
SMART BUILDING FACILITIES
PREVENTION IS BETTER CURE
智能設施：預防勝於治療
OPTICAL
SENSING

A VERY WARM WELCOME & INTRODUCTION

MATTHEW LAM – CEO, OPTICAL SENSING LIMITED

EDUCATION & PROFESSIONAL AFFILIATION

- Bachelor degree in Electronic Engineering [New Zealand]
- Master degree in Electronic Engineering [New Zealand]
- Diploma in Management
- Registered Professional Engineer [Hong Kong]
- Chartered Engineer [UK]
- Corporate Member, Institution of Engineering & Technology
- Chartered Member, Institution of Engineering New Zealand

PREVIOUS RESPONSIBILITIES

- CEO Hutchison Telecom Vietnam
- CEO Hutchison Telecom Malaysia
- COO Hutchison Telecom Sri Lanka
- CTO Wharf T&T [HONG KONG]

WE RESEARCH, DESIGN & IMPLEMENT

FIBRE OPTIC SENSING SYSTEMS + DATA ANALYTICS TO REALISE PREVENTIVE MONITORING

INTELLIGENT BUILDINGS

What is an Intelligent Building

A building that “provides a productive and cost-effective environment through optimization of its four basic elements including

- Structure
- Systems
- Services
- Management

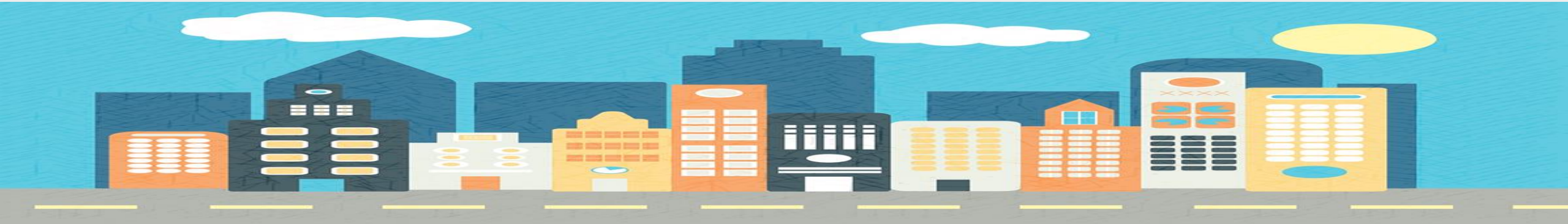
and the interrelationships between them”

By Intelligent Building Institute (IBI)

Characteristics of an Intelligent Building

- Accomplish intelligent behaviour through self diagnosis, condition/ event based actions and learning
- Supports automation in O&M and administration
- With strong cyber security measures
- Supports introduction of new services
- Integrated System / HMI

Extracted from Jean-Christope HUTT, “Energy Efficiency and Intelligent Buildings”

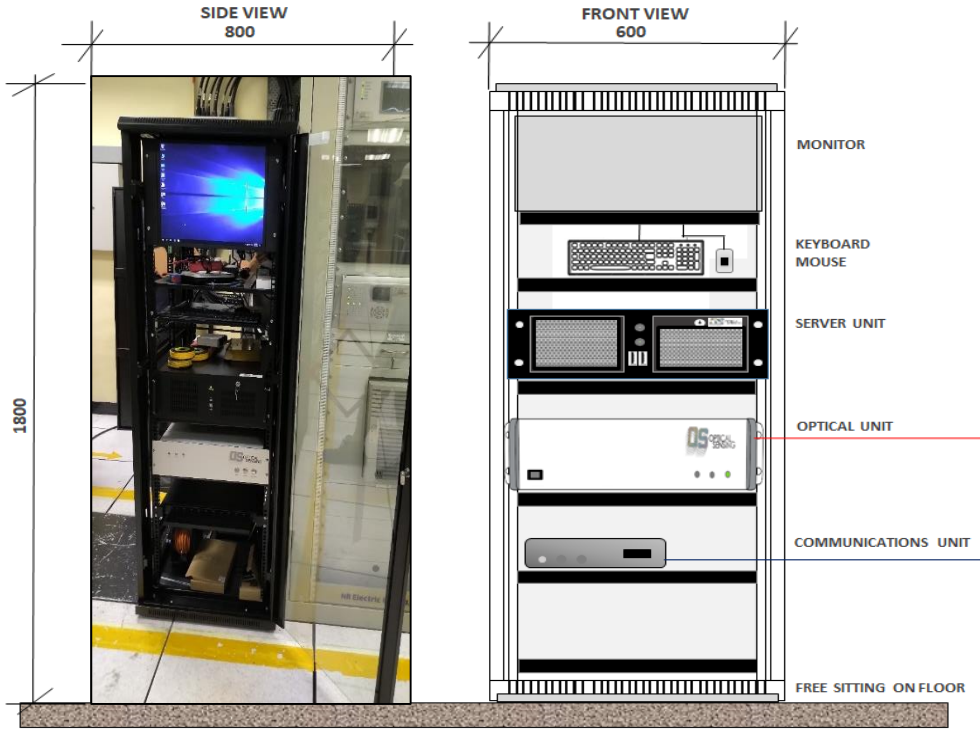


FAILURE OF BUILDING FACILITIES CAN CAUSE DEVASTATING CONSEQUENCES

PREVENTIVE MONITORING TO AVOID FAILURE IS IMPERATIVE IN FACILITIES MANAGEMENT

FIBRE OPTIC SENSING SYSTEM

MAIN CONTROL UNIT

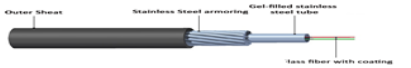


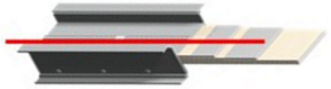
FIBRE OPTIC CABLE

SIGNAL CABLE

FIBRE OPTIC SENSORS

FIBRE OPTIC CONTINUOUS SENSORS





CLIENT'S DEVICES

MODBUS TCP, DRY CONTACT

OPTICAL SENSING	REV.	DESCRIPTION	DATE	CHK.
SUPPLIER: OPTICAL SENSING LIMITED	TITLE: FIBRE OPTIC SENSING SYSTEM FOR BUS DUCTS SYSTEM SCHEMATIC DIAGRAM			
DRAWN: JW	DATE: 15/12/2018			
CHECKED: ML	APPROVED:ML			
SCALE:NOT TO SCALE	SHEET(S) IN SET: 1 OF 2	PROJECT NO.: GENERAL TEMPLATE	CONTRACT NO.:	
SYSTEM DESIGN DOCUMENT		DRG. NO. T GEN 6 5 0 5 3 D O S L 0 0 0 1 0 1 S		

FIBRE OPTIC SENSING IS BEST FOR FACILITIES

WHY FIBRE OPTIC SENSORS

- NEED NO POWER TO OPERATE [PASSIVE DEVICES]
- LONG OPERATIONAL LIFE [AGING TESTED TO 30 YEARS]
- NEED NO MAINTENANCE
- EXCELLENT ACCURACY, STABILITY & LINEARITY
- LOW COST
- PAINLESS TO INSTALL
- IMMUNITY TO EMF NON-EMF RADIATING
- EXCELLENT RESISTANCE TO ELECTRICITY, HEAT, ACID

APPLICATION

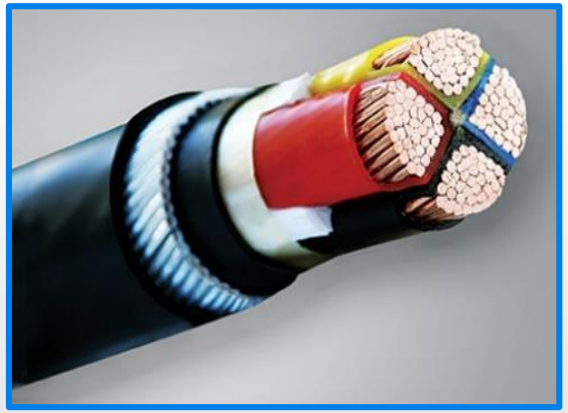
POWER DISTRIBUTION NETWORK

電 Diàn

ELECTRICITY

Power Distribution Network

THE KEY ELEMENTS



THERMAL NUMERICAL MODEL OF POWER NETWORK

IEC61439 & IEC60439 – TABLE 2 defines “Temperature-rise limits” in Kelvin

TEMPERATURE-RISE = PART TEMPERATURE - AMBIENT TEMPERATURE

$$\delta T = T_{part} - T_{ambient}$$

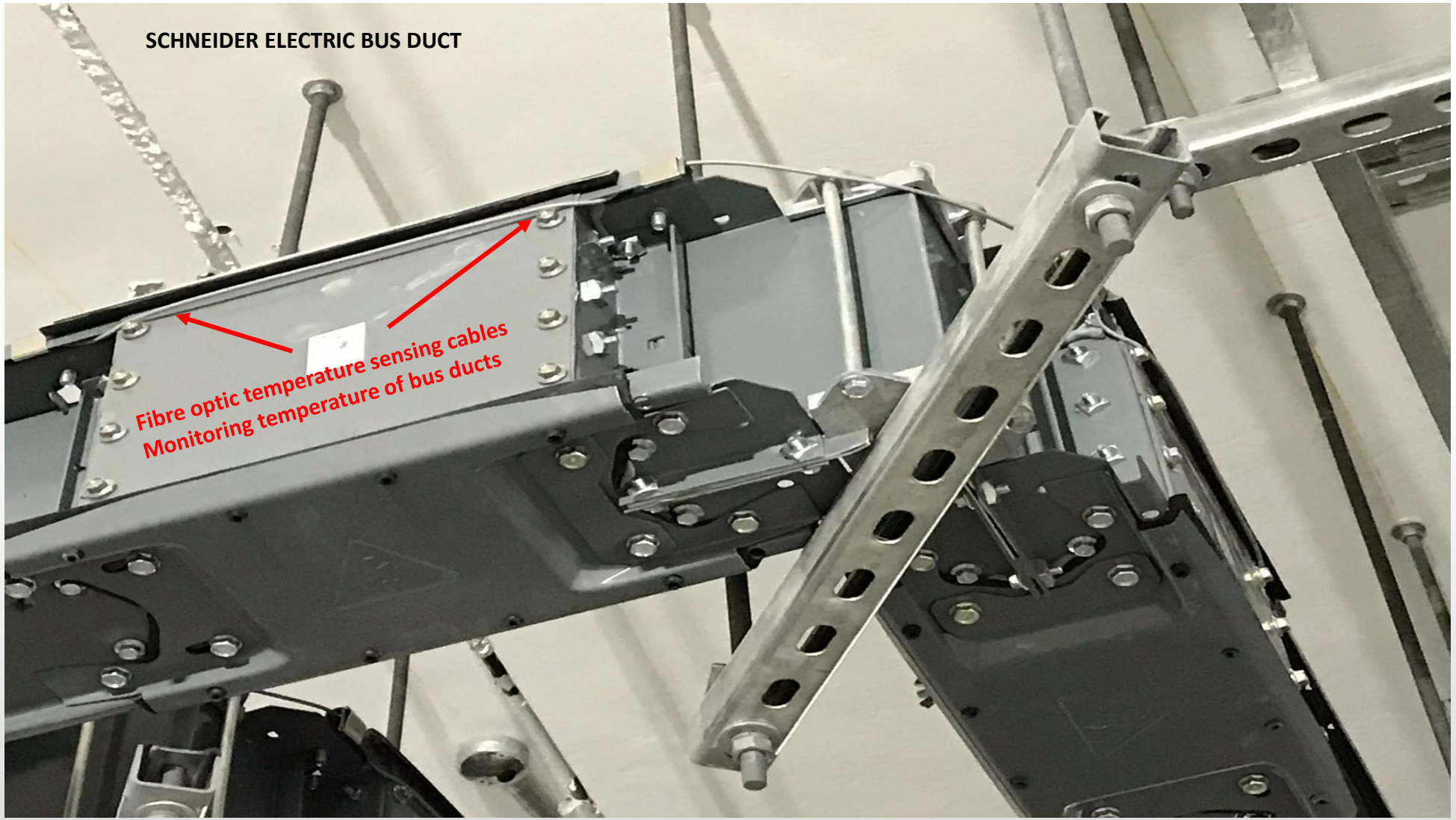
APPLICABLE FOR $T_{ambient}$ NOT EXCEEDING 35°C

PARTS	**δT LIMITS**
TERMINALS FOR EXTERNAL INSULATED CONDUCTORS	70K
ACCESSIBLE EXTERNAL ENCLOSURES - METAL SURFACES - INSULATING SUFACES	 30K 40K
MANUAL OPERATING MEANS - OF METAL - OF INSULATING MATERIAL	 15K 25K

“… a maximum temperature rise of 105K for bare copper busbars conductors shall not be exceeded…. The 105K relates to …. annealing of copper likely to occur”

PREVENTIVE MONITORING – SWITCHBOARD

MONITORING OF BUS DUCTS – EARLY DETECTION OF POTENTIAL FAULTS / HOTSPOTS

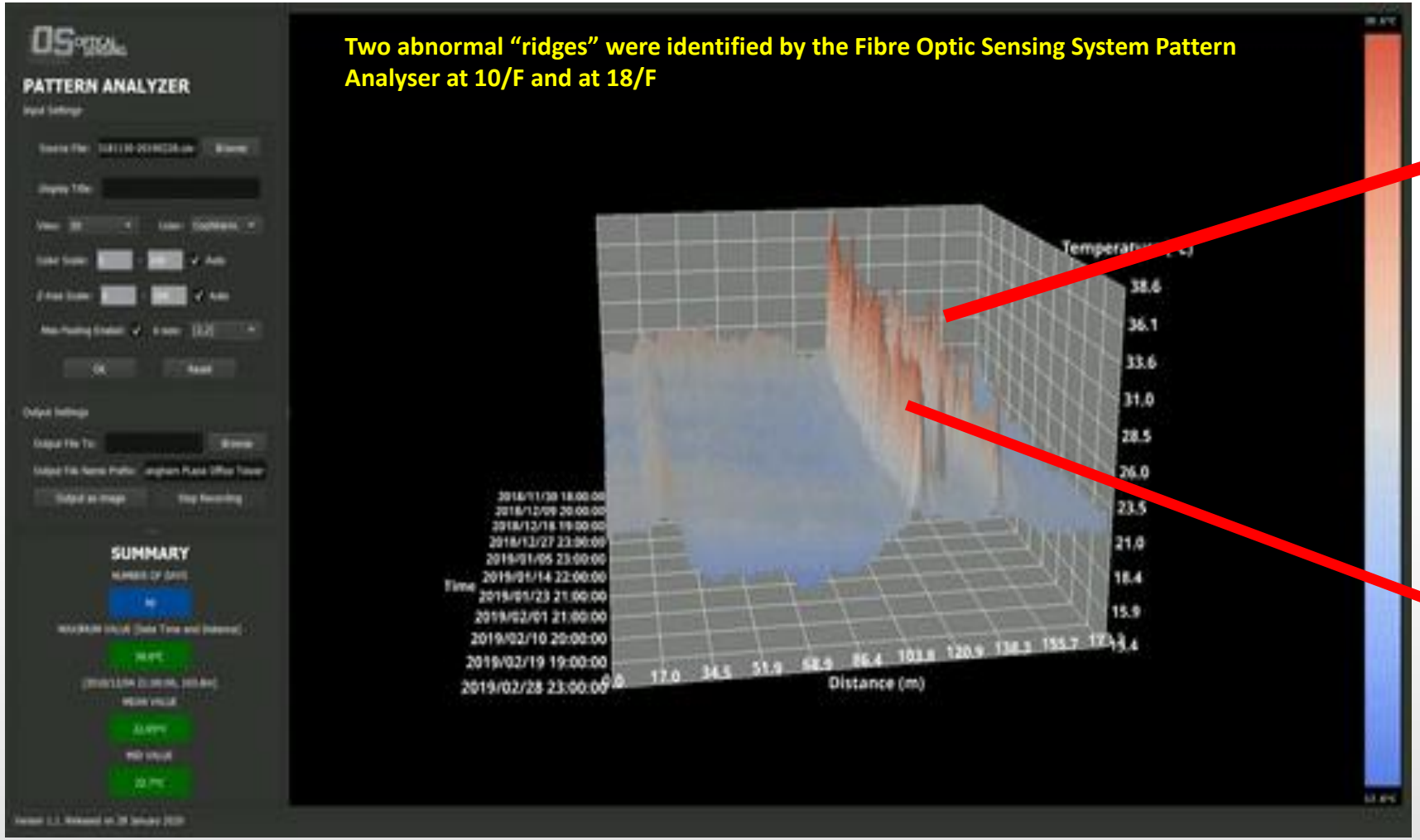


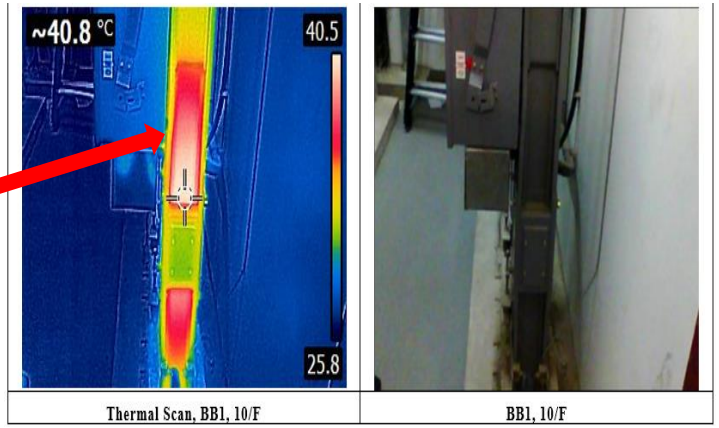
ATTACHMENT OF FIBRE CABLE SENSING CABLES

IPBM BUS DUCT FOR DATA CENTRES

SIEMENS BUS DUCTS

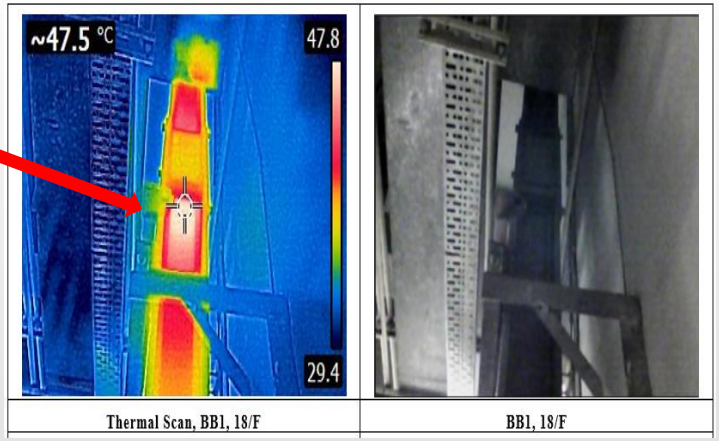
HOW THERMAL PATTERN ANALYSIS PREVENTED BUS DUCT FAILURES





Thermal Scan, BB1, 10/F

BB1, 10/F

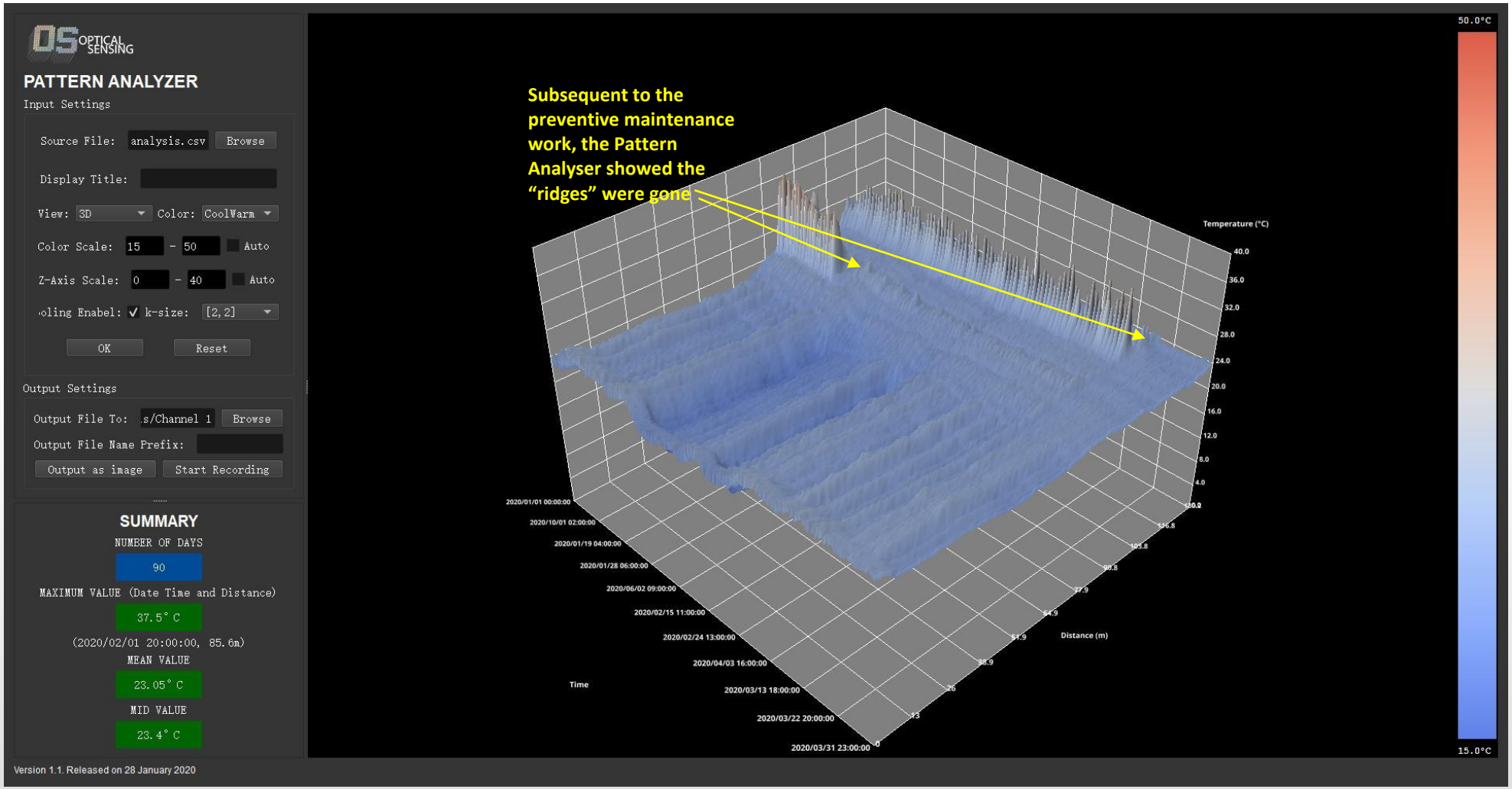


Thermal Scan, BB1, 18/F

BB1, 18/F

PREVENTIVE MAINTENANCE MEASURES

The customer had arranged maintenance work to replace / repair the concerned bus ducts



A potentially serious power outage due to bus duct failure is prevented

APPLICATION - PIPE LEAK DETECTION

水 Shuǐ

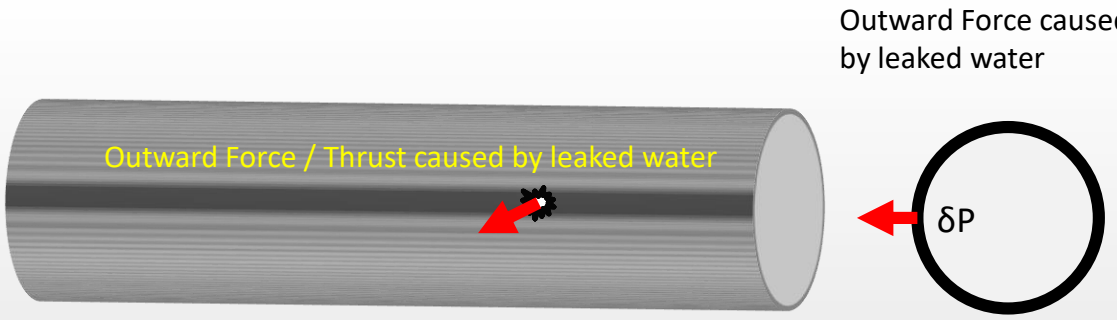
WATER

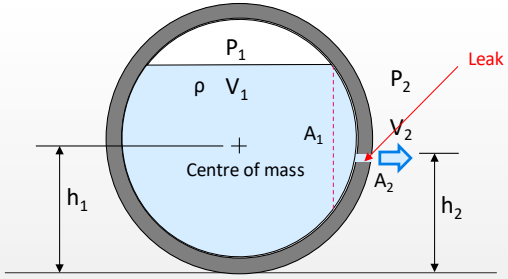
Water Supply System
Drainage System

WATER PIPE LEAK DETECTION

FIBRE OPTIC DISTRIBUTED ACOUSTIC SENSING SYSTEM

RECOGNISE THE "NOISE SIGNATURE" AT THE LEAK POINT





Bernoulli's Equation

$P_2 = P_1 + (1/2)[\rho (V_1)^2 - (V_2)^2]$

where

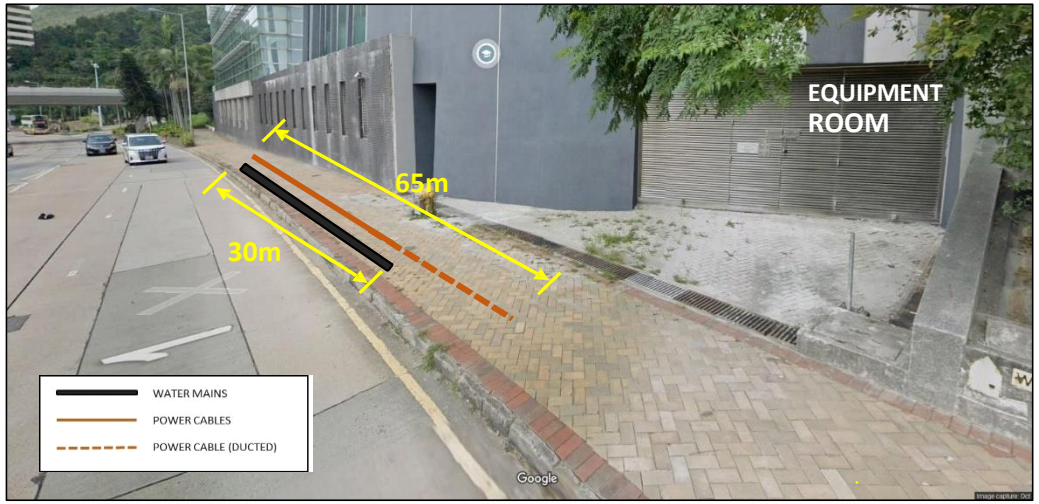
P_1 = Pressure inside the pipe
V_1 = Velocity inside the pipe
h_1 = Height of centre of mass of water inside the pipe
A_1 = Effective area inside the pipe

P_2 = Pressure inside the pipe
V_2 = Velocity inside the pipe
h_2 = Height of centre of mass of water inside the pipe
A_2 = Effective area inside the pipe

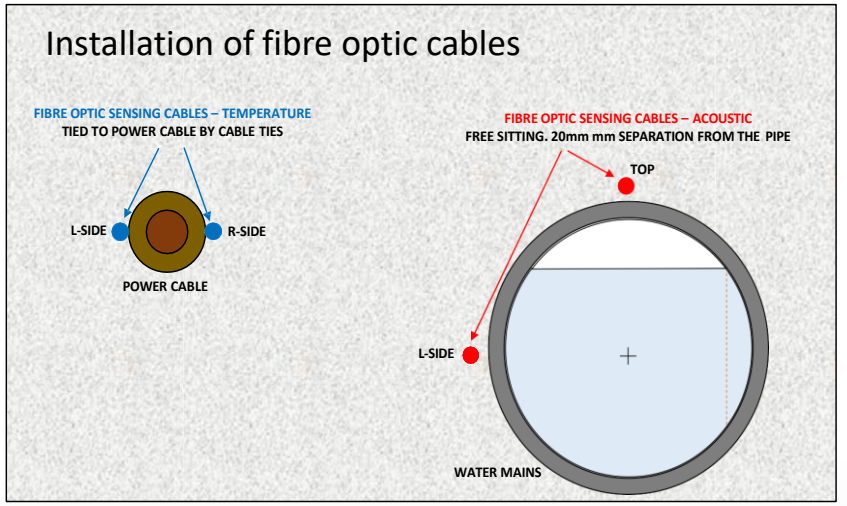
ρ = Density of water

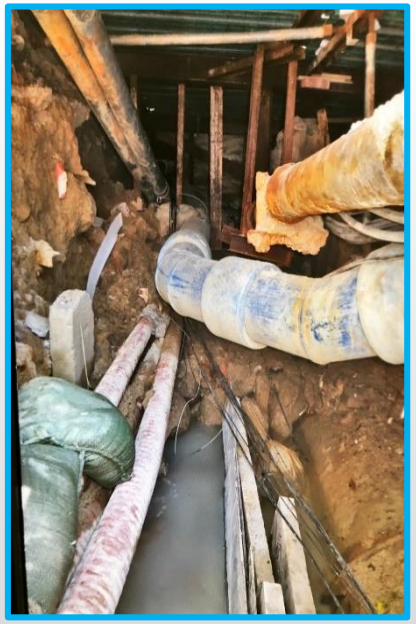
WATER PIPE LEAK DETECTION – PROJECT EXAMPLE AT WONG CHUK HANG

The Site



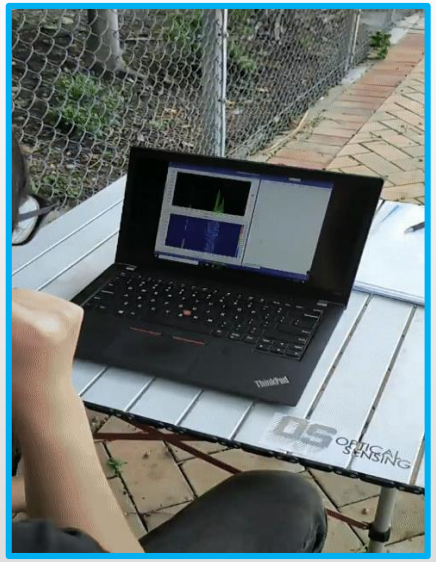
Installation of Fibre Optic Sensing Cables





Control Equipment

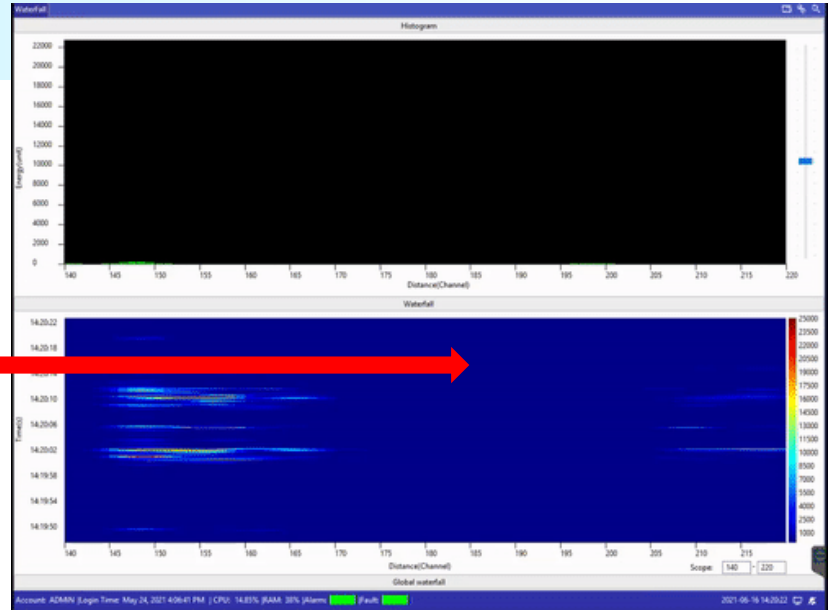
Remote Access through Internet

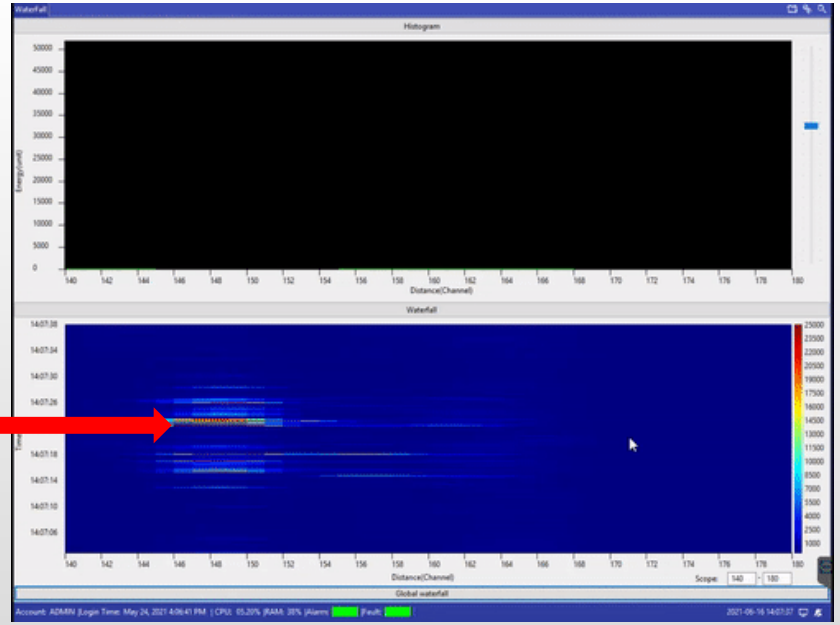


WATER PIPE LEAK DETECTION – LEAK “NOISE SIGNATURE”

Water blasting to simulate a pipe leak

Sand bag dropping to simulate intrusion





FULL SPECTRUM OF APPLICATION AREAS

風 Fēng

WIND

Heating
Ventilation
Air-Conditioning

火 Huǒ

FIRE

Line Heat Detection

水 Shuǐ

WATER

Water Supply System
Drainage System

電 Diàn

ELECTRICITY

Power Distribution Network

力 Lì

FORCE

Strain
Vibration
Displacement

WE HAVE PRESENTED ONLY 2 APPLICATION AREAS HERE. FOR MORE DETAILS, PLEASE CONTACT:

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