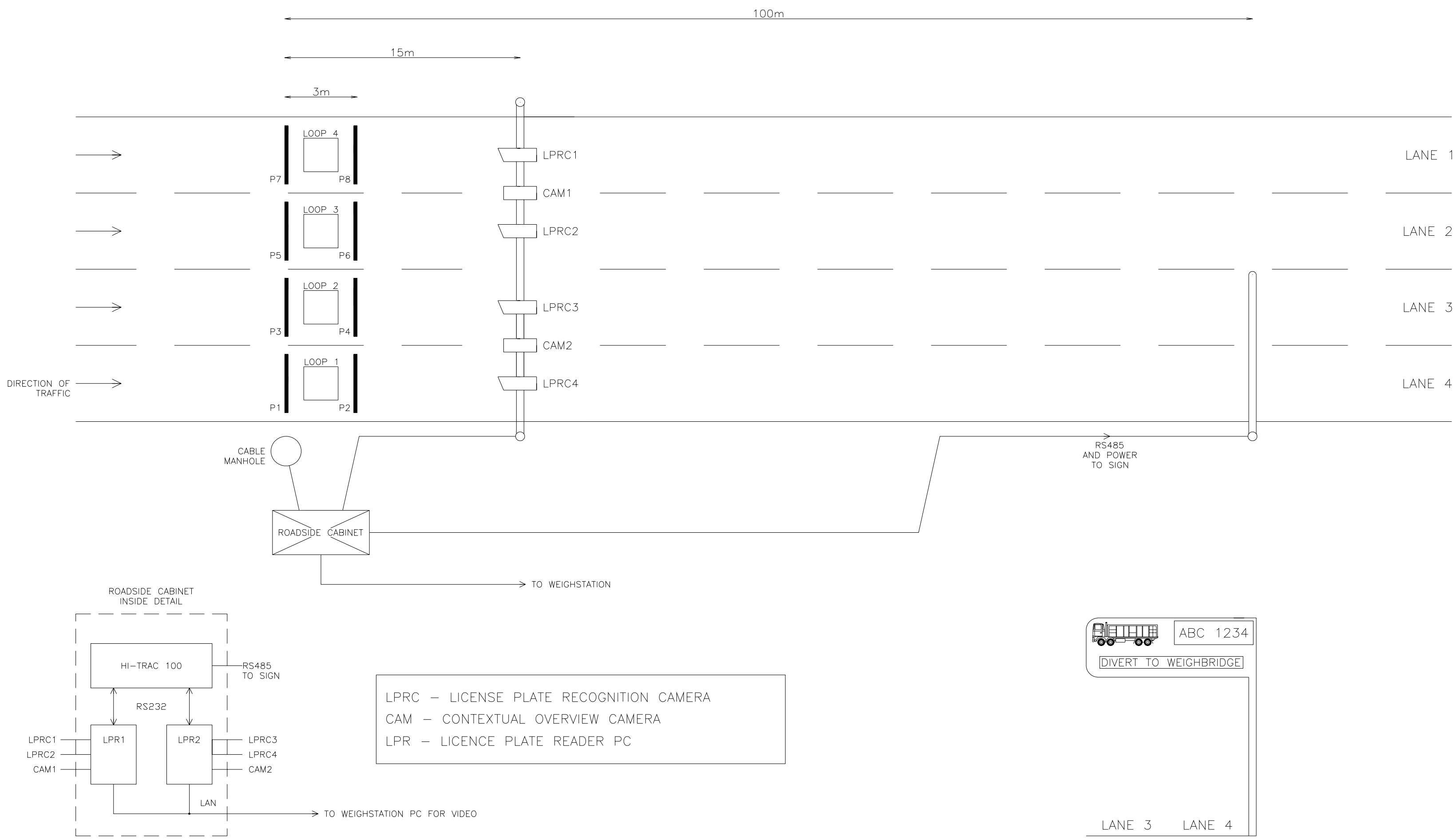
TDC SYSTEMS LTD WESTON-SUPER-MARE ENGLAND	TITLE HI-TRAC 100 WIM & AVC SENSOR INSTALLATION 3 MTR SENSOR LAYOUT	CLIENT	DRAWING No	10-1009-A		
			CHECKED BY	M. PHILLIPS	SHEET	
			DRAWN BY	M. ROSSITER	CAD REF	
			DATE	19/12/2003	SCALE	N.T.S.



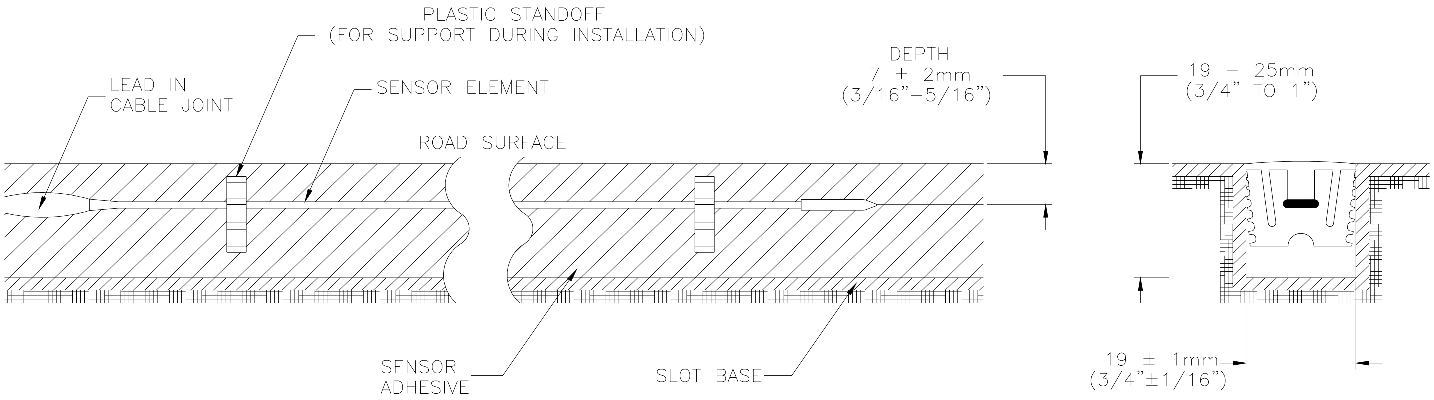
	TITLE	CLIENT				
TDC SYSTEMS LTD WESTON-SUPER-MARE ENGLAND	HI-TRAC 100 AVC SENSOR INSTALLATION LOOP-PIEZO-LOOP LAYOUT		DRAWING No	10-1009-C		
			CHECKED BY	M. PHILLIPS	SHEET	
			DRAWN BY	M. ROSSITER	CAD REF	
			DATE	19/12/2003	SCALE	N.T.S.

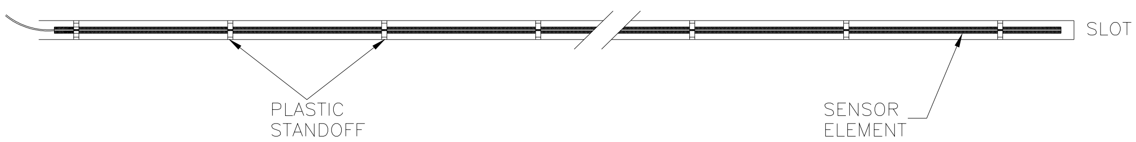


TDC SYSTEMS LTD 22 LYNX CRESCENT WESTON-SUPER-MARE N. SOMERSET, ENGLAND	CLIENT	TITLE 6-LANE : 2 x 3.5m CLASS I PIEZO-LOOP-PIEZO WIM GENERAL LAYOUT	DRAWING No	10-1001	
			CHECKED BY	M. PHILLIPS	SHEET
			DRAWN BY	M. ROSSITER	CAD REF
			DATE	17/12/2003	SCALE N.T.S.



TDC SYSTEMS LTD 22 LYNX CRESCENT ESTATE WINTERSTOKE ROAD WESTON-SUPER-MARE N. SOMERSET BS24 9DJ ENGLAND	TITLE HI-TRAC PRE SELECTION WITH CCTV/LPR SELECTION OPTION	JOB	DRAWING No	10000-1-A		
			CHECKED BY	M. PHILLIPS	SHEET	1 OF 1
			DRAWN BY	BTD	ISSUE	A
			DATE	5/12/03	SCALE	N.T.S

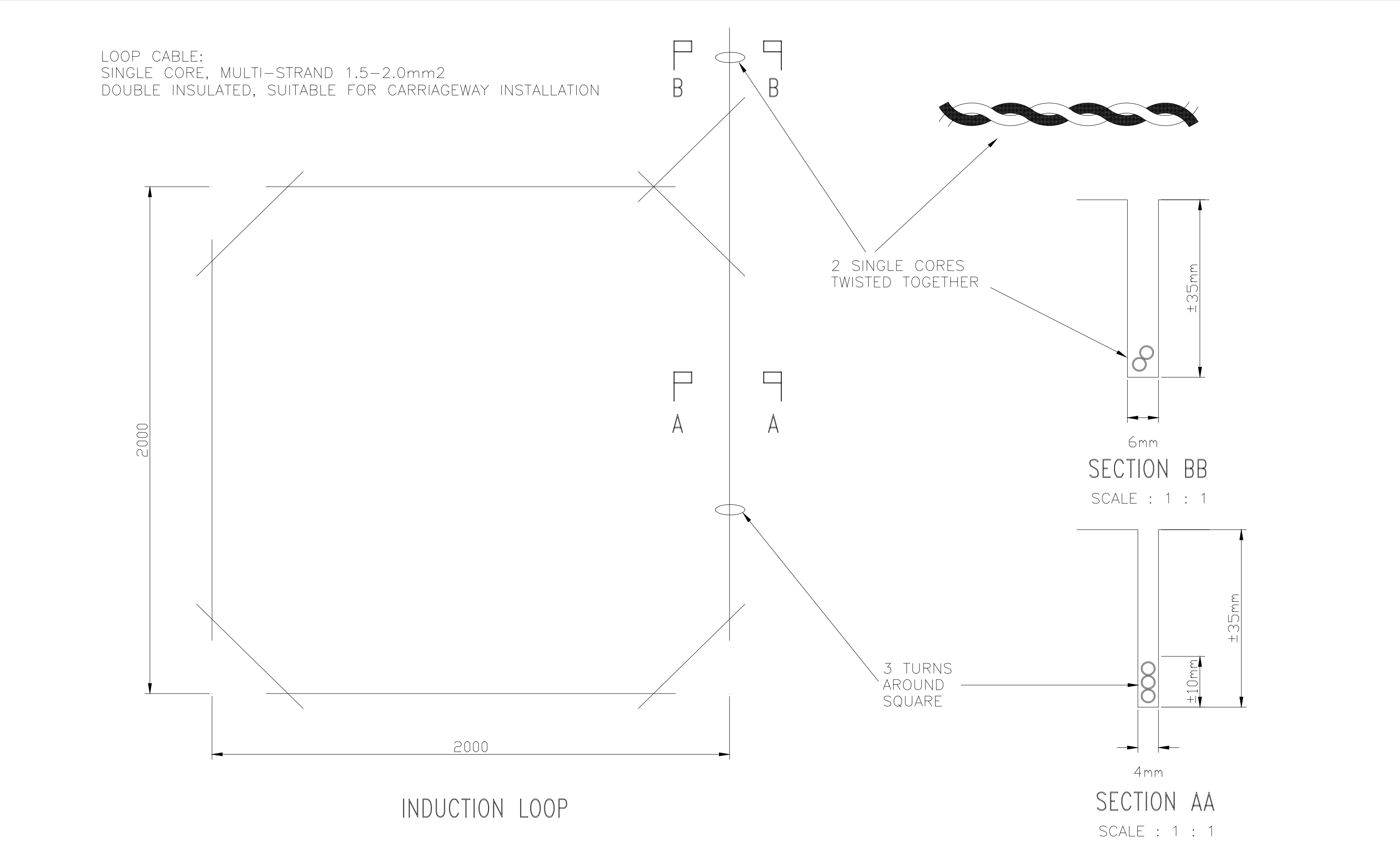




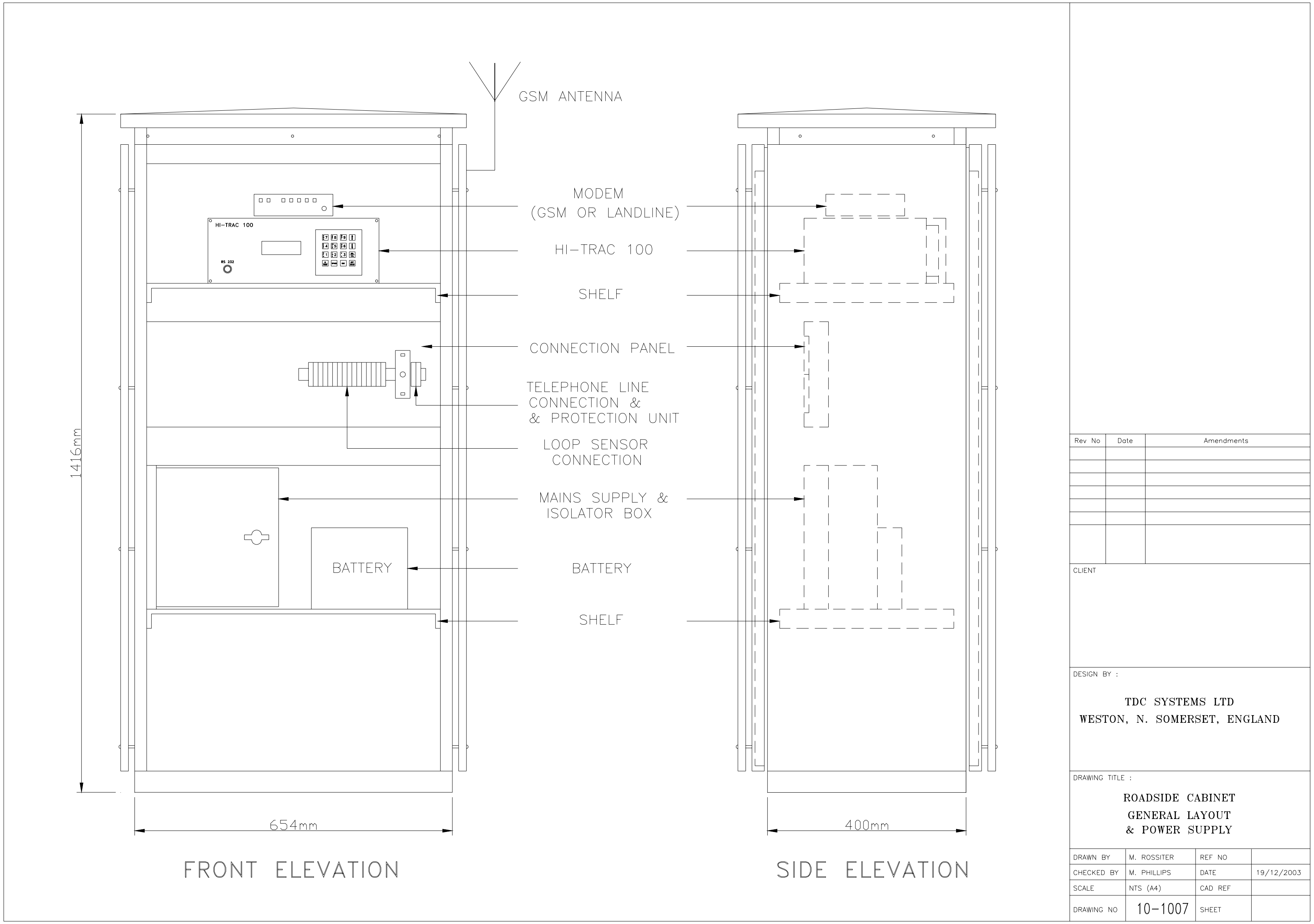
BL TRAFFIC SENSOR INSTALLATION

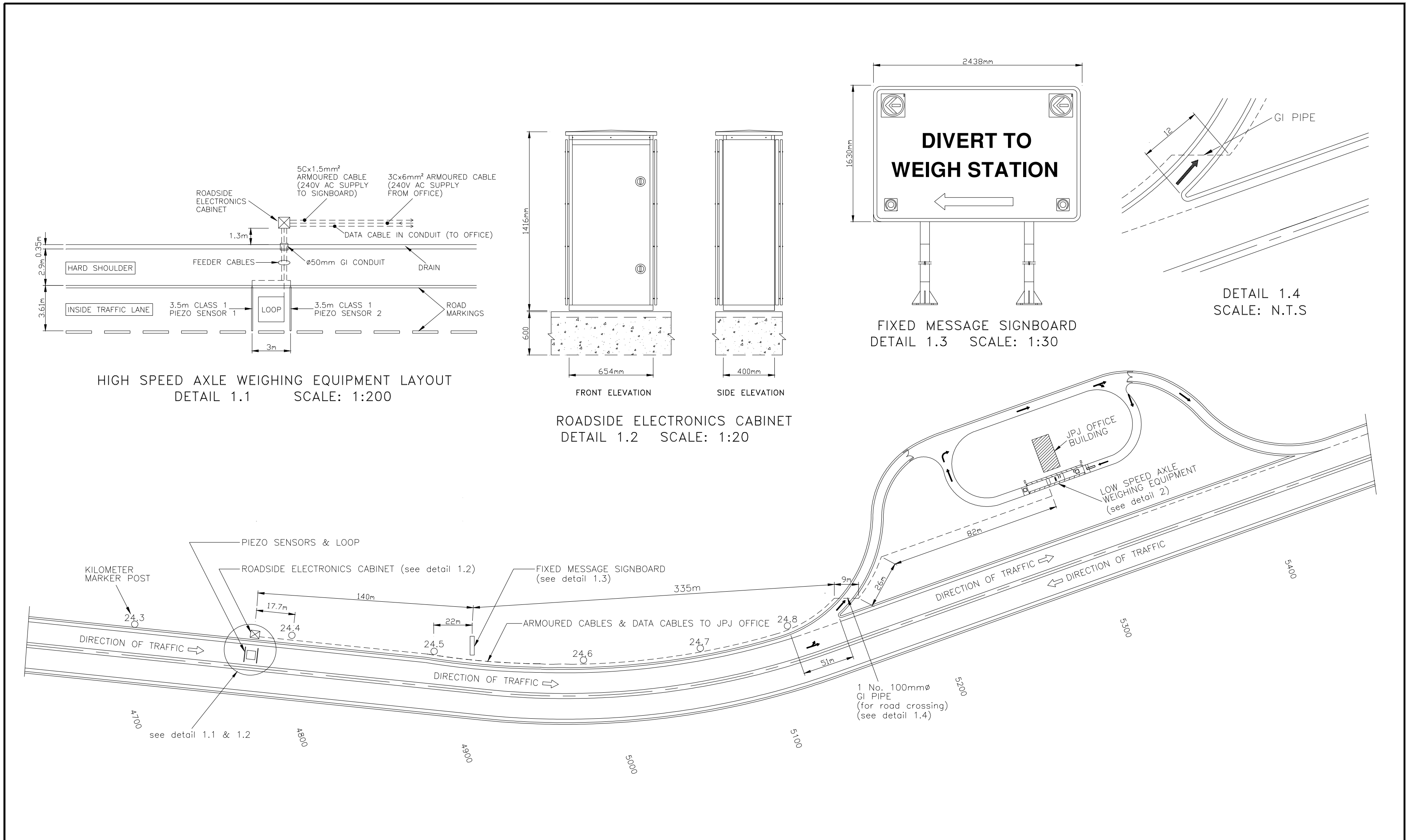
FOR MORE DETAIL PLEASE READ INSTALLATION INSTRUCTION SHEETS CAREFULLY

TDC SYSTEMS LTD WESTON–SUPER–MARE ENGLAND	TITLE HI–TRAC 100 BL SENSOR INSTALLATION	CLIENT	DRAWING No	10–1002		
			CHECKED BY	M. PHILLIPS	SHEET	
			DRAWN BY	M. ROSSITER	CAD REF	
			DATE	18/12/2003	SCALE	N.T.S.

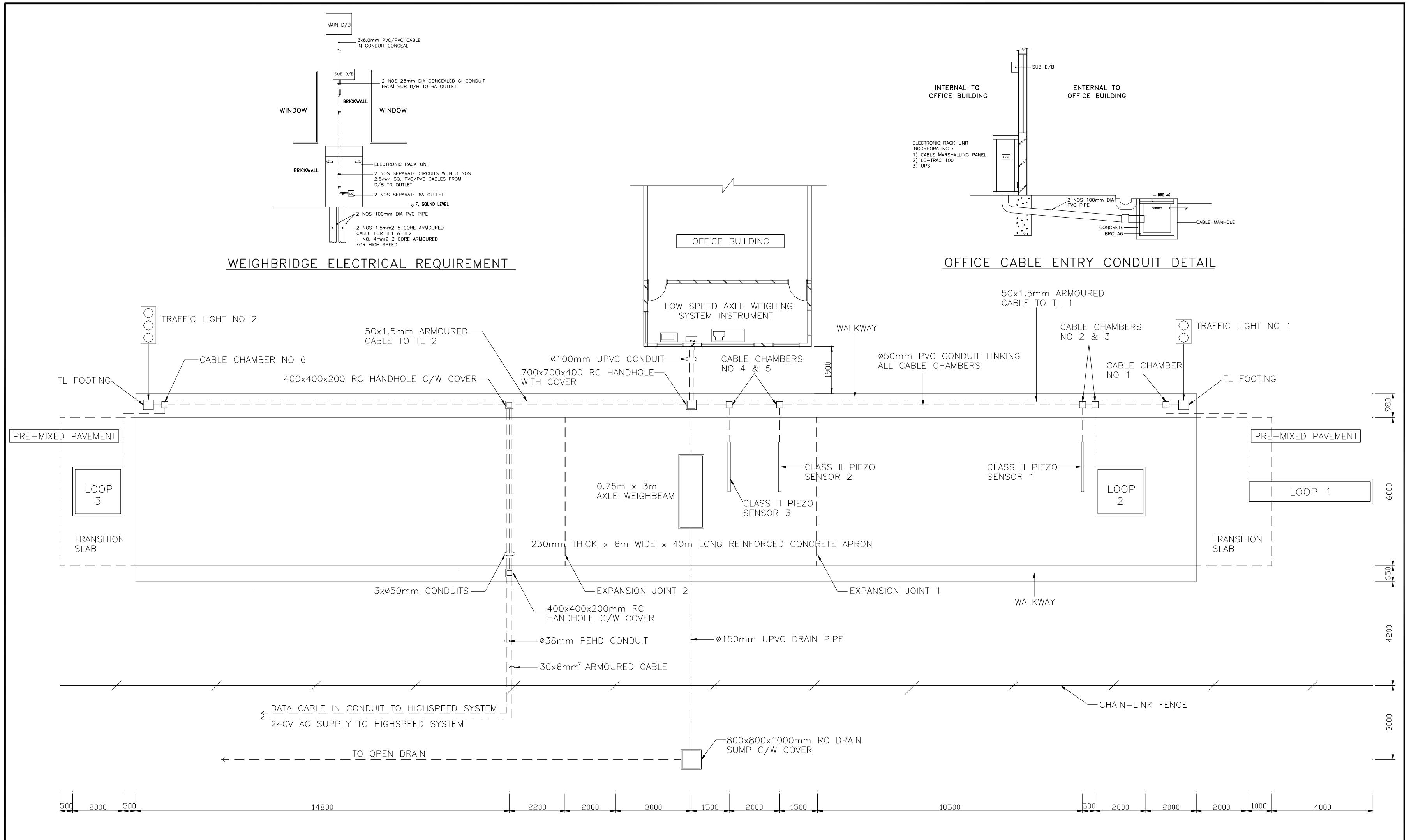


TDC SYSTEMS LTD WESTON-SUPER-MARE ENGLAND	TITLE INDUCTION LOOP MATERIAL & WORKS	CLIENT	DRAWING No	10-1008		
			CHECKED BY	M. PHILLIPS	SHEET	
			DRAWN BY	M. ROSSITER	CAD REF	
			DATE	19/12/2003	SCALE	NTS (A4)

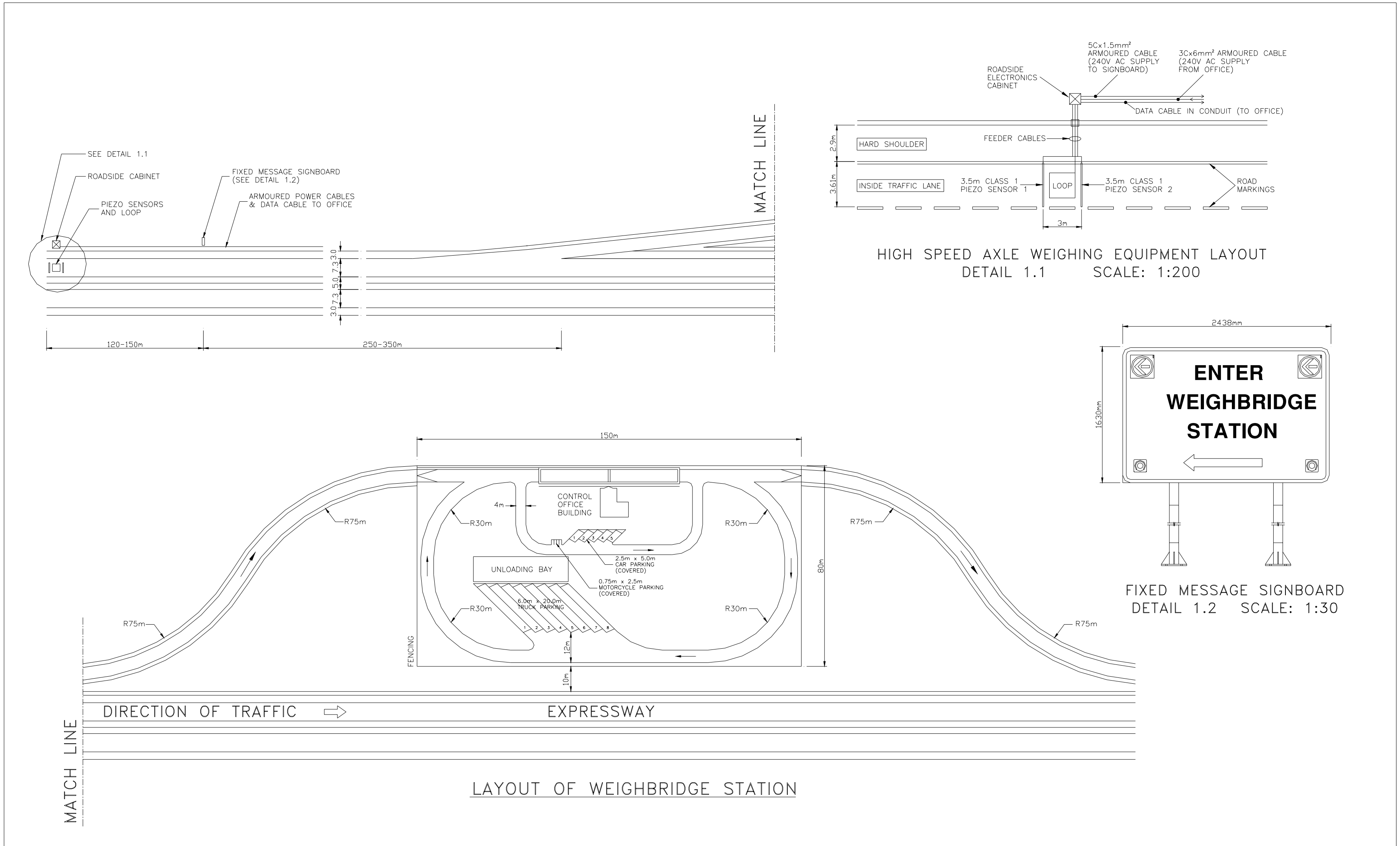

GSM ANTENNA
MODEM
(GSM OR LANDLINE)
HI-TRAC 100
RS 232
SHELF
CONNECTION PANEL
TELEPHONE LINE
CONNECTION &
& PROTECTION UNIT
LOOP SENSOR
CONNECTION
MAINS SUPPLY &
ISOLATOR BOX
BATTERY
BATTERY
SHELF
1416mm
654mm
400mm
FRONT ELEVATION
SIDE ELEVATION
Rev No
Date
Amendments
CLIENT
DESIGN BY :
TDC SYSTEMS LTD
WESTON, N. SOMERSET, ENGLAND
DRAWING TITLE :
ROADSIDE CABINET
GENERAL LAYOUT
& POWER SUPPLY
DRAWN BY
M. ROSSITER
REF NO
CHECKED BY
M. PHILLIPS
DATE
19/12/2003
SCALE
NTS (A4)
CAD REF
DRAWING NO
10-1007
SHEET



TDC SYSTEMS LTD WESTON-SUPER-MARE ENGLAND	CLIENT	TITLE HIGH SPEED PRE-SELECTION SYSTEM GENERAL LAYOUT	DRAWING NO	97041-1	
			CHECKED BY	M. ROSSITER	SHEET 1/2
			DRAWN BY	ZURAIDI	CAD REF
			DATE	30/12/2003	SCALE NTS (A2)



TDC SYSTEMS LTD WESTON-SUPER-MARE ENGLAND	CLIENT	TITLE LOW SPEED AXLE WEIGHING SYSTEM GENERAL LAYOUT	DRAWING NO	97041-2		
			CHECKED BY	M. ROSSITER	SHEET	2/2
			DRAWN BY	ZURAIDI	CAD REF	
			DATE	30/12/2003	SCALE	NTS (A2)



TDC SYSTEMS LTD WESTON–SUPER–MARE ENGLAND	TITLE AXLE WEIGHING SYSTEM GENERAL LAYOUT	JOB	DRAWING No	99050–1		
			CHECKED BY	M.ROSSITER	SHEET	1
			DRAWN BY	ZURAIDI	CAD REF	TDC–05
			DATE	12–6–1999	SCALE	1:1m (A2)