System Design Document For Advance Traffic Management System

Technovaa Software and Hardware Solution Pvt Ltd
303, Pukhraj Corporate, Navlakha, Indore-452001

Email: technovasystem10@gmail.com
www.technovasystems.net

Index (Table of Content)

1 Introduction

Our **ATMS** caters the requirement of monitoring and managing Highway Traffic Operations in a simple and efficient manner. Our Advanced Traffic Management System is a flexible, secured, user friendly application and an advanced system that provides the main features considering the highway safety, traffic monitoring, incident detections and collection of data with greater efficiency.

Being a Turnkey Solution Provider, the key phases of our projects include:

1. Consulting, system designing & drawings
2. Technical design documentation
3. Evaluation of Hardware and its integration
4. Software application development,
5. Installation, Testing & Commissioning and
6. Operations & maintenance.

An inflow of information (e.g., traffic hold-up, accidents etc.) regarding the road status to the road management (operations) staff at Control room and thereby subsequent decision making (e.g., to send a patrol vehicle to regulate traffic, send an ambulance to the accident site etc.) by the road management (operations) company for providing the emergency response services to the Road Users. These decisions are normally guided by their standard procedures and policies.

Requirement of ATMS (an overview):

With recent upgradations in Highway sector, main emphasize is on providing world class facilities to road users to make their journey easy and safe.

The roads are being made wider as well as are maintained to handle heavy traffic volumes.

With good quality roads, there comes a concern of in-route facilities, directions, prevention of accidents and emergency services. There comes the role of **Advanced Traffic Management System (ATMS)** which integrates multiple technologies to improve the flow of vehicle traffic and improves safety. The main parts of this system are:

- Automatic Traffic Classification and Counting (ATCC)
- Closed Circuit Television Surveillance (CCTV) & Video Incident Detection System (VIDS)
- Meteorology Data Station (MDS)
- Emergency Call Box (ECB)
- Fixed and Portable Variable Message Displays (VMS)
- Live Vehicle Tracking(LVT)
- Vehicle Actuated Speed Display (VASD)
- Transmission System Fiber (Connectivity between control center and outdoor equipment)
- ATMS Central Control room equipped with Central Server, Graphic User Interface, Large Display Board, UPS, Software and Hardware

The ATMS system reduces the anxiety of road user through provision of Emergency Call Booths across highway by which a User can get connected to central control room and ask for assistance in case of accidents, breakdowns, fire or to pre-warn the highway users about unusual conditions on road.

2. List of Abbreviations and Definitions

ATMS	Advanced Traffic Management System
ECB	Emergency Call Box
GPS	Global Positioning System
GIS	Geographic Information System
CUG	Corporate User Group
GSM	Global System for Mobile Communication
VoIP	Voice over Internet Protocol
MDS	Meteorological Data System
ATCC	Automatic Traffic counter cum classifier
VMS	Variable Message Sign
VIDS	Video Incident Detection System
CCTV	Close Circuit Television

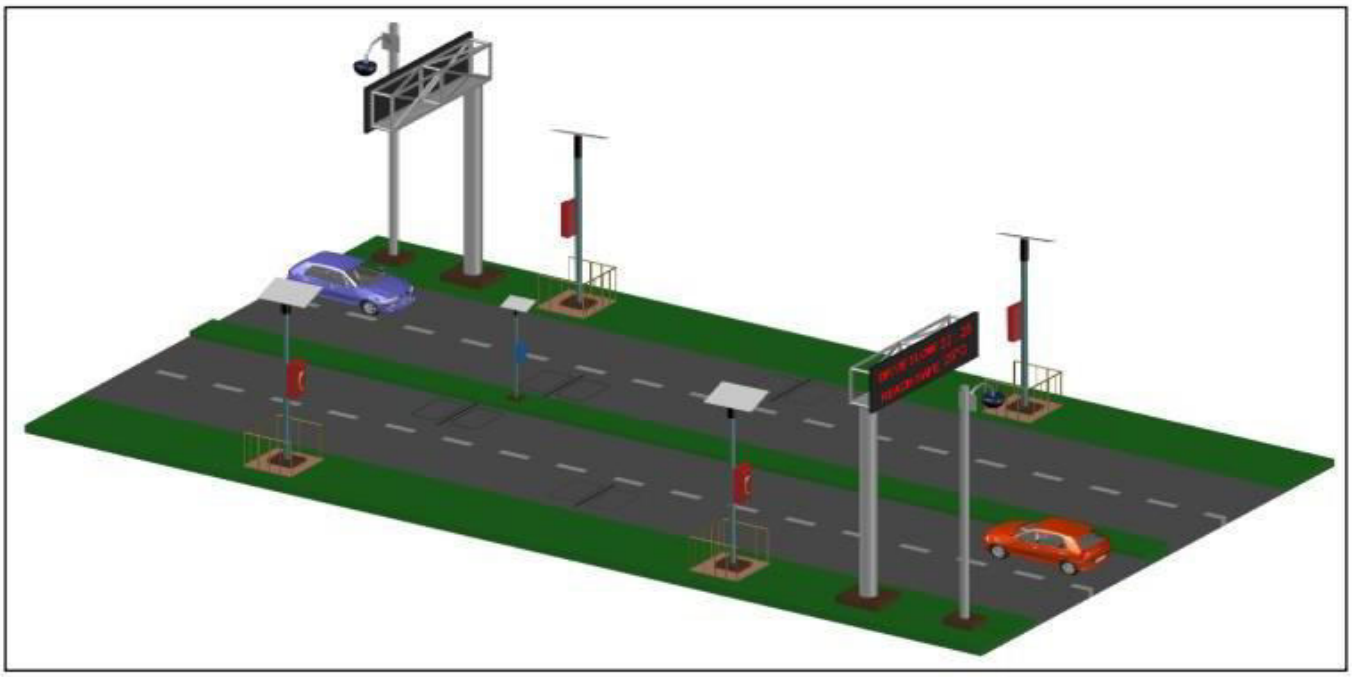
3. About ATMS

The Advanced Traffic Management System (ATMS) integrates multiple technologies to improve the flow of vehicle traffic, improve safety and minimize road accidents on highways using some highly advanced equipment like ECB, VMS, ATCC, MDS etc. Real- time traffic data from a traffic detection system flows into a Traffic Control Centre (TCC) where it is integrated and processed and may result in actions (e.g. traffic routing, VMS messages) with the goal of improving flow of traffic and minimizing losses.

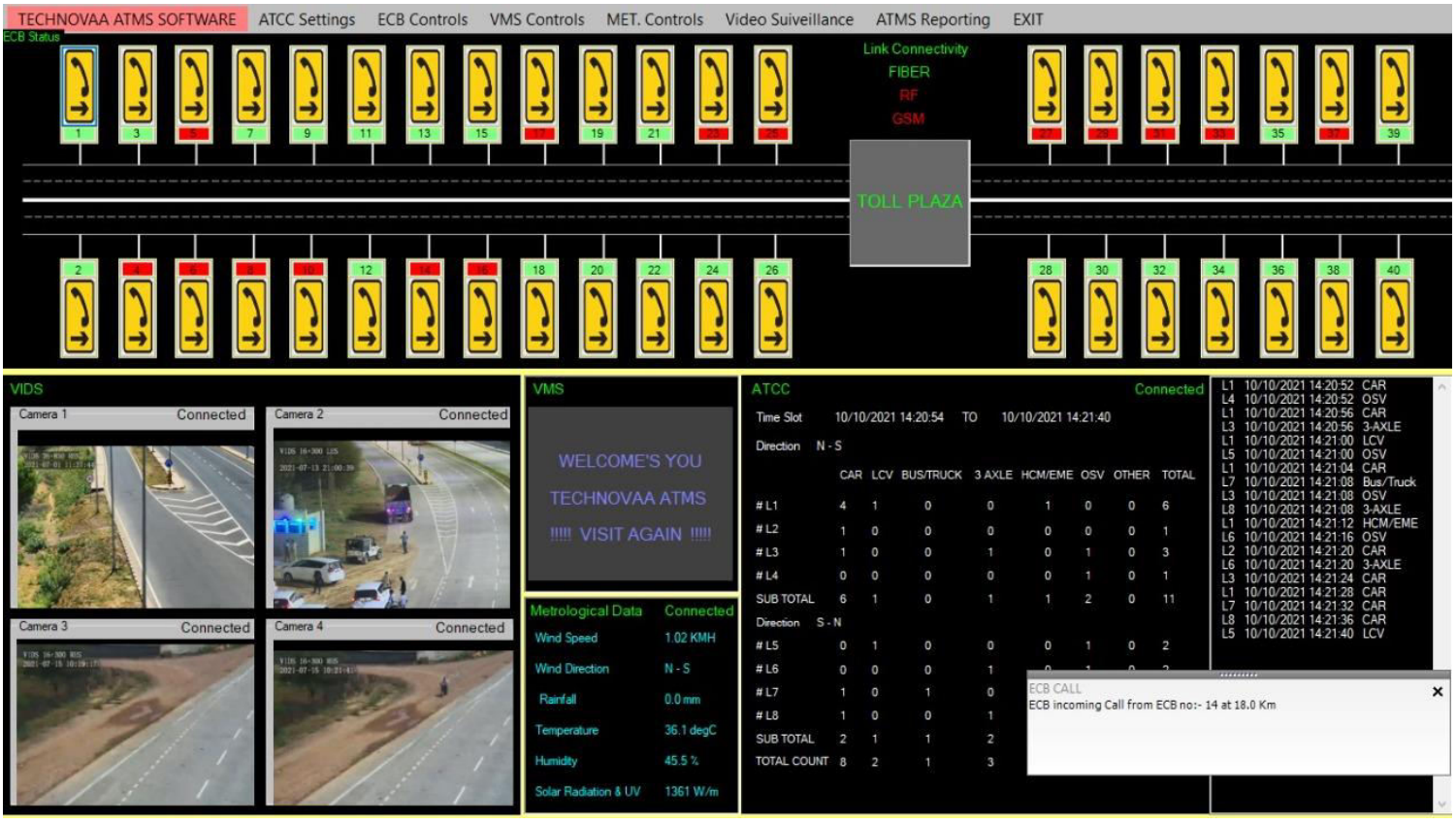
The broader purpose of **ATMS** includes the following advanced system:

- Variable Message Signs (VMS) based on different technologies (LED, OFC) for giving essential message to the road users about the current condition of road, or giving any emergency message or about major or minor intersections on the road.
- Advance Traffic Counters & Classifiers (ATCC) placed on the highway for the count of traffic running on the stretch.
- Emergency Roadside System with Emergency Call Boxes (ECB) using different technologies and media supports.
- Weather Stations or Meteorological Data System (MDS) for collecting the data on current weather forecast as well as the change in weather.
- CCTV Cameras with color and night capability needed to monitor the highway from a single point i.e., control room. This will help the highway authorities to track the incident occurring on the highway immediately.
- Video Incident Detection System (VIDS) based on different technologies (Infrared, motion sensor, virtual Loop).
- Portable Weigh in Motion (PWIM) allows enforcement & monitoring techniques to screen for overweight or oversized vehicles. The key components of a PWIM system are a pair of weigh pads, a controller & system battery.

4. Basic ATMS Architecture



- **Technovaa ATMS Dashboard**



5. Variable Message Sign (VMS)

VMS induced into the ATMS to pre-warn road users about the traffic condition, road blockage, weather or any types of messages through placing the LED based board at certain sections of highways where the safety precaution is needed. The highway authorities can transfer any types of messages from a single point to any of the VMS placed at different sections of highways.

The VMS application consists of two sub-modules:

- VMS Field Equipment: This handles the communication part; taking commands from workstation application and sending the same to VMS boards as desired.
- VMS Software: This handles all administrative functions like configuration, board properties, displaying status etc.

Product Specification

Variable Message Sign (VMS) is intended to provide the road and traffic condition information to the commuters. It will help users travel on the project smoothly without much stress. In case of incident like congestion, drivers can judge whether to take detour or not, or make other decision based on the information provided through VMS.

VMS is mounted on the trolley towable by the patrol vehicle to display the maintenance/ incident related information on it.

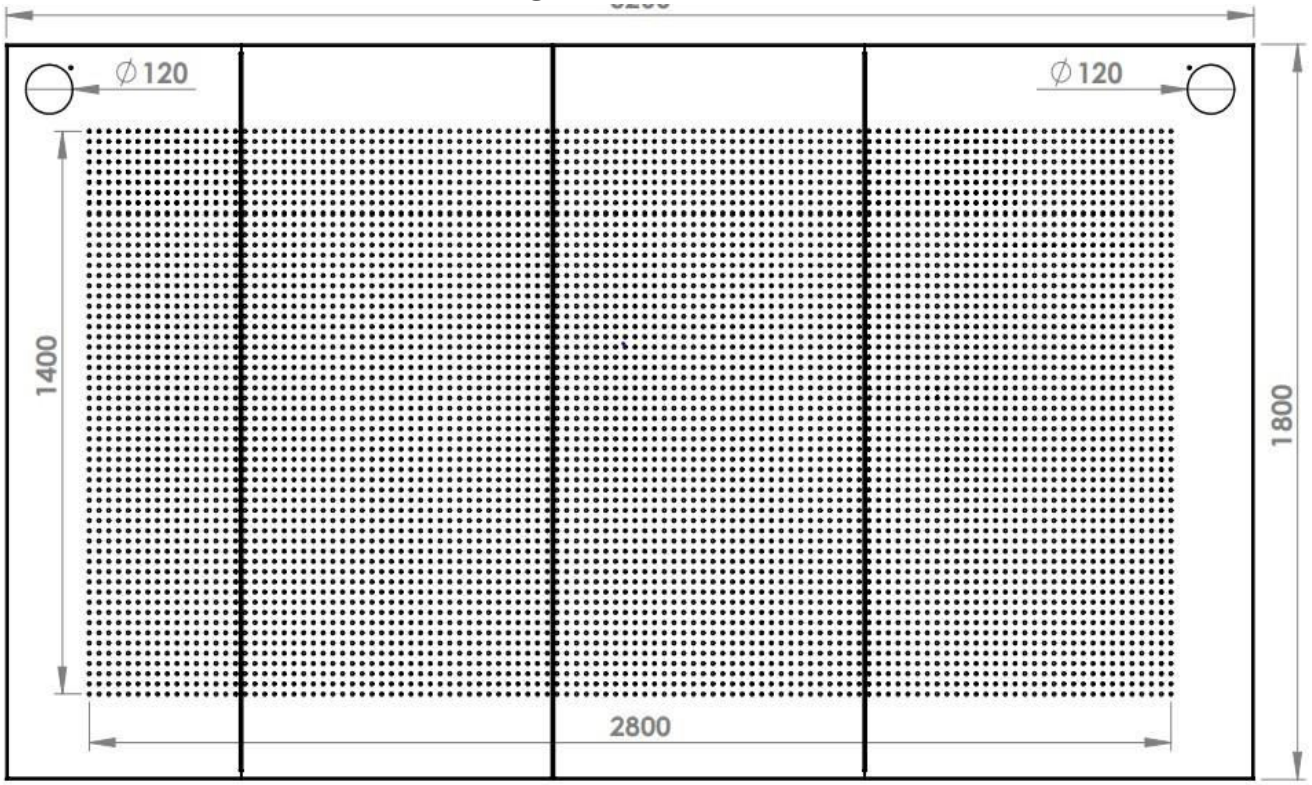
Main components of the VMS subsystem are:

- Field components - consists of the sign module having:
  - VMS case
  - VMS sign (display modules)
  - Power supply
  - Dimmer control (ambient light photo sensor system)
  - Microcontroller
- CCR components
  - VMS server
  - VMS Application software
  - VMS Database software

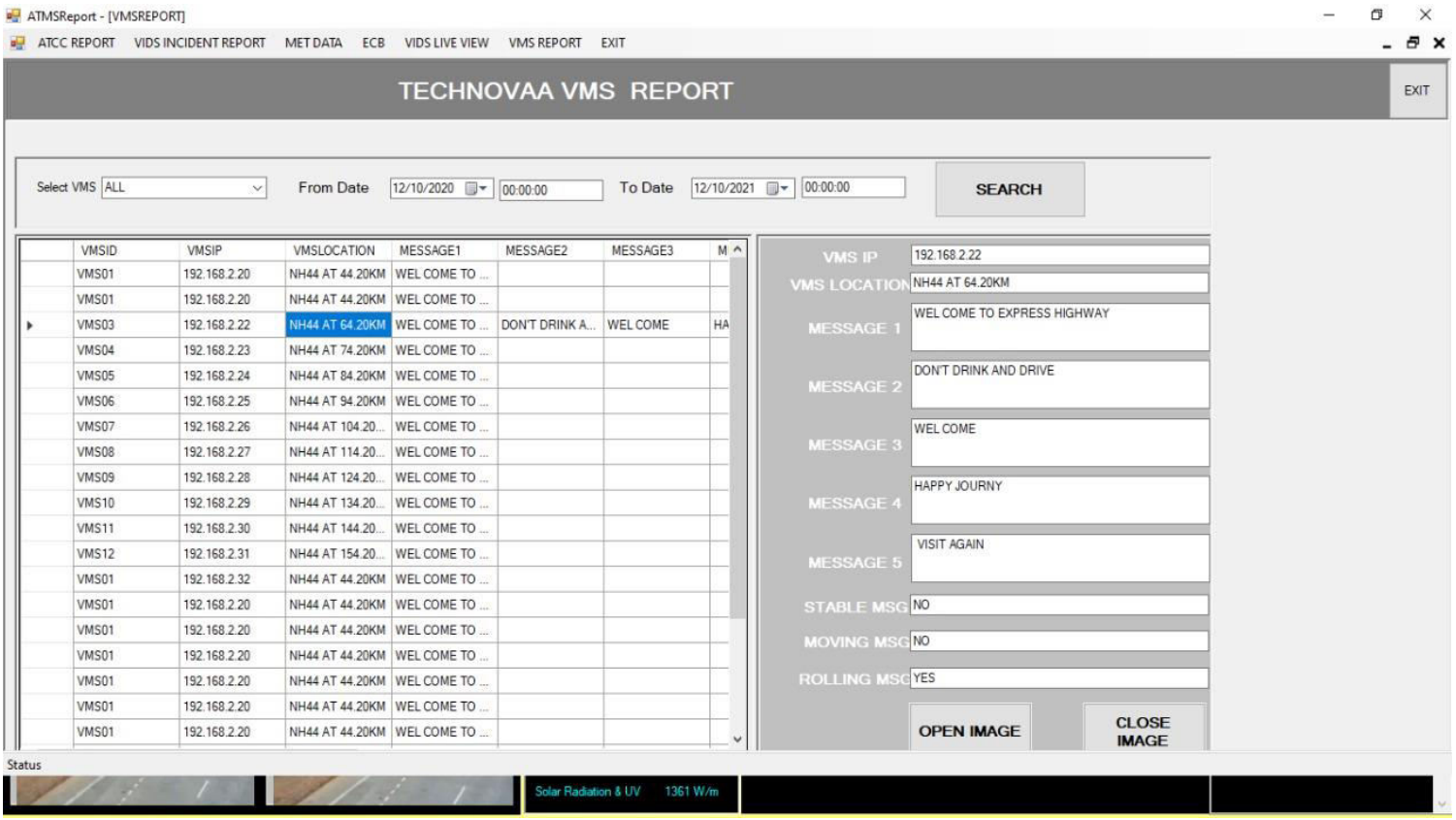
Specifications

- VMS displays all major colors.
- The VMS displays the following:
  - English text
  - Hindi text
  - Gujarati text
  - Marathi text
  - Numeric
  - Punctuation marks
  - Graphics

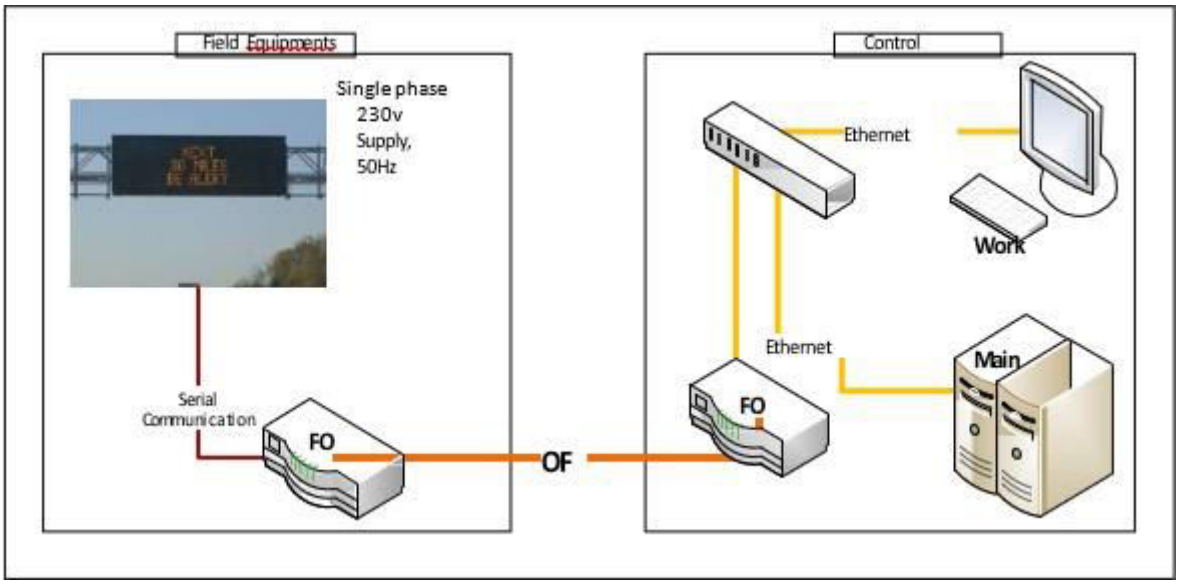
5.1 Fixed VMS Image



5.2 Technovaa VMS Reports



5.3 Interconnection of VMS



6. Automatic Traffic Counting cum Classifier (ATCC)

The main purpose of installing ATCC is to monitor the traffic flow of the highway with the vehicle classification. Our ATCC has its own classification module for classifying, detecting and counting of vehicle. It includes two magnetic loops that are installed under the road. The ATCC works through the data logger associated with a number of sensors installed at the site and connected to the control room through OFC.

Product Specification – Field Equipment

This system is used for identifying and recording all types of vehicles on Expressway for effective monitoring and data collection at Control Centre. The system detects and records all types of vehicles plying on Expressway.

Besides the above vehicle classes, the system is capable of classifying any other vehicle category as per need. Vehicle classification is user selectable based on vehicle parameters. The system has interface with the ATMS software for central monitoring.

Location

ATCC is installed at suitable location after thorough survey of the site. The final location may be adjusted as per the site condition, only with the consent of the NHAI/Traffic and Transportation expert. The ATCC cabinet is installed in median or on the side of the expressway at a distance of 2-3 meters from the soft shoulder.

Main components are:

1. Field components:
    a. ATCC roadside cabinet / electronics/data logger
    b. In-road/non-intrusive sensors and cables
    c. Field computer/laptop
    d. Power supply
    e. Lightning protection and earthling
2. CCR components
    a. ATCC server
    b. Application Software
    c. Database Software
    d. Report Printer

Specifications

1. The ATCC is designed for multiple (in this case 8) lanes of traffic i.e., one cabinet/data logging unit is able to record data for at least 8 lanes (4 in each direction).
2. System uses a combination of loop and piezo sensors or any other sensor mechanism (intrusive or non-intrusive) for correctly counting and classifying vehicles.
3. Piezo sensor installation is in concrete. ASTM 1318-02 recommends a concrete pavement of 90m (60m before sensor and 30m after) to ensure good accuracy. This is followed during installation.
4. The ATCC detects all classes of vehicles as per toll classification scheme.
5. One or more of the following information is generated by the ATCC for each lane to correctly count and classify the vehicle:
    a. Vehicle length
    b. Vehicle speed
    c. Number of axles
    d. Axle spacing
    e. Vehicle Weight

Specifications for ATCC equipment

- Application Software
    - Single software for all data loggers in each package
    - Windows based
    - unlimited period use license for each package
    - Communicates with each data logger in the field
    - GUI based

- Database Software
    - records non editable
    - Oracle 10g
- Reports - All reports can be time-wise, lane-wise, location-wise or total summary reports for all data loggers. The reports are in tabular and graphic form. All reports are in metric units and dd/mm/yyyy time format. The following are a few reports:

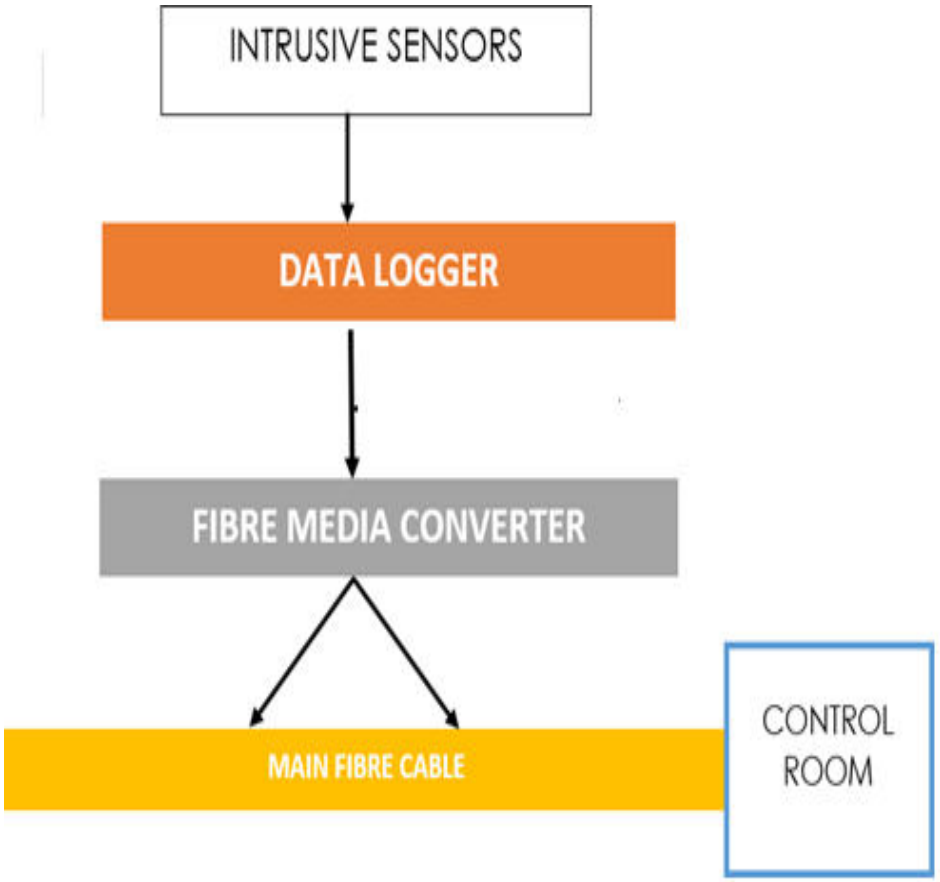
    - Average Speed per Vehicle Category per Lane / per Day
    - Traffic Volume per Vehicle Category per Lane / per Day
    - Traffic Volume per Hour per Lane / per Day
    - Volume (count) per Class / per Lane
    - Average Speed per Class / per Lane
    - Volume per Lane per Time Band
    - Volume per Speed Band per Lane
    - Average Speed per Category
    - Malfunction Management Report (fault report)
    - Traffic Volume by Category & by Lane (binned data)
    - The reports can be generated in both MS Excel and Acrobat pdf format.
    - Multi-year calendar adjusted for leap years

6.1 Software Specification

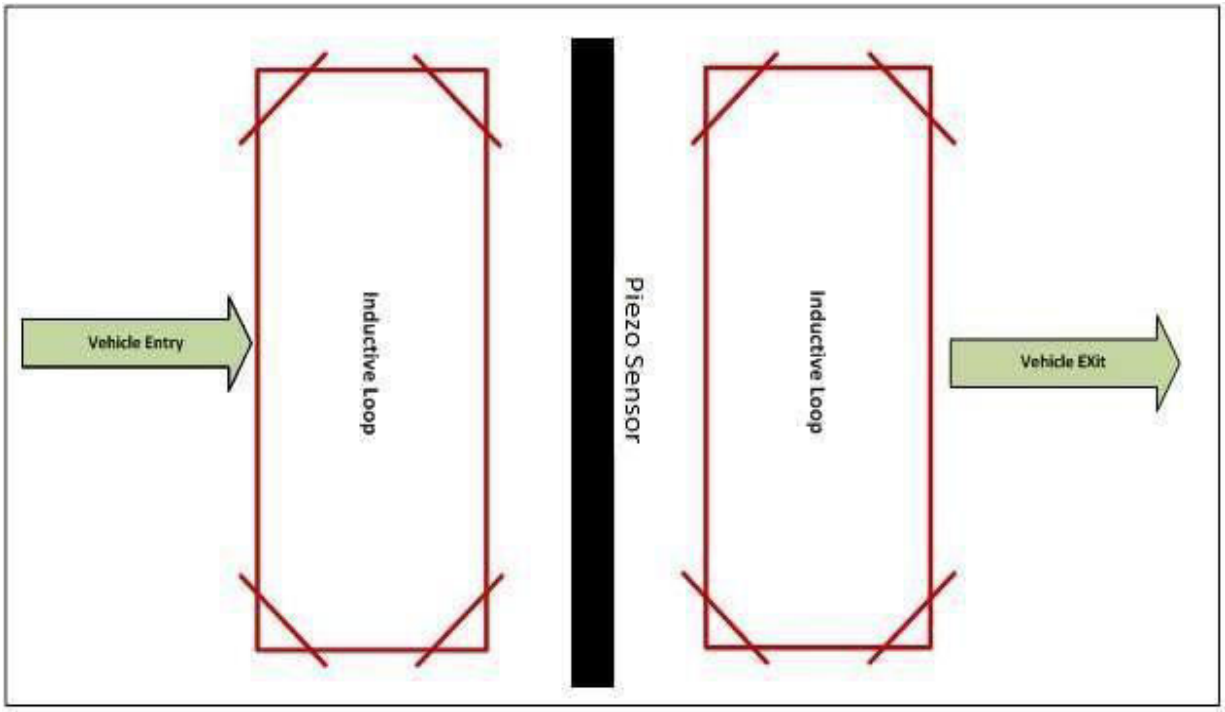
- The Automatic Traffic counter-cum-classifier system is employed for centrally monitoring the road traffic. Its purpose is to use as an independent traffic counting / classification system for following applications:
- Traffic pattern studies for statistical use
- Road maintenance planning
- Auditing system
- This application consists of two parts: ATMS and ATCC Workstation software. The traffic data is stored into the logger and data is inserted into the database and the traffic information is obtained by generating the reports.

6.2 ATCC Interconnection

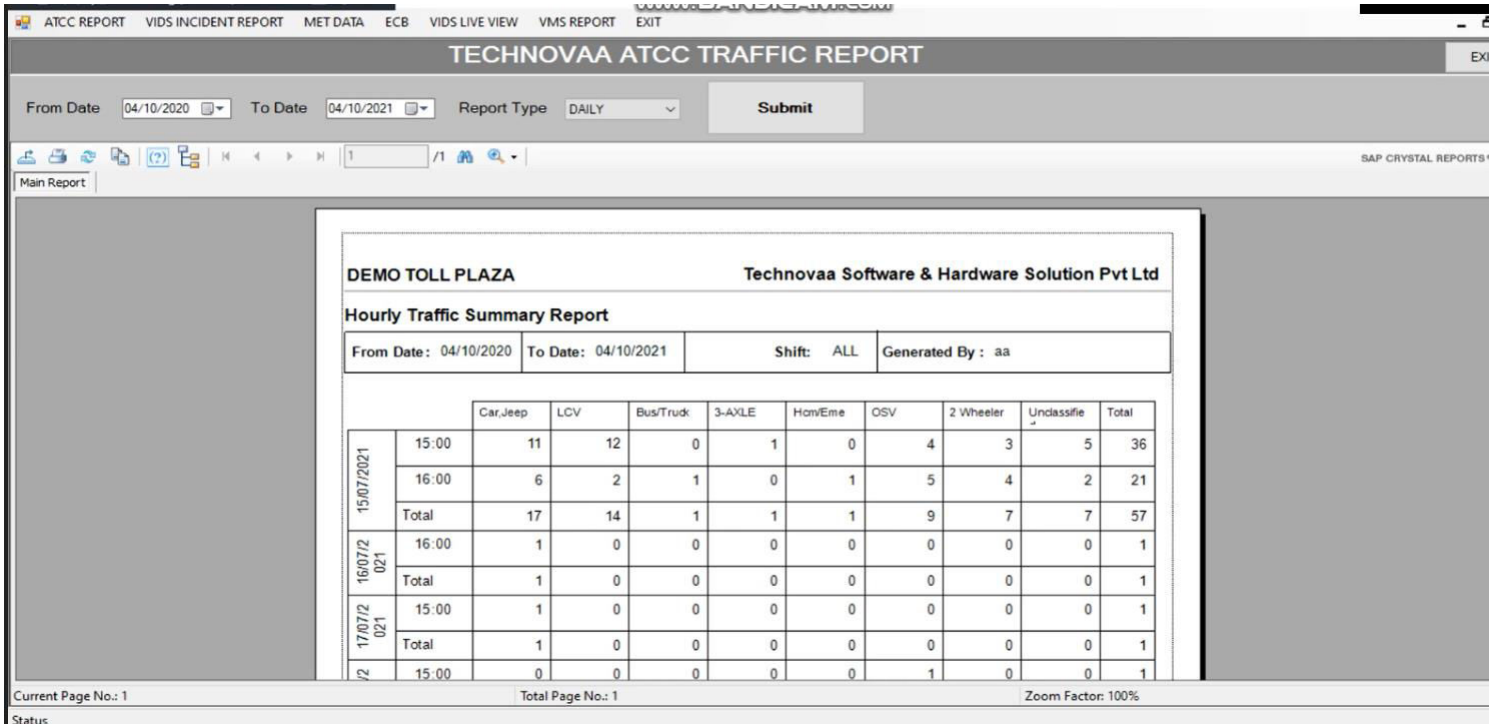
c



6.3 ATCC Loop Structure



6.2 TECHNOVAA ATCC REPORTS



		Car,Jeep	LCV	Bus/Truck	3-AXLE	Hcm/Eme	OSV	2 Wheeler	Unclassifie	Total
15/07/2021	15:00	11	12	0	1	0	4	3	5	36
	16:00	6	2	1	0	1	5	4	2	21
	Total	17	14	1	1	1	9	7	7	57
16/07/2021	16:00	1	0	0	0	0	0	0	0	1
	Total	1	0	0	0	0	0	0	0	1
17/07/2021	15:00	1	0	0	0	0	0	0	0	1
	Total	1	0	0	0	0	0	0	0	1
/2	15:00	0	0	0	0	0	1	0	0	1

7. Emergency Call Box (ECB)

ECBs are the most needed communication system on highways. Through ECBs user is able to communicate with the control room in the fastest possible way. This single push communication system on both sides of the road is installed on the highway wherever the communication is required. It works through OFC Communication.

- **Specification**

Emergency Communication System

- 2 Call boxes placed every 2 kms on either side of road.
- The emergency call boxes are in pairs of the opposite sides of highway. Main ECB unit (Master)and is located on one side and the secondary unit (Slave unit) on the opposite side
- ECB's are equipped with Optic interface, Solar Panel, Battery backup and voice Communication mechanism

Major Components

- Field Component
    - Emergency Call Box - master and Slave
    - Power Supply (Solar)
    - Enclosure - IP65 Ratting
    - Guard Rail for protection
    - EMI/ESI Interface through shielding/grounding
- CCR Components
    - ECB Server
    - Head Phone Speaker and microphone (Answering unit)
    - Voice recorder / Logger
    - Application Software
    - Database Software

7.1 Functional Specification

- The system is connected to the CCR over the OFC backbone
- ECB has loud speaker, microphone, solar panel, and battery and activation button with LED indicating conversation. It is housed in vandal proof casing and operate in expressway noise levels with built in diagnostic
- The road user just needs to press the push button on the ECB and shall be connected to the CCR. In case the CCR operator is busy, the user shall hear a recorded message and shall hold till he/she is connected. The Master unit records message and holds till he/she is connected. The Master unit is connected to the CCR over the communication backbone. The Slave unit is connected to the CCR through the Master unit.
- The CCR can also call any specific ECB for testing/calling.
- Vandal proof casing with tamper detection switch
- Push button
- Activation LED
- Loud speaker
- Microphone
- Two-way communication between ECB and CCR
- Solar panel with batteries
- Hands free operation.
- Usage instructions in Hindi, English, Marathi and Guajarati pasted or printed on it along with graphical instructions.
- Reflective stickers facing the motorist pasted on the ECB indicating that it is a phone.
- The CCR software manages the calls to and from the ECB.
- The ECB has ringing tone to indicate progress of call when button is pressed; confidence tone to indicate call is still connected when on hold and recorded message if line is busy.
- Up to four programmable auto dial numbers associated with the push button. The ECB automatically dials subsequent numbers if the first number is busy or unavailable.
- The ECB automatically ends call when CCR telephone is disconnected.
- All calls recorded in the CCR voice logger/recorder along with date/time stamp. The voice recorder checks for following minimum fault conditions:
- Failure of recording electronics
- Failure of storage media used for recording
- Excessive recoverable errors on the storage medium
- Lack of activity on a channel
- Constant activity on a channel
- Constant ringing on channel (answered calls)
- Programmable from the CCR and at the field by laptop.
- Powered by DC batteries which in turn shall be charged by solar panel. The battery supports 7 days of operation (under normal circumstances) with minimum talk time of 90 minutes over 3 days in succession in case there is no sunlight for this period.
- The ECB has tamper resistant screw bits on the outside and is security locked. It is not be possible to open the ECB with normal tools or keys
- ECB foundation is concrete.
- Each ECB pillar is numbered
- The ECB Mic /speaker is located 1-1.5m above ground.
- The system does not permit cancellation of any call before answering.

7.2 Functionalities

- This software consists of Emergency Call Box (ECB) front-end applications as well as ECB back-end applications.
- Functionalities provided by front end application:
    - Configuration on Screen Icons
    - Status Management (showing ECB connected / disconnected, calling etc.)
    - Help for control room
    - Entry of Call Related Information
- Functionalities provided by back-end application:
    - Call Management and Routing
    - Audio Matrix Control
    - Information to Front End Features

- Attend to incoming calls from ECBs using PC based console
- Call waiting signal to ECB and put the call on queue
- Create log and record for all conversation
- Generate a unique call number for all calls with annotations from operator
- Terminating of any call by operator
- Easy Addition/ Deletion of ECBs on the network
- Audio call record facility
- Audio Visual Alarm in case of Vandalism
- Provide audible and visual alert on the screen for any incoming calls from the Emergency call boxes. In this case the color of the icon representing the Call boxes on the graphical map shall change indicating the following states.
    - Phone healthy
    - Phone faulty
    - Incoming call
    - Conversation in progress
    - Call on hold.

7.3 Generic ECB Structure

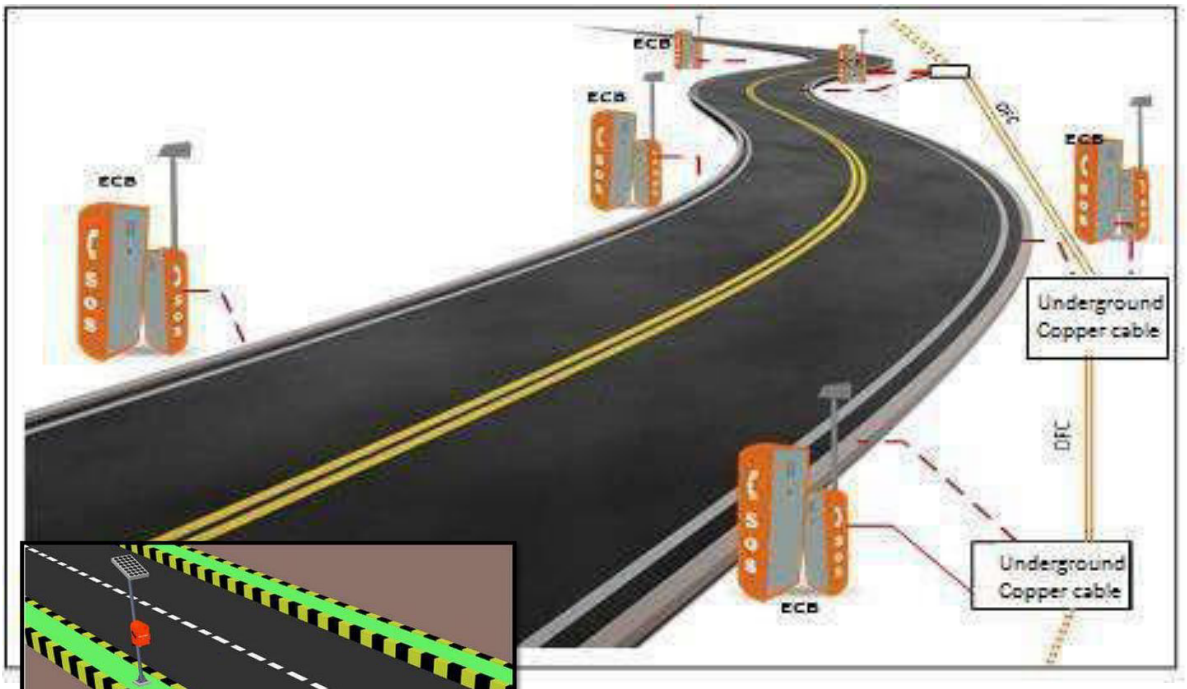
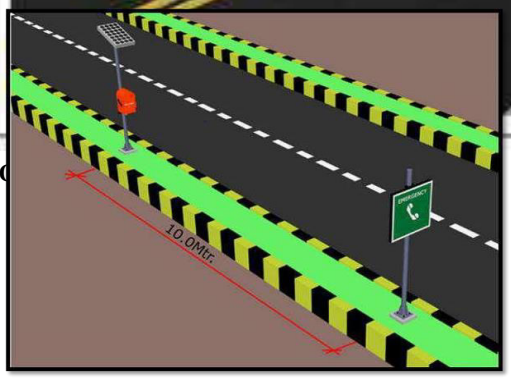


Figure 8.0

- 

Generic View of ECB-1

Generic View of ECB-2

7.4 ECB Mounting Arrangement

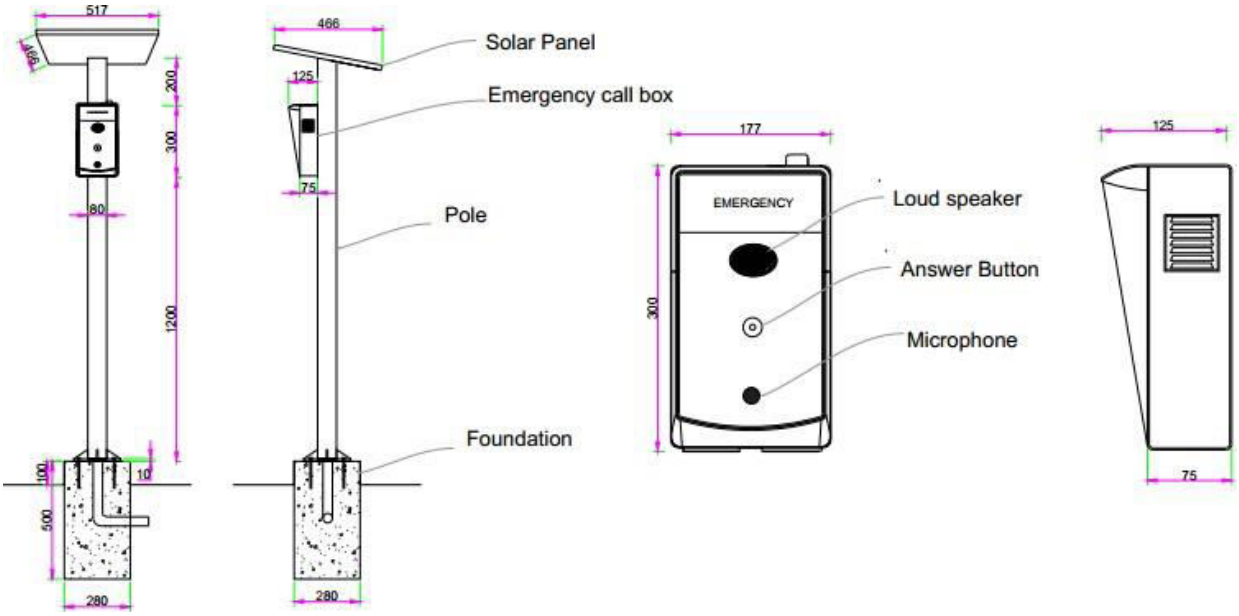
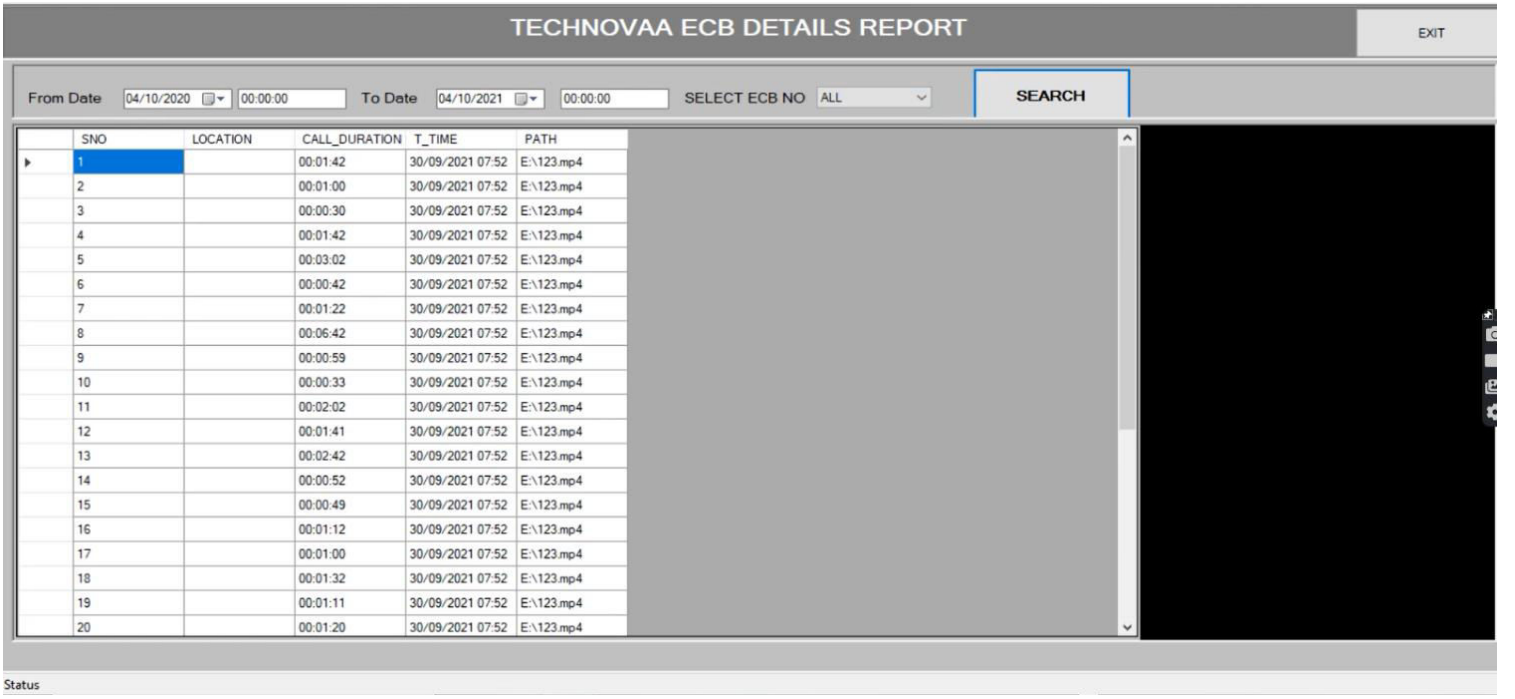


Figure 8.3-4 ECB Mounting Arrangement

ECB Actual Image

ECB Actual Image

7.5 Technovaa ECB Reports



8. Meteorological Data System (MDS)

MDS comes into picture when we need the essential weather report, which is further provided to the road user through VMS (Mostly) and other process. Weather is also a factor, which can affect the traffic flow and also can cause accidents on the road. By this weather report, the highway authority can plan accordingly and can take some precautionary steps to minimize the possible accidents.

8.1 Product Specification

- The Meteorological Data System is capable of providing data regarding weather, including Air Pollution parameters, atmospheric temperature, humidity, visibility, wind speed & direction. The information based on these data shall be made available to the road users through VMS so that they are forewarned of the weather conditions on the expressway.

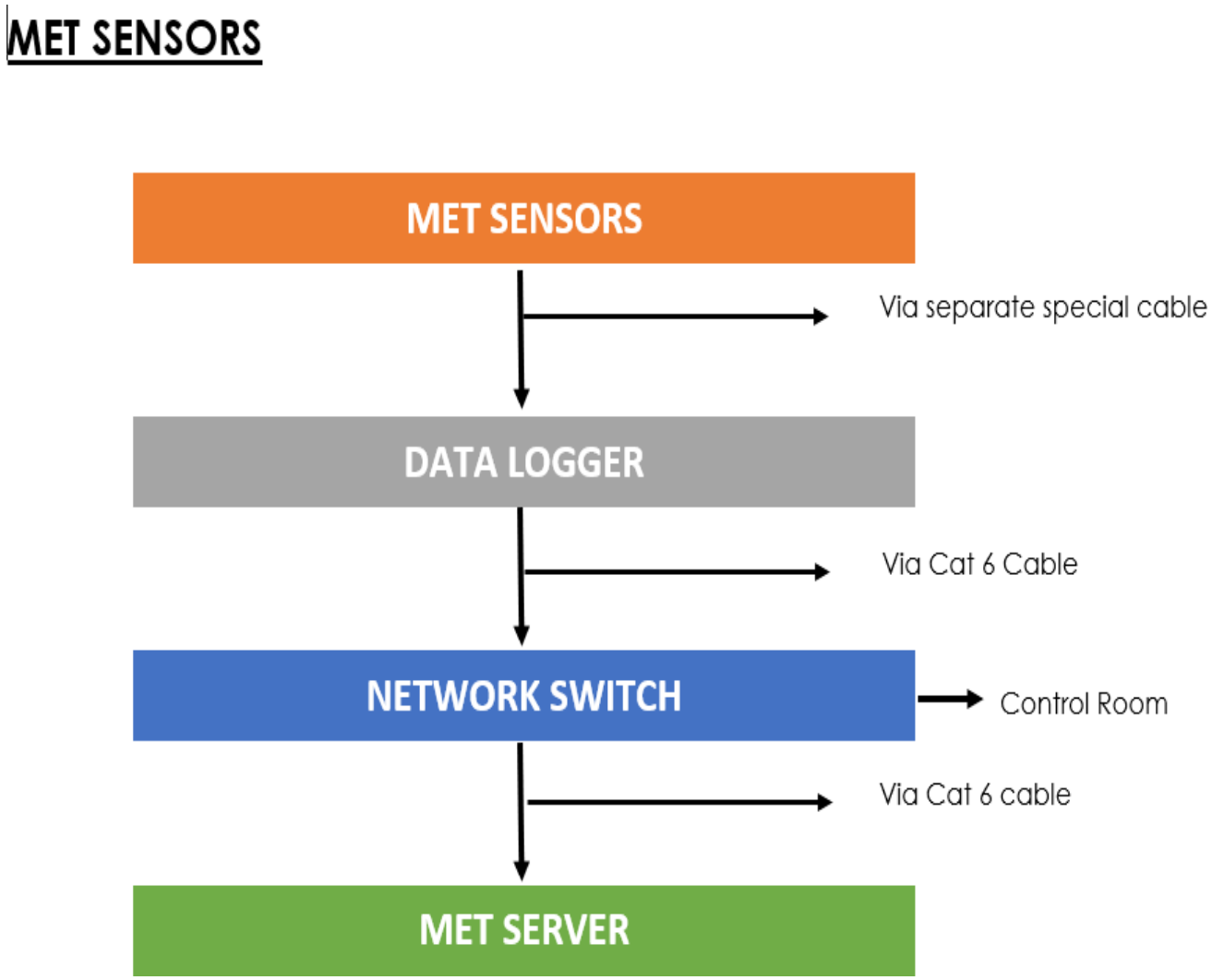
Major Components

- The Meteorological Data System has following components:
- Sensor for atmospheric temperature
- Sensor for road surface temperature
- Sensor for humidity
- Sensor for visibility
- Sensor for wind speed & direction
- Data Acquisition Unit / Logger
- Control room computer
- Software - application, OS, database

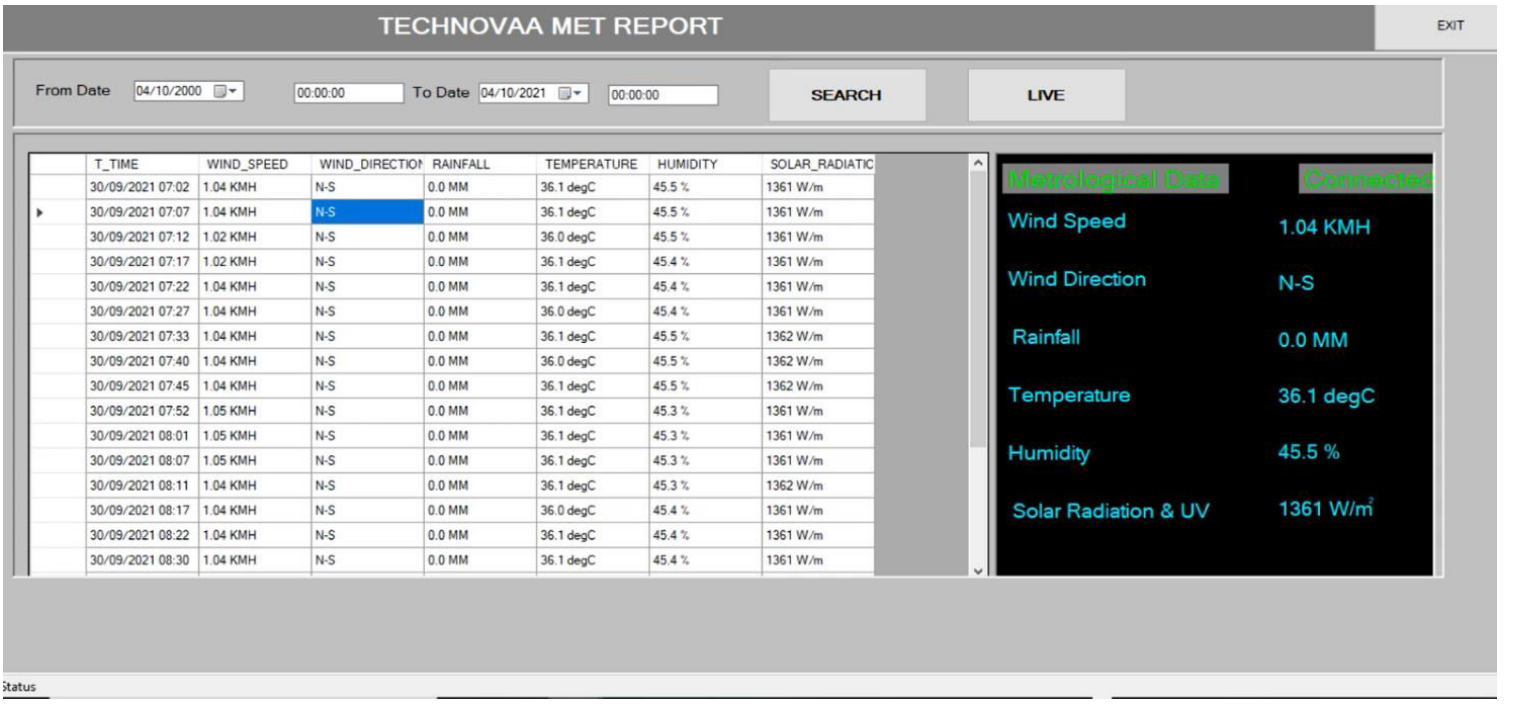
Specifications

- The Meteorological Data System provides data regarding
  - atmospheric temperature
  - humidity
  - visibility,
  - wind speed & direction
- The data from all sensors is fed into the data logger.
- This information is made available to the users through the variable message signs as per requirement.
- The Meteorological Data System has the facility to communicate through PIJF/Optical fiber cable.
- The Meteorological Data System is compact, rugged in design and have ease of maintenance.
- The software in the CCR is capable of processing sensor data, store and retrieve it and draw reports.
- All reports are in tabular as well as graphical.
- The weather data is automatically fed to the VMS subsystem. The VMS also displays data at fixed time intervals.
- Specification of Application Software (in the CCR)
  - The application software for continuous air monitoring is Windows based.
  - Provision of Calibration windows for analyzer calibration from computer.
  - Main windows for real time display of all major parameters with status of all analyzers and sensors.
  - Control Panel window for control of each analyzer.
  - Window for alarms of all analyzers and sensors
  - Real time and multi curves / graphs for all parameters.
  - Historic multi curves/ graphs over user selectable time-period.
  - Real time status & diagnostics for maintenance people.

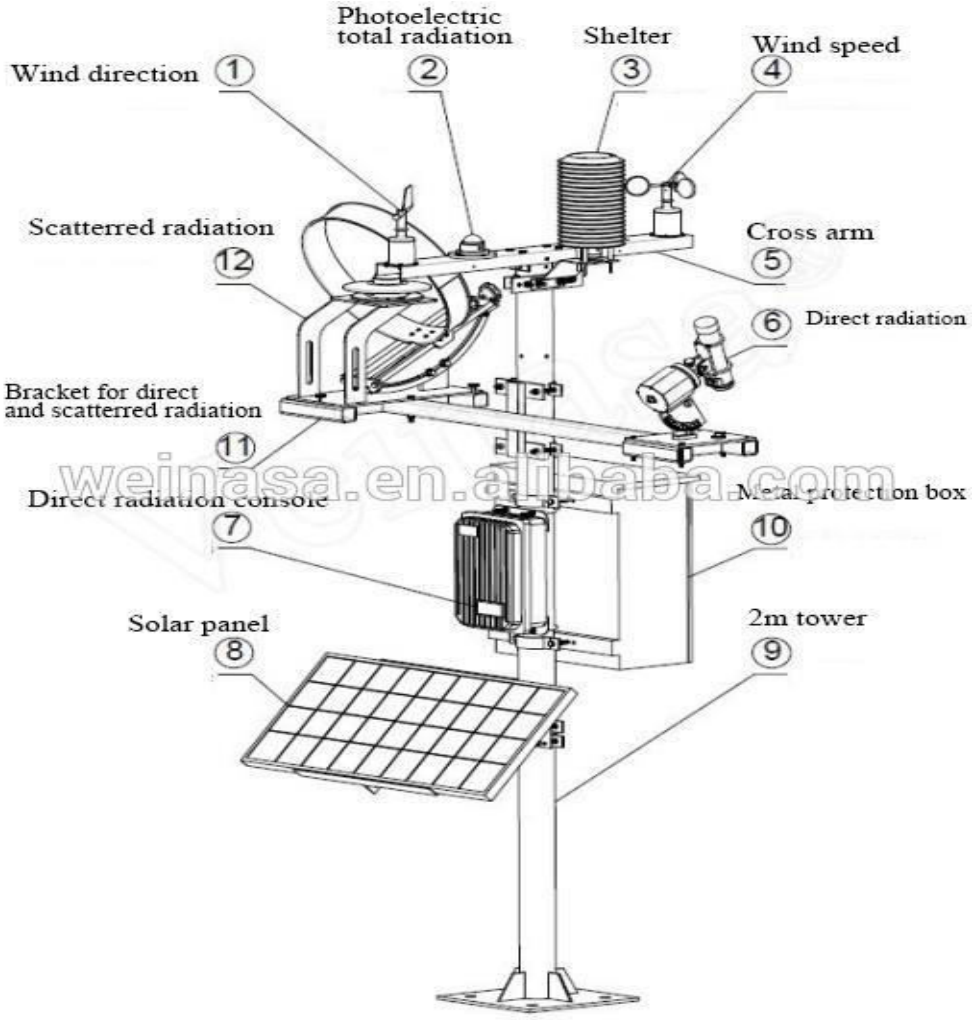
8.1 Interconnection of MDS



8.2 Technovaa MET Reports



8.3 MDS Image


Photoelectric
total radiation
Shelter
Wind speed
Wind direction
1
2
3
4
Scatterred radiation
12
Cross arm
5
6
Direct radiation
Bracket for direct
and scatterred radiation
11
Direct radiation console
7
10
Solar panel
8
2m tower
9

9. Surveillance Camera

Surveillance cameras are installed at different position of the highway where the possibilities of accident are more like sharp turns, junction's road intersections etc. This surveillance system is monitored 24x7 manually from control room. To keep track of the most accident- prone zone surveillance system is needed.

8.5.1 Product Specification

The purpose of the Video surveillance system is to monitor specific areas of the expressway remotely from the CCR by use of cameras installed at such critical junctions. This shall help in managing incidents.

The system also records and stores video for analysis and future reference.

Major Components

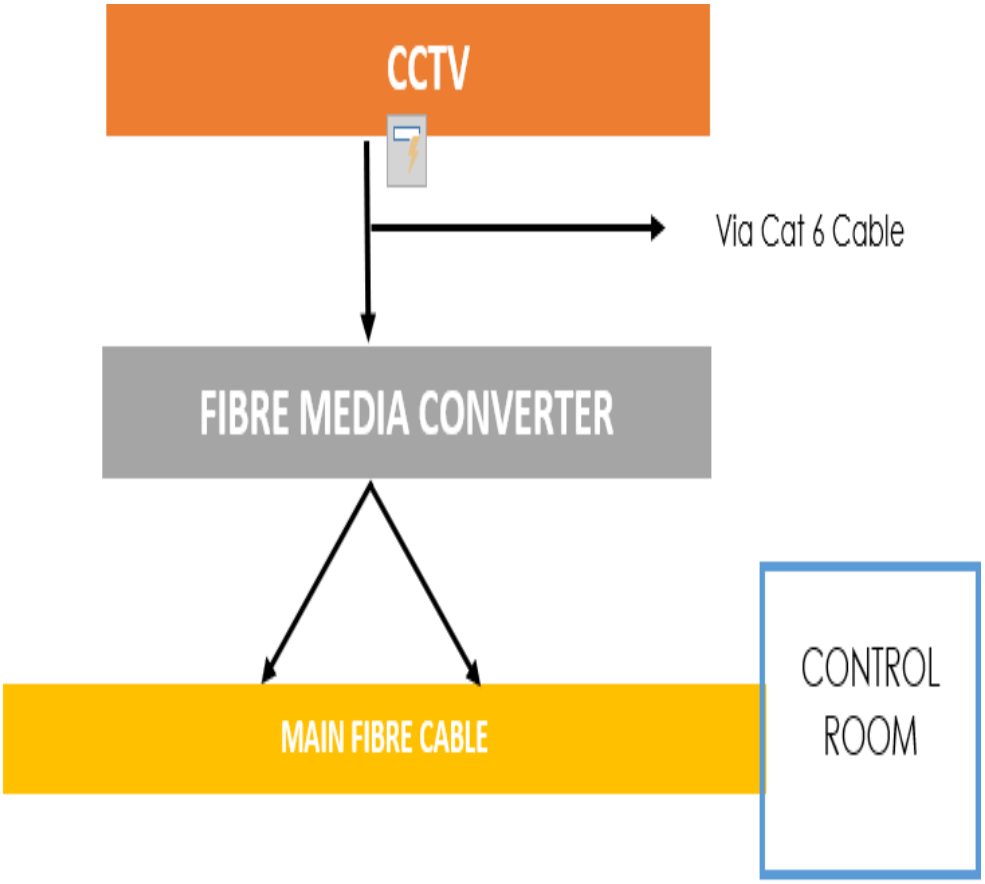
- Field components:
  - CCTV camera with housing
  - CCTV pole
  - Video transmission unit (encoder)
  - PTZ control
  - Power supply - solar panel
  - Lightning protection and earthling
- CCR components
  - Server with OS
  - b) CCTV decoder/ switcher unit
  - c) PTZ control/joystick
  - d) Video Wall
  - e) DVR / NVR
  - f) Application software
  - g) Database software

CCTV monitoring methods are used for surveillance of the road section. CCTV cameras with pan, tilt and zoom features, placed at a high level are perfect for highway surveillance, while vandal-proof dome cameras are best for high criminality locations. Multiple types of cameras can help record and display video with ability to schedule video recording or trigger recording in response to an incident.
Central control room uses the feeds of the traffic from CCTVs installed along particular sections of the highway. It enables CCR to take quick decisions on Highway incidents.

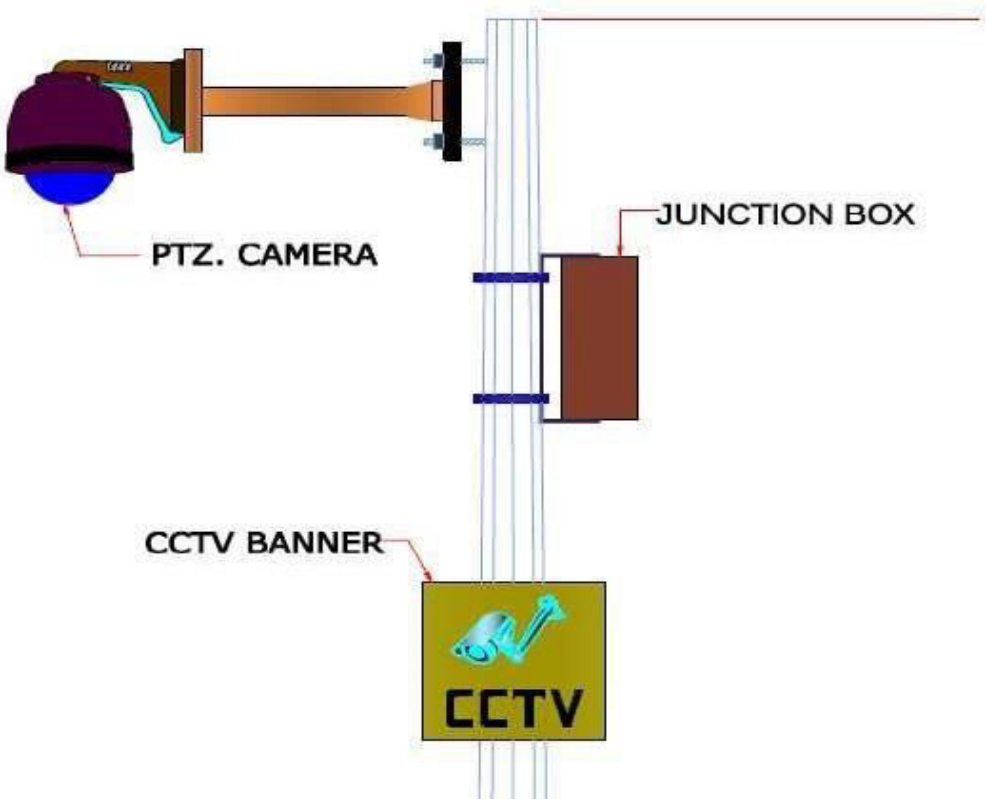
Features:
Optical Zoom

- Digital Wide Dynamic Range
- 3D Intelligent Positioning functions
- Cloud Support
- High IR distance
- Security efficiency with key events and objects recorded
- Wide range of features of intrusion detection, line crossing detection, Audio exception

9.1 Generic Surveillance Structure



9.2 Mounting Plan for Surveillance System



Mounting Plan for Surveillance System

10. VIDS (Video Incident Detection System)

Product Specification

The purpose of the VIDS is to sense, detect and record the incident. The system shall be an intelligent image detection using camera. The VIDS shall have inbuilt intelligence to ascertain when the image has meaningfully deviated from the standard image originally recorded. A pilot run for VIDS is suggested before implementation.

Major Components

- Field components:
  - VID camera with housing
  - Pole
  - Data transmission unit (encoder)
  - Power supply - solar panel
  - Lightning protection and earthling
  - CCR components
- Server with OS
- Data analyzer
- DVR
- Application software
- Database software

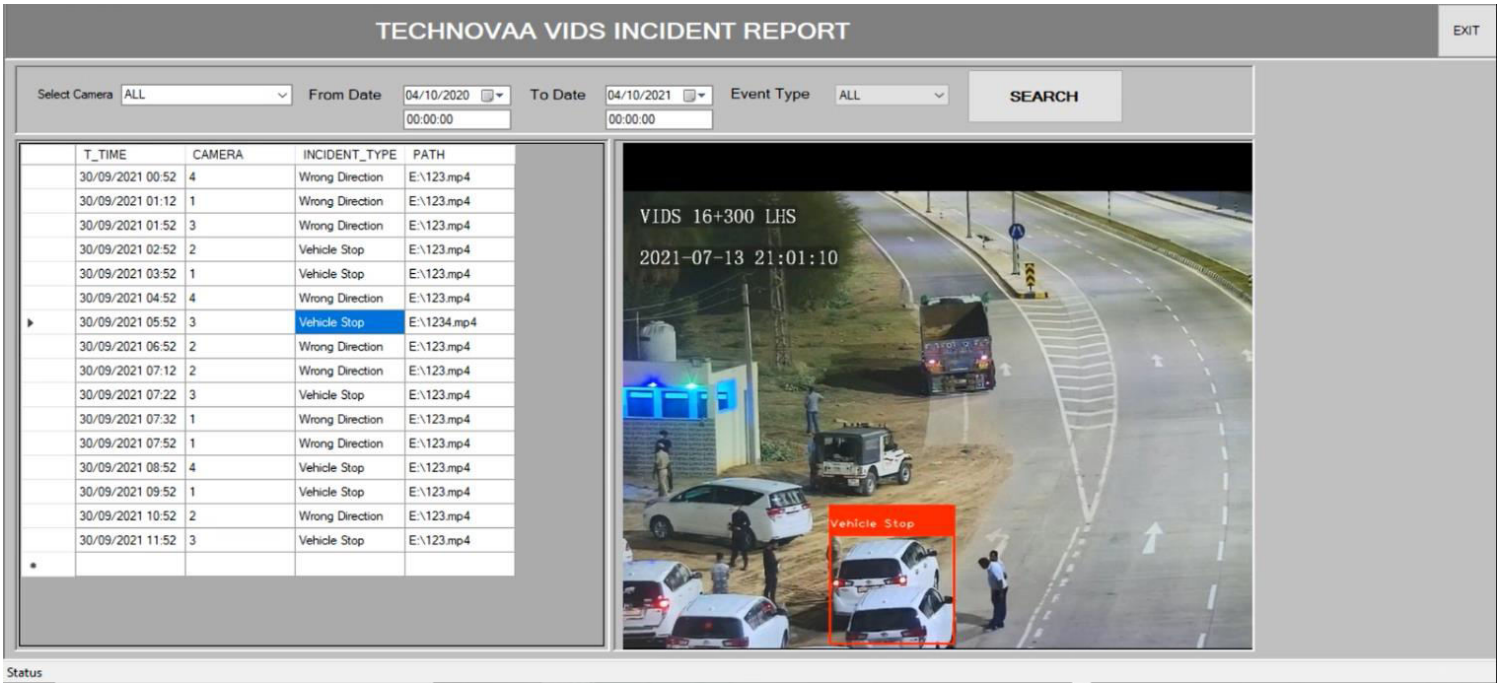
Following events are captured

- Measurement of traffic flow speed between 0 and 150 km/hr. for up to 6- lanes
- Detection of vehicles driving in wrong direction
- Automatic detection of 5 types of traffic flow: normal, dense, delayed, congested, and stop and go
- Detection of stopped vehicles, within 10 sec and for up to 16 detection zones.
- Monitor Zone occupancy of the detection area
- Detection of deceleration
- Detection of fog/smoke

Following alarms are captured

- Queue
- Stop
- Inverse direction
- Speed drop
- Fog/smoke
- No video signals
- Error

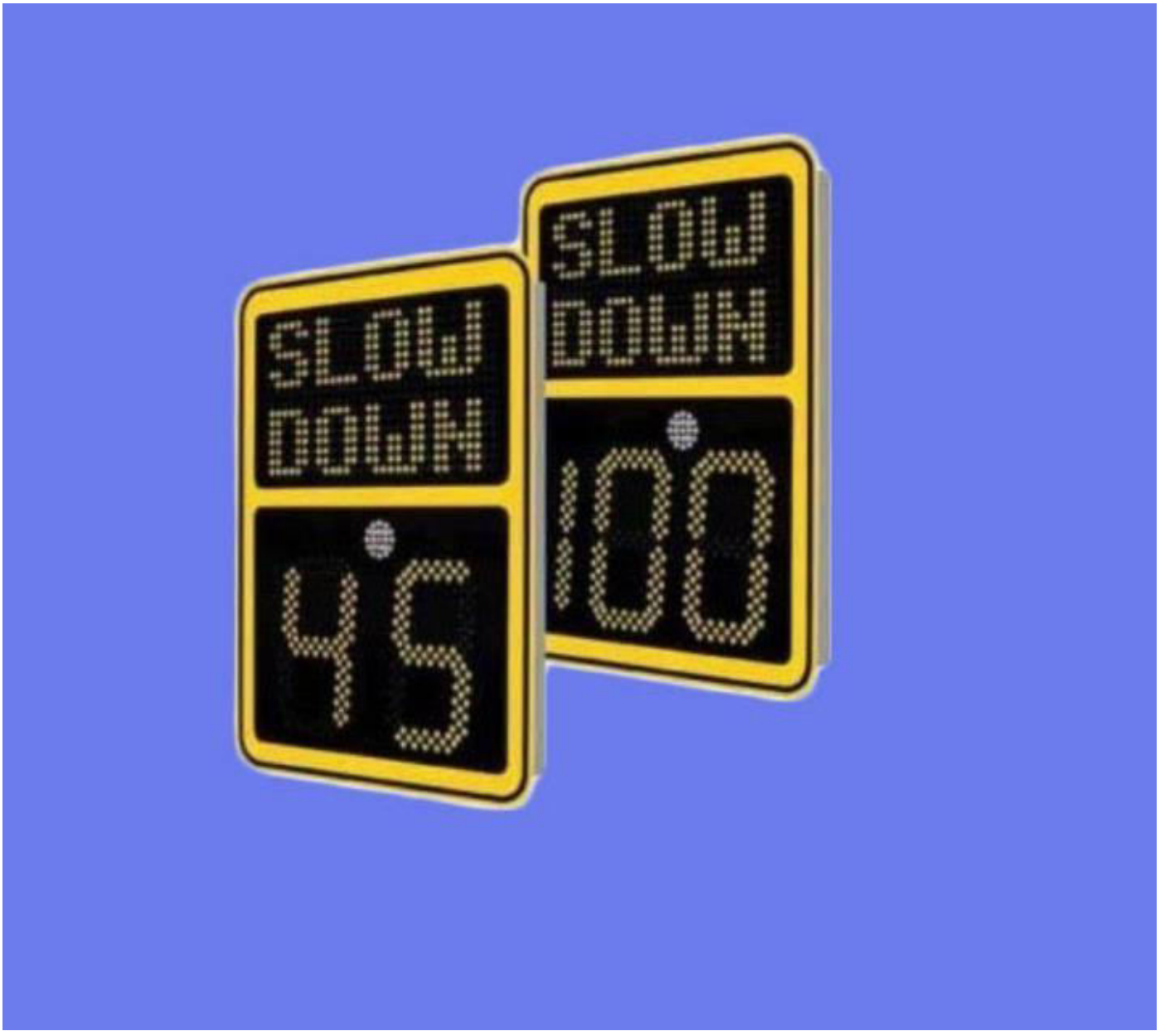
10.1 Technovaa VIDS Reports



11. Vehicle Actuated Speed Display (VASD)

The speed display shall display the speed of the vehicle in real-time and provide textual or graphical warning to the vehicles exceeding the pre-set speed limit. The speed shall be displayed in green color if the speed is within the permissible limit for the vehicle class, orange color if the speed is matching the speed limit, and red if the vehicle is over-speeding. The display shall blink continuously if the speed of vehicle is more than 120% of the permissible speed limit, along with the message “Over-Speed – Slow down” in the first row of the display. One speed display shall be installed for each lane on both the sides of the road.

Time shall be displayed at the top section of the display in HH:MM:SS (24 hour) format at all the times, even if no speed is being displayed on the VASD. The font size shall be suitable and visible from 100 meters distance. The time on all the displayed shall be synced with the central server.



- The system shall perform during day and night as well as in adverse weather conditions.
- It shall have built in diagnostic functions to quickly asses the validity of speed calibration.
- It shall adjust display intensity automatically to suit the ambient light conditions.
- It shall be modular in construction for ease of maintenance.
- It shall display numeric speed data as well as graphical (standard IRC road warning sign) (preferably) / textual warning.
- Measurement:
- Speed range: 0.5 km/h to 200 km/h
- ii. Maximum Measuring errors: Up to 100 km/h ± 3 km/h, Above 100 km/ ± 5 km/h
- iii. Minimum Monitored section length: 100m
- It shall have the facility to log vehicle speed of over- speeding vehicles and transfer them to the ATMS control centre.
- The speed display shall be formed using individual modules.
- Speed display must be constructed using corrosion resistant panel with LED pixels in row: column matrix.
- Scanning/Multiplexing ratio shall be 1/8 or better.
- The LED Cluster shall consist of individual LED`s rated for out-door use.
- Shall support an industry standard communication interface such as TCP/IP on copper, Wi-Fi, and/or fibre optic to help setting the pre-set speed and retrieve log data.
- Shall maintain time stamped record (speed and vehicle image) of each case of over speeding in a log file that can be retrieved over the connected network or using a locally connected laptop.
- It shall optionally be possible to configure the display to send real time violation event record (speed, and time stamp) over the connected network while recording the same
- It shall be possible to control the brightness of displays automatically using built-in light sensors.
- All PCB`s shall be of FR4 material, 1.6mm thick and LED matrix PCB shall be 2.4mm thick. PCBs shall be of the quality suitable for use in environment conditions specified.
- The equipment shall allow local diagnostics via laptop connected to its communication port.
- Display size shall be suitable to display both the speed of the vehicle and warning message simultaneously in two rows.
- Brightness intensity shall be 7500 cd per sq.m.
- Fault diagnostics shall be provided to include the following as a minimum:
- Radar Failure

Transmission Media

11.1 Specification

- System Comprises of Auxiliary fiber optic cable and Copper cable for connectivity of the road side equipment to the Control-center.
- A separate and independent (auxiliary) Optical Fiber Cable System shall be used for the transmission of video signals, data signals form the equipment location to sub-center where copper cable has limitations for transmission of signals
- System shall comprise optical line terminals, interface cards and network management.
- The Power Supply System shall support the requirements of individuals sub-systems
- The Power Supply System proposed for individual sub-system shall take into account the overall availability/ reliability requirements
- The Power Supply System design shall take in to consideration local power availability, temperature and other climatic variation, and easy maintainability.
- Fiber cable is approved with TEC standard.
- Connectivity of Roadside equipment’s are as shown below.

12. ATMS Control Room

The main purpose of the Control Centre is to monitor and control all the ATMS sub- systems and its field equipment. Control center has ATMS local area network (LAN) comprising of ATMS server, network computers and associated software applications installed on computers. Control center equipment also includes monitoring & control equipment for cameras, data conversion equipment which are not part of ATMS LAN.

Control Room Specification

The purpose of CCR is to monitor the expressway and to provide information to road users. The CCR also houses the central server and data processing equipment

Data System, CCTV & Video Incident Detection

- Video Wall/Large Display Board LED
- Servers
- Switches
- Administration Computer and Network Printer
- Emergency Call Management System Equipment & Software
- Computer for NMS for fiber Optic Communication system.
- CCTV console equipment
- VIDS control equipment
- Computers for VMS, AVCC, Met, Traffic Control
- A network printer
- An office computer (administration terminal)
- A power supply and backup system/UPS

Functional Specification

The CCR has the following functions and capabilities:

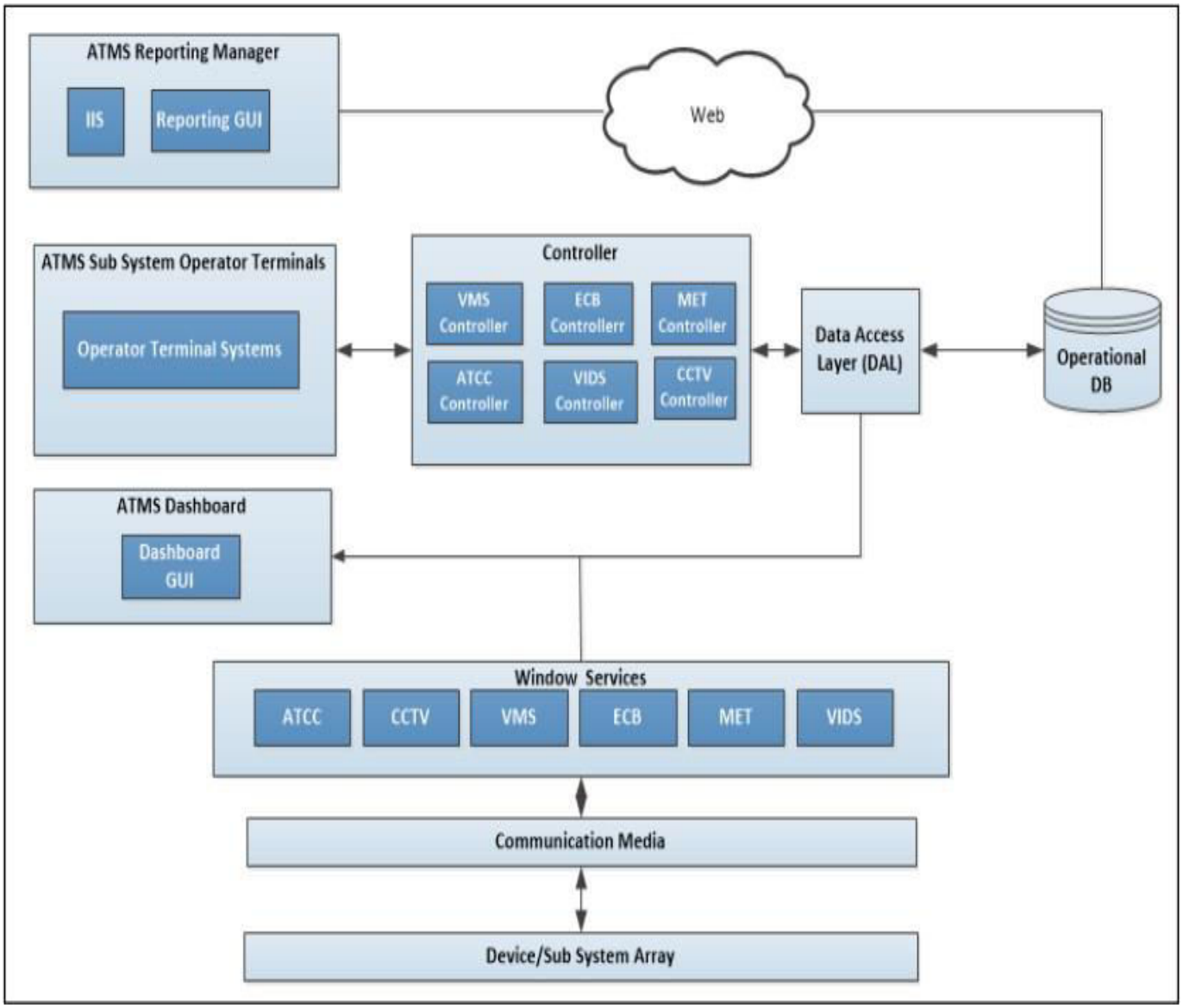
- Real time images of the expressway locations (from camera locations) to the control center.
- Emergency communication system for communication from the predefined ECB locations to the control center.
- Real time information to the users from control center (about the route conditions, traffic situation, etc.) using variable message signs installed on gantries.
- Real time monitoring of the traffic situation and collection of traffic data using traffic counting and classifying system
- Monitoring of the weather conditions
- Traffic Control System at the interchanges
- Monitoring and control of the expressway traffic from the main control center using integrated expressway system
- Compilation, recording, analysis, processing, storage of traffic information and data
- Storing Facility of 12-month data will be provided

Server

- Server for Emergency Call System
- Server for Video Surveillance system, VIDS system
- Common server for VMS, ATCC, Meteorological Data System

12.1 Software Data Flow

The following block diagram depicts a typical Control Center Software main component.



This is a highly modular, highly configurable architecture, allowing for a multitude of module combinations and deployment schemas.

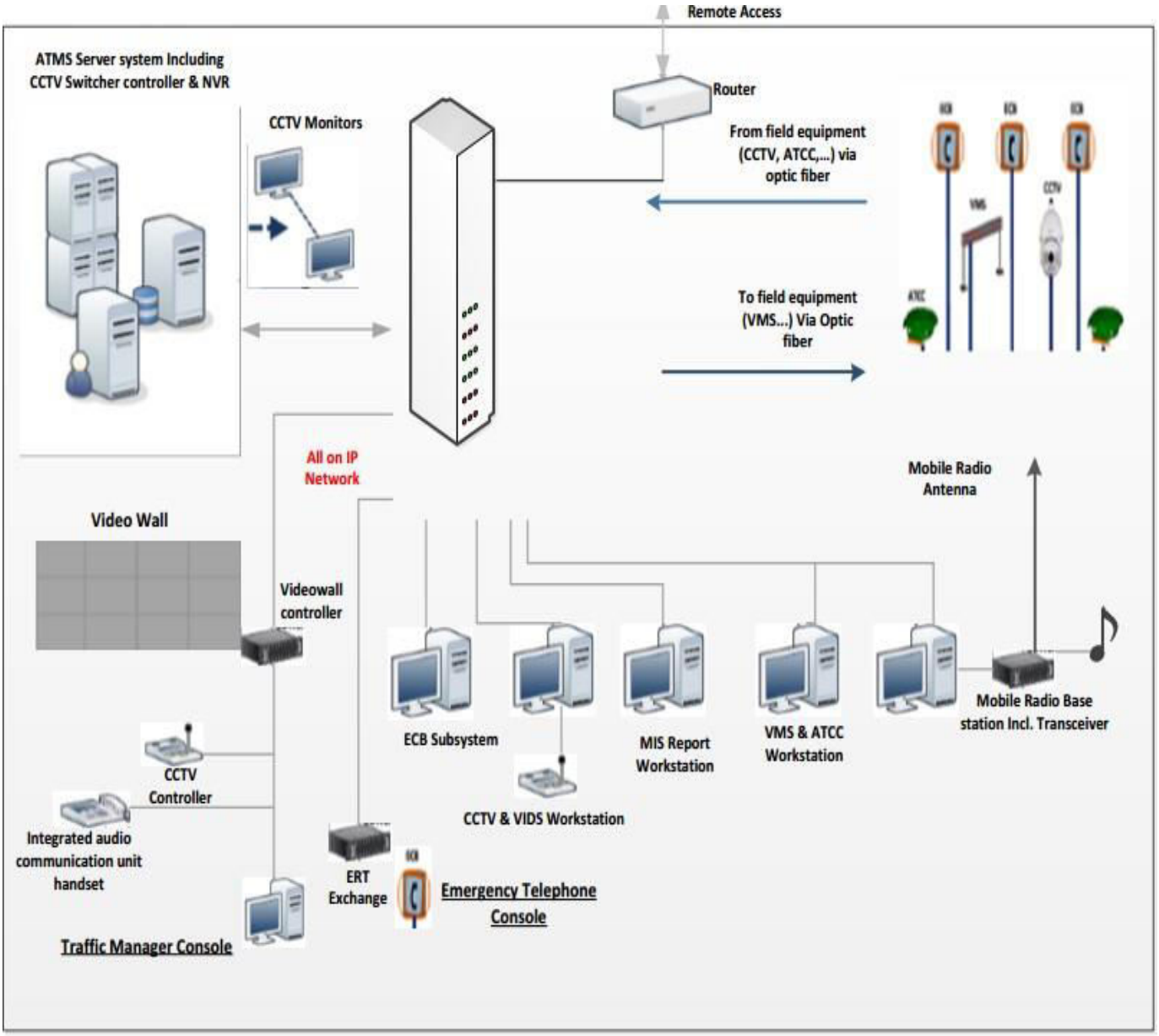
For example:

- The User interface can be spanned across several workstations or installed all in one;
- The Services can be deployed from one server per Service to all Services on one server allowing for any combination in between.
- Deploy only the necessary managers.

This architecture also allows the integration of any kind of subsystem or hardware, as long as there is any type of interface.

12.2 System & Network Architecture

A schematic of the ATMS control Centre system is shown



The ATMS software integrates the field equipment like CCTV cameras, VIDS, ATCC, MET & VMS with the Integrated Traffic Management (ITM) console to ensure the availability of an effective system for Traffic monitoring & incident/ accident management.

The ATMS software is a modular system comprising the following modules:

- Data acquisition module for acquiring data, video streams and audio stream from field equipment
- Highway Traffic Monitoring module
- Incident / Accident Management Module
- Integrated audio communication module (ECB)
- Report generation module
- System Administration module
- Communication module for authorized access by external systems (e.g. NHAI's Regional control Centre & the Main control Centre)

- **ATMS Dashboard**