BeanAir

READY FOR INDUSTRIAL INTERNET OF THINGS ?

WIRELESS IIOT SENSORS

SUCCESS STORIES

Beanair plays a leading role in industrial markets with a great future. Discover how our innovative wireless IIOT sensors are used in a wide range of applications:

- Improving Real-Time and Long-Term Structural Monitoring
- Introducing new methods of data analysis for Test and Measurement on rolling stock
- Pushing the limits of condition monitoring on machines and pumps

MADE IN GERMANY

ABOUT US

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Recent developments in sensor technology, especially when wireless technology is considered, have opened up new gates in terms of health monitoring and preemptive fault detection.

To meet these new challenges, BeanAir, a leading German company in sensing technology, designs and manufactures smart, rugged and open-standard wireless IIOT sensors.

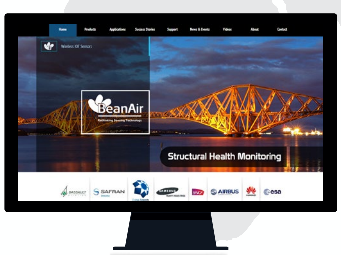
BeanAir Wireless IIOT sensors constitute an outstanding technology for various applications: Structural Health Monitoring, Test and Measurement, Land Surveying, Condition Monitoring, Environmental Monitoring ...

Furthermore, the high level of versatility, performance, and reliability of its wireless IIOT sensors, in addition to a worldwide presence thanks to effective system integrators partners, Beanair has acquired an international outreach and continues to maintain a strong reputation with major customers in numerous sectors.

www.industrial-wsn.com

WWW.BEANAIR.COM

www.youtube.com/user/BeanairSensors



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APPLICATION

Location: Pasupati Bridge Indonesia
Site monitored since : July 2018

REAL-TIME STRUCTURAL HEALTH MONITORING ON HIGHWAY BRIDGE

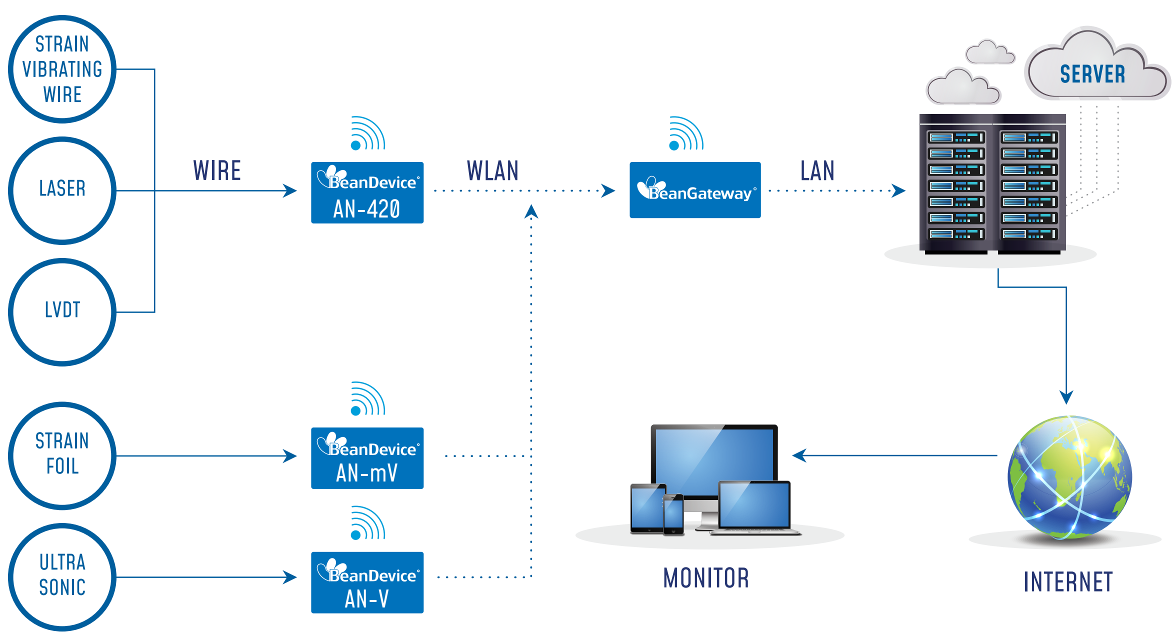
DESCRIPTION OF THE STRUCTURE AND OVERALL TASKS

The Pasupati Bridge is the first in Indonesia that utilizes anti-earthquake technology. A lock up device (LUD), engineered in France, consists of 76 individual pieces. The bridge has 663 segments overall, supported by 46 poles. Each segment weighs from 80 tons up to 140 tons. The overpass structure includes a long cable-stayed bridge that crosses 161 meters above the Cikapundung valley with no intervening supports. The bridge over the Cikapundung is supported by 19 steel cables consisting of 10 wires on the western side and 9 cables on the eastern side. Each cable contains 91 small cables that each consists of seven smaller cables again. The ten western cables are paired

Since July 2018, our Indonesian partner Luwes has deployed Beanair's 2.4GHz sensor series on this bridge structure:

- Wireless inclinometers (BeanDevice® 2.4GHz HI-INC)
- Wireless accelerometers (BeanDevice® 2.4GHz AX-3D)
- Wireless DAQ system (BeanDevice® 2.4GHz AN-420, BeanDevice® 2.4GHz AN-mV) connected to Displacement (LVDT technology), Laser deflection, Loadcell, UltraSonic and Vibrating wire Sensors were deployed on pillars where resonances frequencies and cracks are critically high.

WIRELESSS IIOT SENSORS - SYSTEM ARCHITECTURE



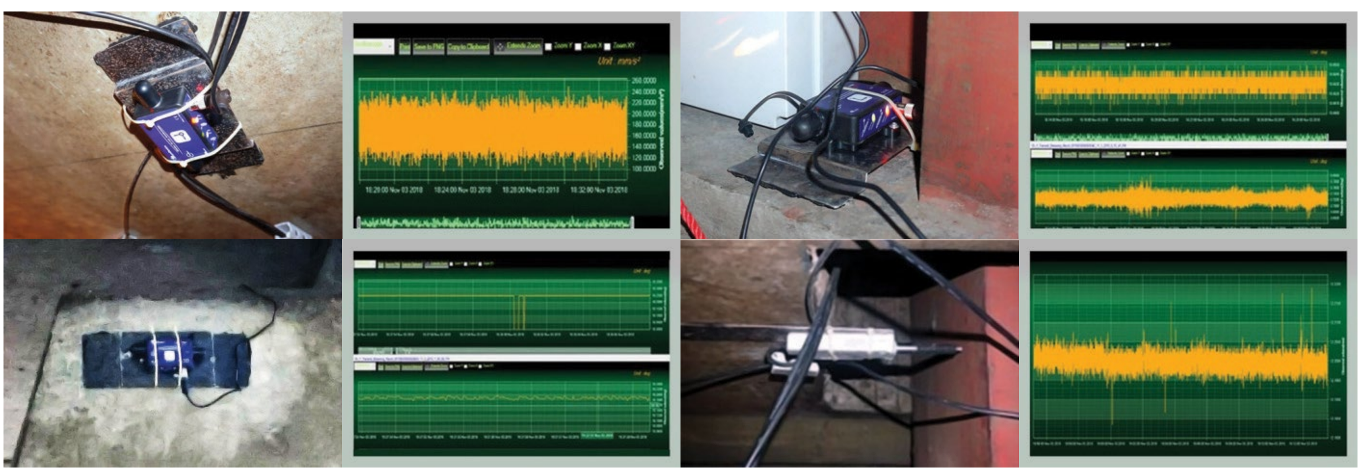
APPLICATION

Location: Pasupati Bridge Indonesia
Site monitored since : July 2018

Caption 1: LVDT sensor mounted with our BeanDevice® 2.4GHz AN-420

Caption 2: Laser sensor mounted with our wireless DAQ system (ref: BeanDevice® 2.4GHz AN-420)

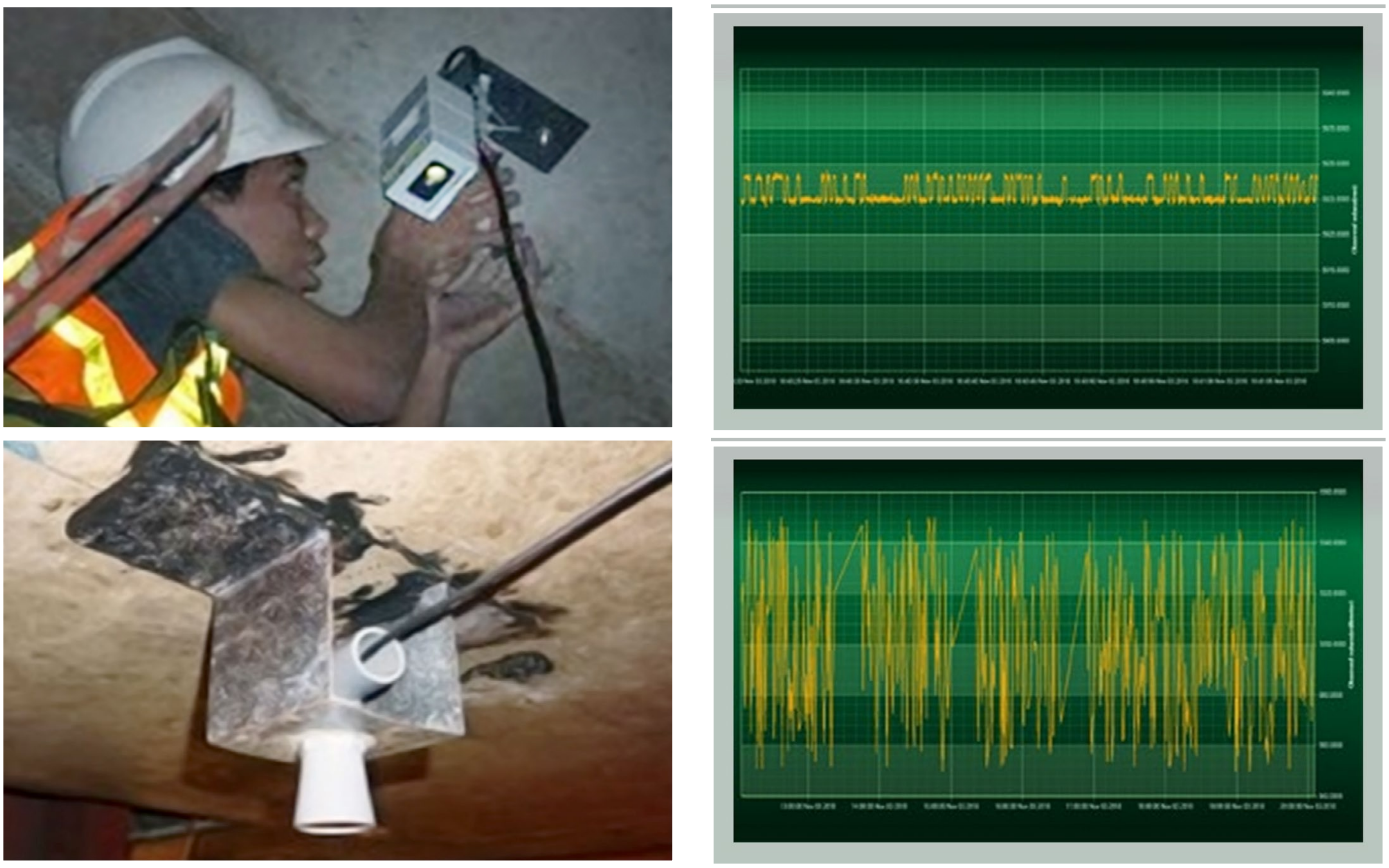
Caption 3: Overview of Pillars on Pasupati Bridge



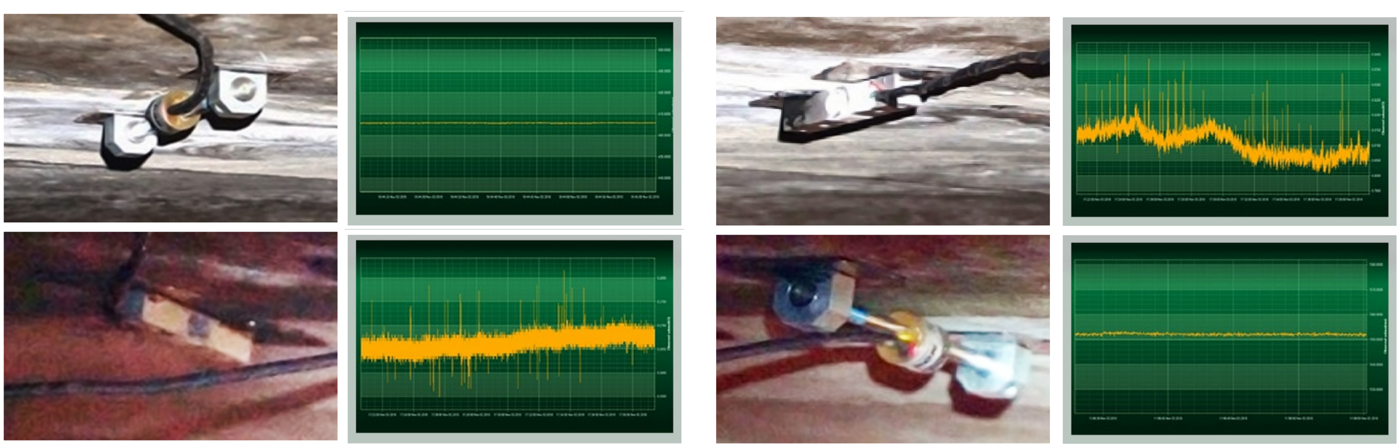
Caption 4: Wireless vibration sensors are used to extract resonance frequencies on Bridge Structure

APPLICATION

Location: Pasupati Bridge Indonesia
Site monitored since : July 2018



Caption 5: Connected to our Wireless DAQ System
(Ref: BeanDevice® 2.4GHz AN-V) , the ultrasonic sensor is used to measure bridge movement.



Caption 6: Structure deformation is monitored with a strain gauge sensor connected to our
Wireless DAQ system BeanDevice® 2.4GHz AN-mV

WIRELESS IIOT SENSORS

SUCCESS STORIES

APPLICATION

Location: Toulon, France
Site monitored since : March 2018

TILT MONITORING ON ANTENNA BASE STATION

OVERALL TASKS

Toulon Naval Base is the second-largest naval port in France. Located on the south-east coast of the country, the base is he home port of the French Navy Mediterranean fleet.
Military antenna base stations and Radars are deployed on cliffs and covers communication with military ships. A soil subsidence of 0.05deg per year is provoked by water infiltration in the soil. A real-time monitoring system was required to monitor soil subsidence with a precise wireless inclinometer (factory precision of ±0.02° on the FS) and remotely sends alarms by email when the alarm threshold is reached.

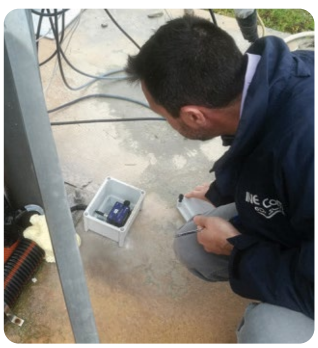
EQUIPMENT USED

BeanDevice® 2.4GHz HI-Inc | Wireless inclinometer sensor | tilt / inclination / slope monitoring built-in datalogger

BeanDevice® 2.4GHz HI-Inc X-range | Wireless inclinometer sensor | tilt / inclination / slope monitoring | built-in datalogger | High-Performance version

RESULTS AND CONCLUSION

Since March 2018, 20 wireless inclinometers were deployed to monitor the inclination on 10 radars and antenna base station, with an accuracy of ±0.02° on the FS . Measurement drift is only 0.001° per year and the wireless system is showing a great stability over the time.



Caption 1: Installed under the antenna base station, our wireless inclinometer (Ref: BeanDevice® 2.4GHz HI-INC) is monitoring soil subsidence with an accuracy of ± 0.02°

Caption 2: For a better IP protection, the wireless inclinometer is integrated inside a waterproof casing.

Caption 3: Remote access is enabled thanks to our Wireless IIOT Supervision sofware (BeanScape® 2.4GHz)

Caption 4: Overview of antenna base station

WIRELESS IIOT SENSORS

APPLICATION
Location: Houston (Texas), USA
Site monitored since : December 2017

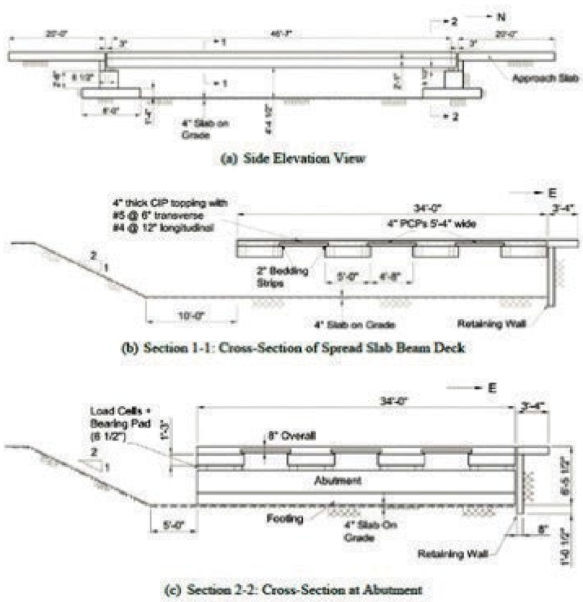
STRUCTURAL HEALTH MONITORING OF A SPREAD PRESTRESSED CONCRETE SLAB BEAM BRIDGE

DESCRIPTION OF THE STRUCTURE AND OVERALL TASKS

BeanAir GmbH and Ensyso Corp. entered a partnership to demonstrate their expertise, know-how and most recent technological capabilities via performing a structural health monitoring technology demonstration test which was performed at Texas A&M University's Riverside Campus.The bridge was recently built as part of a high budget research effort performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The objective of the research was to explore the use of slab beams that are used in a spread configuration for short span bridges and to provide appropriate design recommendations.

The test structure is a simply supported bridge which was designed and built at the edge of a runway located at the Texas A&M University Riverside Campus. It has a 46 ft 7 in. span length (from center to center of the bearing pads) and an overall width of 34 ft .The bridge superstructure has four slab beam girders spaced at 4 ft 8 in. clear spacing with prestressed concrete panels (PCPs) between the slab beams as stay-in-place (SIP) forms. The slab beam girders are standard TxDOT 5SB15 slab beams. The 4 in. thick PCPsare 8 ft long and have an overall width of 5 ft 4 in. The cast-in-place (CIP) deck thickness varies slightly along the length to accommodate the camber of the prestressed slab beams.

Slab beam girders were instrumented with wireless accelerometers, with a range of ±2g. Collected test data were compared with the ones obtained via Finite Element Analysis (FEA) following the completion of the testing activities Structure was excited with a loaded truck. Wireless accelerometer were used with a sampling rate of 10Hz up to 100Hz.



Caption 1: Riverside Bridge Superstructure

WIRELESS IIOT SENSORS

APPLICATION

Location: Houston (Texas), USA
Site monitored since : December 2017

EQUIPMENT USED

BeanDevice® Wilow® AX-3D

Ultra-Low-Power WIFI Vibration Sensor | built-in datalogger | MQTT Protocol Communication

Caption 2: Location of Bridge Site

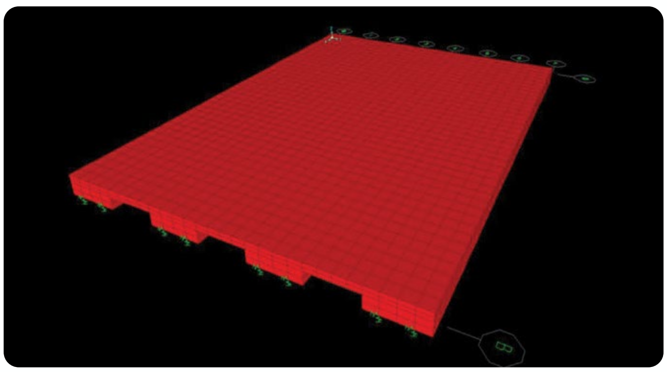
Caption 3: Truck used to generate excitation on structure

Caption 4: Riverside Bridge – Side View

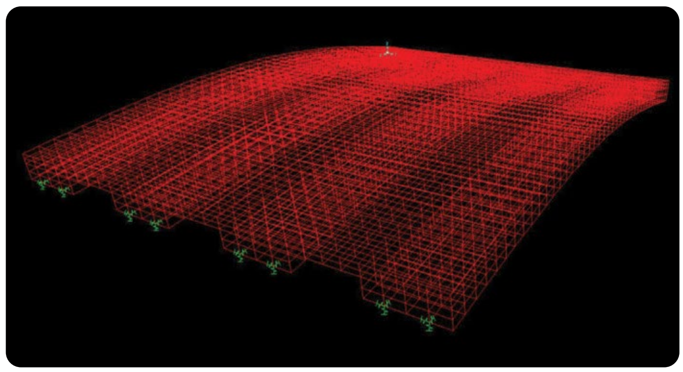
Caption 5: Riverside Bridge – Top View

Caption 6: Riverside Bridge – View of the Slab Beams with Cables used for Instrumentation

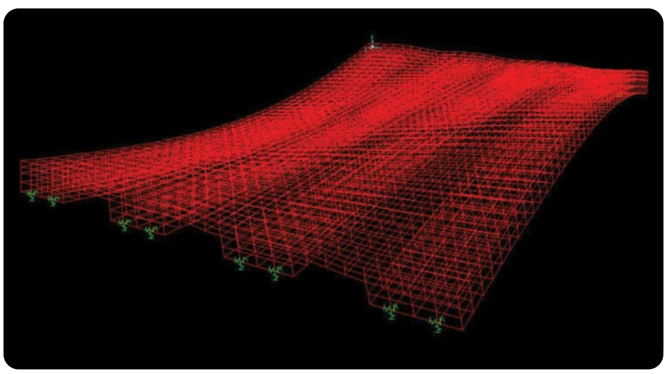
Caption 7: Riverside Bridge – View of the Bearing Pads



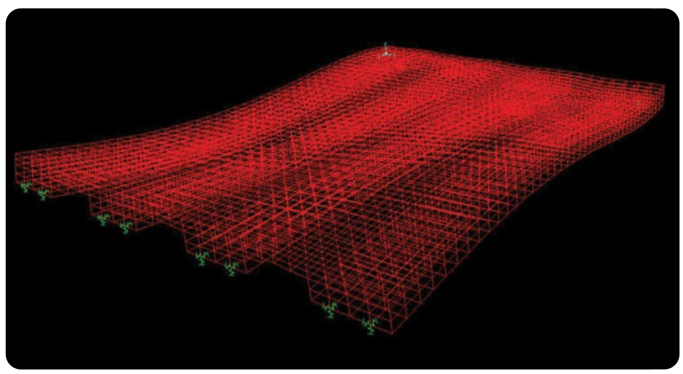
Caption 8: Finite Element Model of the Riverside Bridge



Caption 9: First Bending Mode of the Riverside Bridge (5.8 Hz)



Caption 10: Second Bending Mode of the Riverside Bridge (8.3 Hz)



Caption 11: Third Bending Mode of the Riverside Bridge (14.5 Hz)

WIRELESS IIOT SENSORS

APPLICATION

Location: Houston (Texas), USA
Site monitored since : December 2017

Caption 12: Deployment of 10 wireless vibration sensors (Ref: BeanDevice® Wilow® AX-3D ±2g)

Caption 13: Vibration activity is collected on BeanScape® Wilow® software

Caption 14: Wireless IIOT sensors configuration before deployment

Caption 15: Wireless vibration sensors mounted with screws

ABOUT OUR PARTNER ENSYSO CORP

Ensyso Corp. is a independent engineering company that provides professional engineering services and consultancy in several areas including global and local analysis of structural and mechanical systems, dynamic simulations and vibration and damage assessment. Ensyso has developed a non-destructive damage evaluation (NDE) methodology which can detect the location and severity of damage on structures using vibration information (e.g., acceleration, strain, displacement).

Visit their website: www.ensyso.com

Caption 16: Overview of wireless accelerometers on the slab beams

IIoT

WIRELESS IIOT SENSORS

APPLICATION

Location: Nanterre, France
Site monitored since : November 2017

GROUND VIBRATION ON CONSTRUCTION SITE

OVERALL TASKS

At the beginning, Grand Paris (Greater Paris) is a project to transform the Paris metropolitan area into a major world and European metropolis of the 21st century, in order to improve the living environment of the inhabitants, to correct the territorial inequalities and to build a sustainable city.
During the suburb train line (RER) in Nanterrre, the monitoring work consisted to track ground vibration on gas and water pipeline during construction work alongside the bridge structure.

EQUIPMENT USED

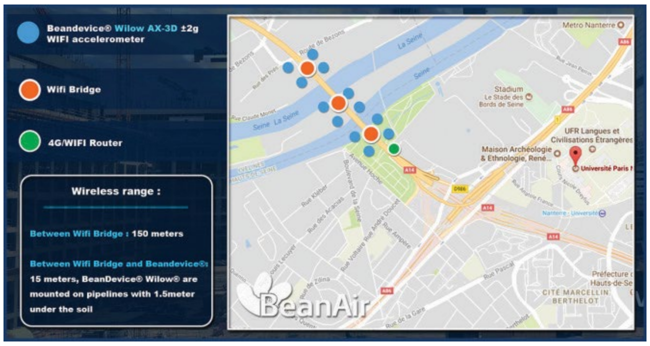
The following materials were deployed on the monitoring site:

- 12 x wireless vibrations sensors (Ref: BeanDevice® Wilow AX-3D) were deployed
- 1 x IOT Gateway with 3G/4G/LTE connectivity provides a remote access
- 1 x BeanScape® RA (Remote access)

BeanDevice® Wilow® AX-3D Wireless Vibration sensor (acceleration and Velocity)
Due to the low noise, the BeanDevice® AX-3D is suitable for Static Velocity Measurement on construction material

OPERATION MODE

- DAQ Mode: Streaming with event-trigger (S.E.T.) with 100Hz of sampling rate
- Alarm thresholds : 1.4G on Z axis and 0.4G on X and Y Axis



Caption 1: IIOT sensors deployment alongside the bridge structure

Caption 2: Overall view of monitoring site

APPLICATION

Location: Nanterre, France
Site monitored since : November 2017

DAQ MODE CONFIGURATION

STREAMING WITH EVENT-TRIGGER (S.E.T.) DATA ACQUISITION MODE NOTIFICATION CYCLE :

Every 10 minutes, the BeanDevice® Wilow® transmits a notification to the BeanScape® Wilow® software

SAMPLING RATE AND DATA ACQUISITION DURATION :

When a trigger is reached, the BeanDevice® Wilow® transmits data measurement to the supervision software for a duration of 10 seconds with a sampling rate of 100 Hz

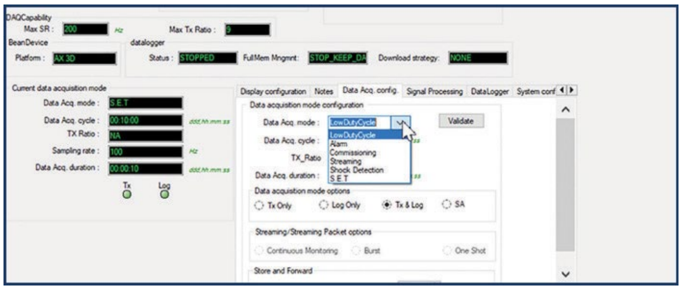
DATALOGGER :

Only measurements with a value higher than the threshold are recorded on the onboard datalogger (5 millions Logs)

ONLINE DATA ANALYSIS MODE :

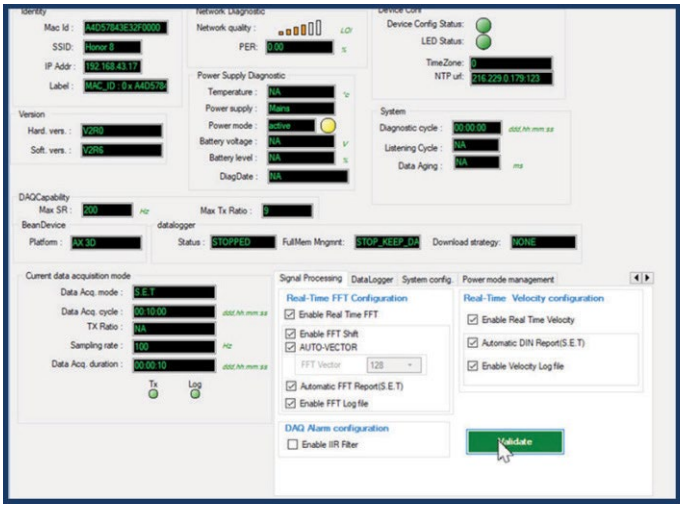
Online Data Analysis Module enables Real-Time FFT and PPV (Peak Particle Velocity):

- Automatic FFT and PPV reports (following DIN4150-3 standard)
- Real-Time FFT and PPV display

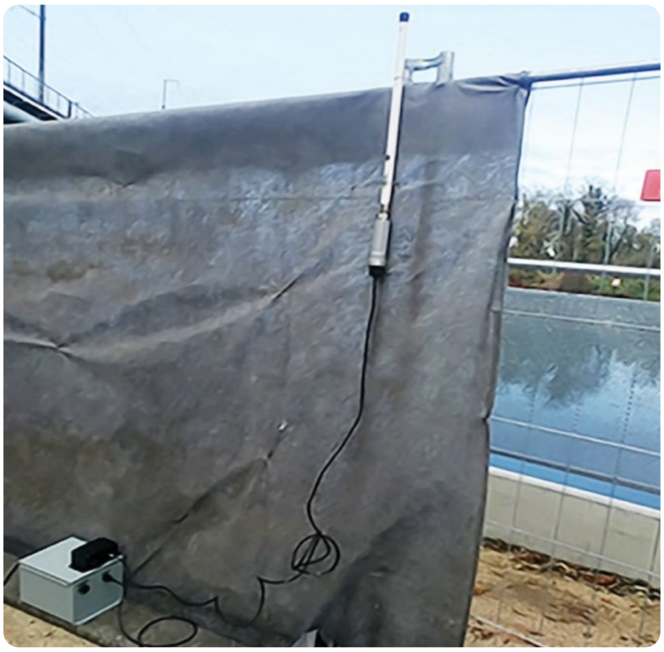


Caption 3: Streaming with event trigger

Caption 4: IIOT Vibration sensor installation on pipeline (BeanDevice® Wilow® AX-3D)



Caption 5: Online Data Analysis Tool



Caption 6: WIFI Bridge is used to extend the wireless range

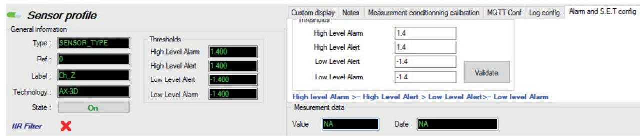
Caption 7: IOT Gateway with 3G/4G/LTE Connectivity

APPLICATION

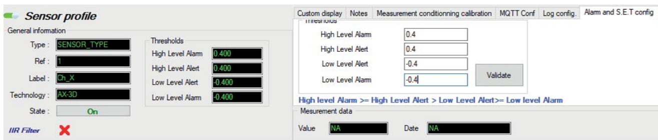
Location: Nanterre, France
Site monitored since : November 2017

ALARMS TRIGGER:

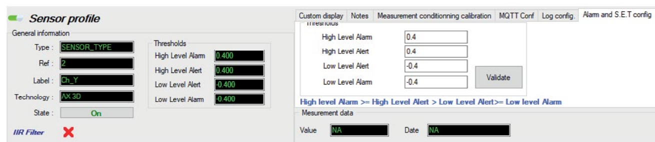
Each Measurement channel X,Y,Z, comes with 3 levels of Alarm: Alarm Alert and Action



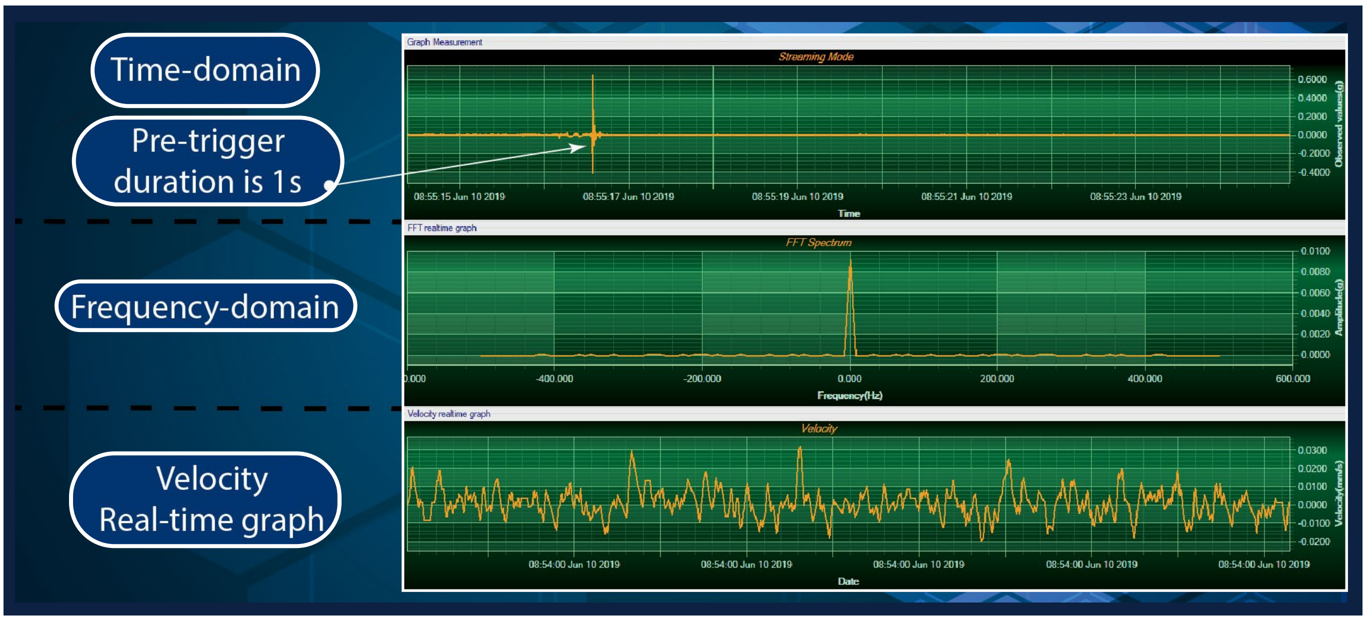
Caption 8: Alarms trigger on Z Axis



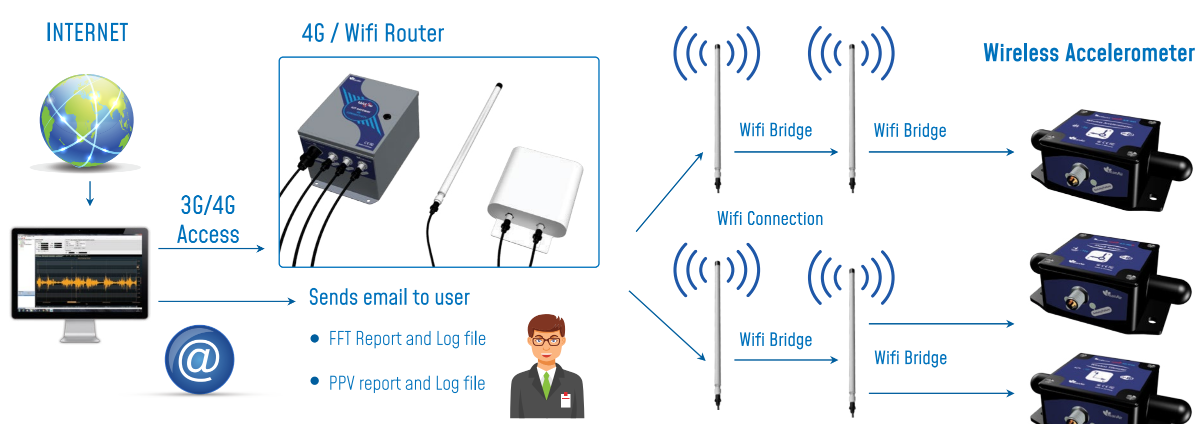
Caption 9: Alarms trigger on X Axis



Caption 10: Alarms trigger on Y Axis



Caption 11: Real-Time Velocity and FFT (Fast Fourrier Transform)



Network Topology - from sensors to alarm reporting

APPLICATION
Location: Poland
Site monitored since : September 2017

VIBRATION MONITORING AND ANALYSIS INSIDE AN AUTOMOTIVE COMPONENTS PLANT

OVERALL TASKS

The Automotive components plant is located in Warsaw - Poland, the production line is equipped with three vibrational conveyors, and four wheel blasting machines. Excessive vibration was observed on the first floor of office building near casting line. The level of human perception of vibration is described by a polish norm PN-B-02171 (similar to BS 6472:2008) , this level was was exceeded several times. People working on the first floor were complaining about excessive vibration. The target of Simdes Partner, a polish consulting group was to identify source of vibration, analyze the building structure analysis and detect presence of resonance phenomena .

EQUIPMENT USED

Wireless vibration sensor
(Ref: Beandevice® 2.4GHz AX-3D ±2g)
for floor vibration

Caption 1:
Floor vibration measurement:
BeanDevice® 2.4GHz AX-3D ±2G

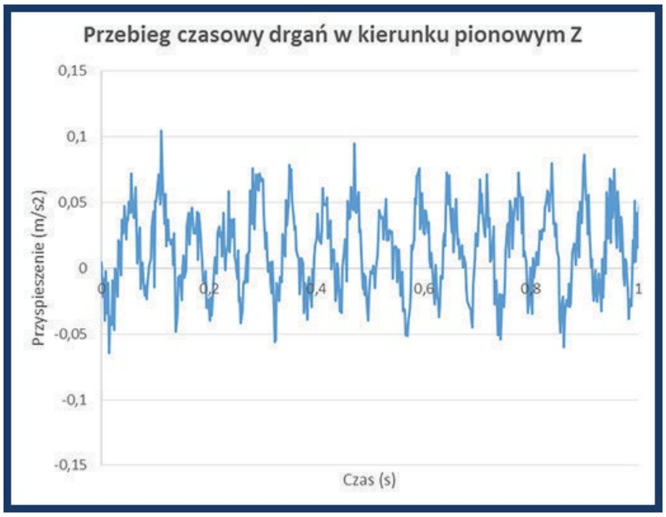
Caption 2: Conveyors machines are monitored with our wireless accelerometers (Ref: BeanDevice® 2.4GHz AX-3D)

APPLICATION

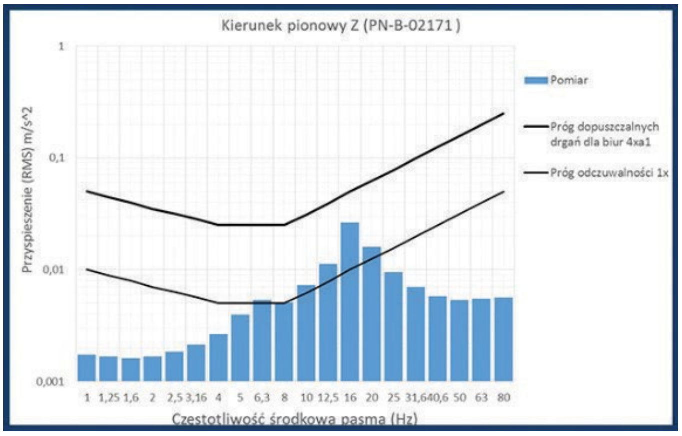
Location: Poland
Site monitored since : September 2017

DATA ANALYSIS TOOLS

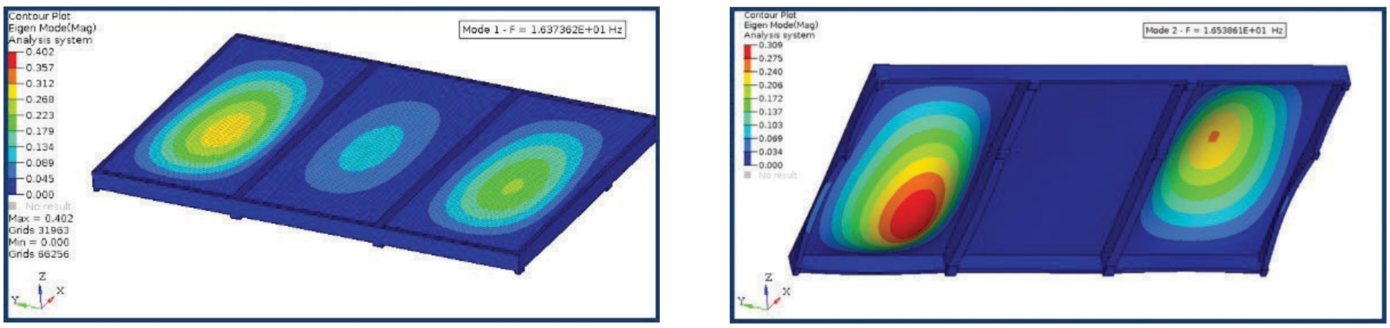
FFT (Fast Fourier Transform) and one-third-octave bands data filtering scripts are developed with Python (PN-B-02171 standard compliant)



Caption 3: Vibration activity on vertical direction



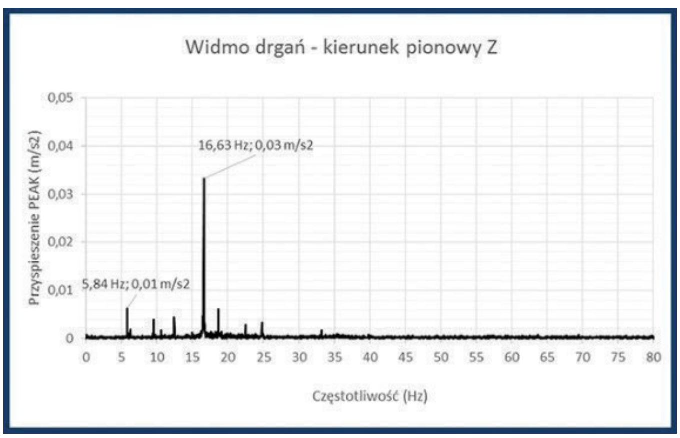
Caption 4: Vibration activity on vertical direction(RMS)



Caption 5: FFT Analysis according to Polish Standard (PN-B-02171)

RESULTS AND CONCLUSION

The floor vibration frequency was identical to the vibration frequency of one of the vibration conveyors and coincide with first natural ceiling mode, resonance phenomena has occurred. Customer was advised to change vibration conveyors dumpers and reinforced cellings.



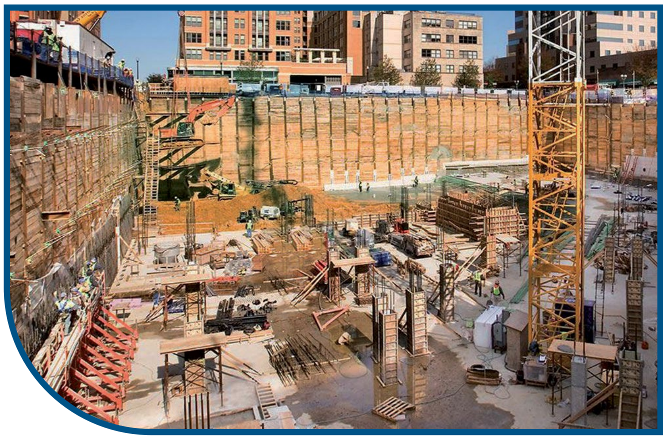
Caption 6: Frequency domain on vertical direction

WIRELESS IIOT SENSORS

APPLICATION

Location: London, UK
Site monitored since : June 2015

TILT MONITORING ON CONSTRUCTION SITE



OVERALL TASKS

During the extension of rail network close to Wembley Park tube station (London, UK), noise protection barriers were fragilized by construction work.

Wireless tiltmeter (Ref: Beandevice® 2.4GHz HI-INC Xtend) were deployed every 15 meters to prevent barrier collapsing. Configured with a survey mode, alarms are transmitted to the user when thresholds are reached.

EQUIPMENT USED

BeanDevice® 2.4GHz HI-INC ±15° Xrange – Wireless Tiltmeter

X-Solar : High efficiency Solar Panel with Solar Charging Controller and Lead-acid battery

BeanScape® 2.4GHz Basic Wireless IIOT Sensors Supervision software

BeanGateway® 2.4GHz Ethernet Outdoor – Wireless coordinator

OPERATION MODE

DAQ Mode: Survey mode every 10 minutes
Alarm thresholds : 0.5° on tilt sensors

Caption 1: Overview of construction site (Wembley Park - London)

WIRELESS IIOT SENSORS

APPLICATION

Location: London, UK
Site monitored since : June 2015

PORT FORWARDING ENABLES REMOTE ACCESS TO MONITORING SITE

Caption 2: Mounted on a pole, the BeanGateway® 2.4GHz (outdoor version) can reach a wireless range of 300 meters in urban and noisy environment.

WIRELESS SENSORS WERE POWER SUPPLIED FROM SOLAR PANEL KIT (REF: X-SOLAR) FOR A DURATION OF 3 YEARS

Caption 3: The wireless tilt sensor can monitor tilt on both horizontal direction with an accuracy of ±0.05° and a resolution of ±0.001°

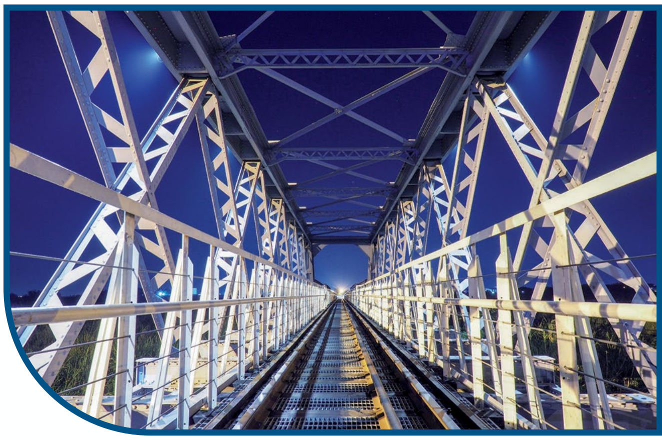
Caption 4: Wireless tiltmeter (Ref: Beandevice® 2.4GHz HI-INC Xrange) is mounted on the noise barrier (brick construction)

WIRELESS IIOT SENSORS

APPLICATION

Location: Montreal, Canda
Site monitored since : Febrary 2015

LARGE-SCALE DEPLOYMENT OF WIRELESS IIOT SENSORS ON A FREEWAY INTERCHANGE



DESCRIPTION OF THE STRUCTURE

Beanair Wireless IIOT sensors was deployed for assessing the impact of construction-related activities and evaluating the effect of structural retrofitting. Additionally, inherent monitoring of environmental loads and influences, operational loads, and traffic patterns and densities were used to collect a database of field measurements for providing feedback during the interchange structure extension.
A total of 300 wireless IIOT sensors were deployed for monitoring vibration, inclination, cracks, and deformation on the interchange structure:

- Vibration response of the bridge from ambient excitation was measured by using an accurate wireless accelerometer mounted on the interchange pillar. A sampling rate of 100 Hz was configured on concrete structure and 400 Hz on the steel structure. Resonance frequencies of the structure were established by extracting the spectrum on the structure.
- Wireless inclinometers with an accuracy of ±0.05° and a measurement range of ±15° were used to monitor structure sinking during the construction work.
- Displacement sensors (LVDT and Potentiometer technologies) with a maximum stroke of 20 mm were mounted on the interchange pillars.

Caption 1: Underside of the various overpasses comprising the Turcot Interchange.

Caption 2: Wireless inclinometers are screw mounted on pillars

Caption 3: Wireless vibration sensors mounted on a concrete structure with a 90° mounting bracket
(Ref: BeanDevice® 2.4GHz AX-3D)

Caption 4: Wireless IIOT sensors Gateway with 4G connectivity enables remote access
(Ref: BeanGateway® 2.4GHz 4G)

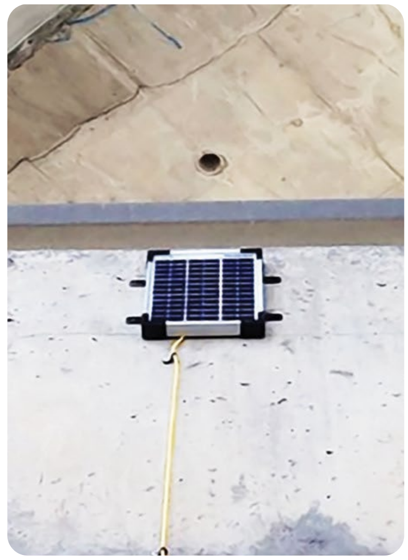
WIRELESS IIOT SENSORS

APPLICATION

Location: Montreal, Canda
Site monitored since : Febrary 2015

Caption 5: Displacement sensors are connected to our Wireless DAQ System
(Ref: BeanDevice® 2.4GHz AN-mV)

Caption 6:
Wireless Inclinometers mounted on a 90° mounting bracket (Ref: BeanDevice® 2.4GHz HI-INC) are used to monitor the concrete structure



Caption 7:
A 10W Solar Panel is powering 4 Wireless Inclinometers at the same time
(Ref: BeanDevice® 2.4GHz HI-INC)

OVERALL TASKS

Our Wireless IIOT sensors were deployed for assessing the impact of construction-related activities and evaluating the effect of structural retrofitting.
Additionally, inherent monitoring of environmental loads and influences, operational loads, and traffic patterns and densities were used to collect a database of field measurements for providing feedback during the interchange structure extension. A total of 300 wireless sensors were deployed for monitoring vibration, inclination and deformation on the interchange structure:

- Vibration response of the bridge from ambient excitation was measured by using an accurate wireless accelerometer mounted on the interchange pillar. A sampling rate of 100 Hz was configured on concrete structure and 400 Hz on the streel structure.
- Wireless inclinometers with an accuracy of ±0.05° and a measurement range of ±15° were used to monitor structure sinking during the construction work.
- Several wireless crack meters (LVDT technology) with a maximum stroke of 20mm were mounted on interchange pillars. Crack meter can only be used on existing cracks and cracks evolution were compared to the resonance frequencies observed on the interchange pillars

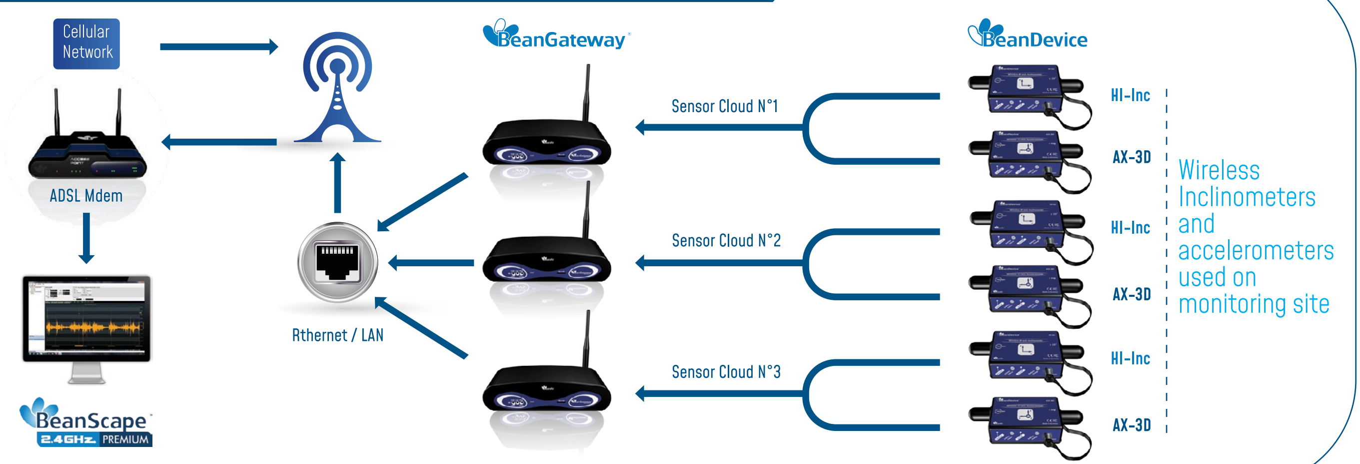
WIRELESS IIOT SENSORS

APPLICATION

Location: Montreal, Canda
Site monitored since : Febrary 2015

More than 25 wireless networks with the same NTP clock source (provided by a 3G/4G modem) were deployed on the monitoring site. Wireless Sensor nodes were synchronized by using a two-way ranging technique. This means that there is no event that triggers the sensor nodes, but the nodes should take a sample at precisely the right time. This was achieved via immediate synchronization (where sensor nodes receive the order to immediately take a sample and time-stamp it) or anticipated synchronization (where the order is to take the sample at some future time, the target time). Anticipated synchronization is necessary if it cannot be guaranteed that the order can be transmitted rapidly and simultaneously to all involved sensor nodes. This is especially the case if sensor nodes are more than one hop away from the node giving the order (mesh or cluster-tree networks).

REMOTE ACCESS TO MONITORING SITE BASED ON PORT FORWARDING



TECHNICAL CHALLENGES

NETWORK BOTTLENECK AND AGGREGATION CAPACITY OF A WIRELESSE SENSOR NETWORKS

A review of recent wireless IIOT sensors deployments for structural health monitoring of bridges reveals that the networks have generally relied on either local data logging and post-sampling transmission of sensor data or on low sampling rates and/or limited numbers of sensors in order to address Wireless sensors bandwidth limitations. Such concessions severely limit the versatility and capability of a structural health monitoring system in terms of sampling duration, data acquisition rates, and spatial resolution as well as quality of the derived mode shapes.
This problem was solved by setting up several Wireless Networks at the same time and managed by an unique supervision system (BeanScape® 2.4GHz Premium).

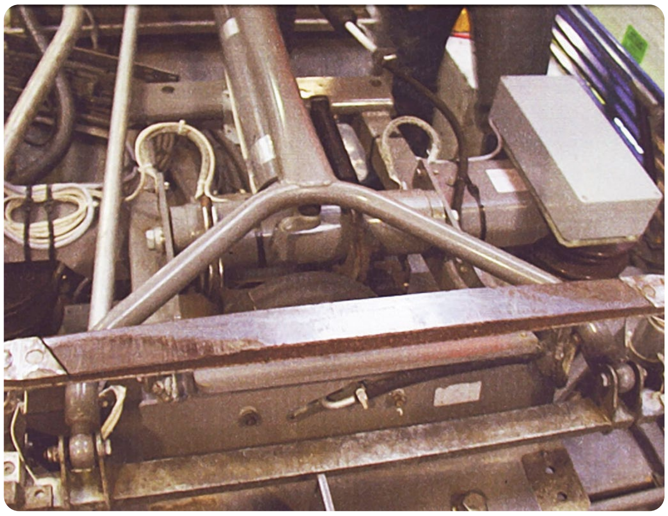
Caption 8: Displacement and inclinometer sensors are deployed on bridges pillars

APPLICATION
Location: Le Mans, FRANCE
Site monitored since : June 2012

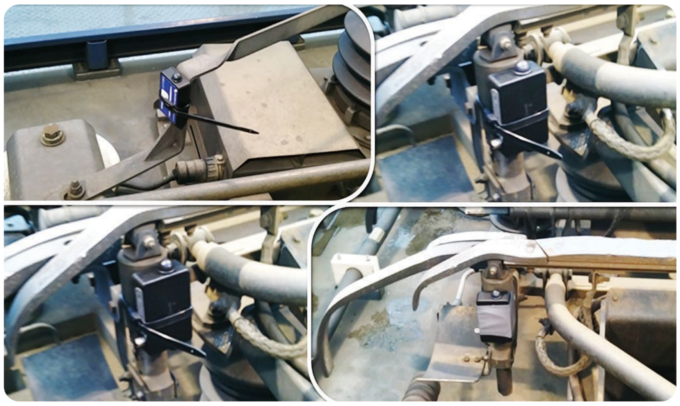
SHOCK MONITORING ON PANTOGRAPH

OVERALL TASKS

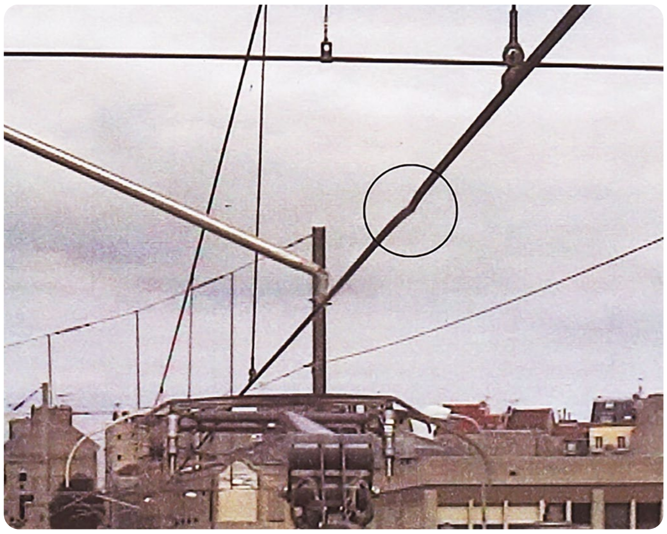
A serious failure of pantograph can not only damage contact wires but can also inflict widespread damage on the catenary system network.
Pantographs are subject to regular inspection at rolling stock depots, but some failures are difficult to detect by the visual checks. In addition, visual check at the depots cannot directly help to quickly detect pantograph failures in operation.
A cost-effective and real-time monitoring system during train operation was required by the railway operator.
Our wireless shock sensors (Ref: Beandevice® 2.4GHz AX-3DS) were used to monitor in real-time pantograph defects during train operation.
Thanks to our Smart Shock Detection Mode (SSD), the wireless monitoring system can wakeup on a shock trigger and transmit an alarm notification to field workers.



Caption 1: Damaged carbon contact band



Caption 2: Wireless Shock and Impact sensor (Ref: BeanDevice® 2.4GHz AX-3DS) is mounted on train pantograph's damper



Caption 3: Catenary deformation at REIMS train station

Caption 4: Wireless IIOT sensors (BeanGateway® 2.4GHz) is installed inside the suspended ceiling

WIRELESS IIOT SENSORS

APPLICATION

Location: Le Mans, FRANCE
Site monitored since : June 2012

EQUIPMENT USED

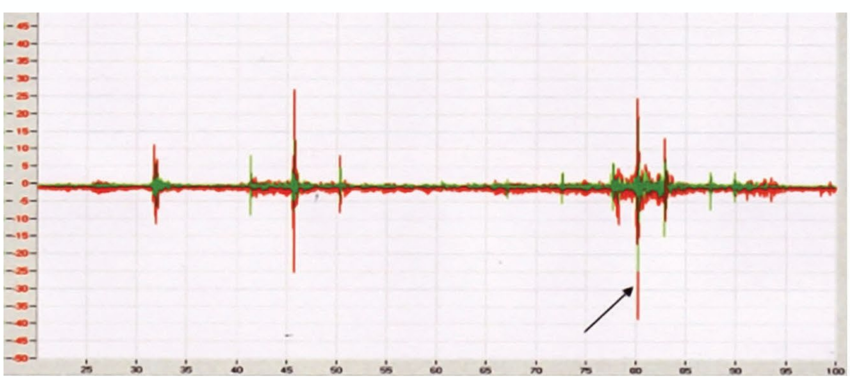
Caption 5: BeanDevice® 2.4GHz AX-3DS Wireless Shock sensors

Caption 6: Wireless IIOT sensors coordinator (BeanGateway® 2.4GHz Ethernet Outdoor)

Caption 7: Wireless IIOT sensors supervision software (Ref: BeanScape® 2.4GHz Basic)

OPERATION MODE

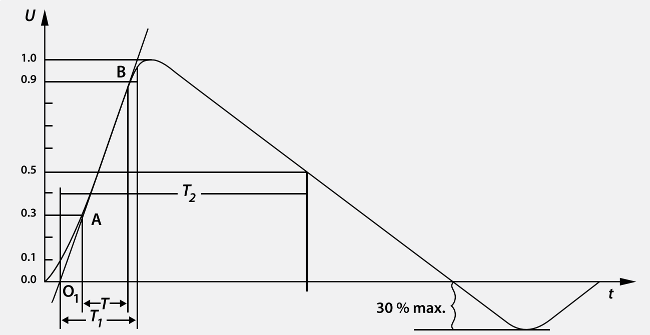
- DAQ Mode: Smart Shock Detection Mode
- Shock thresholds: Shock threshold 5g and 6g, time-hysteresis 5ms
- Battery life: 12-14 days with 30-40 shock events per day



Caption 8: Several consecutive impacts recorded on train pantograph.

APPLICATION

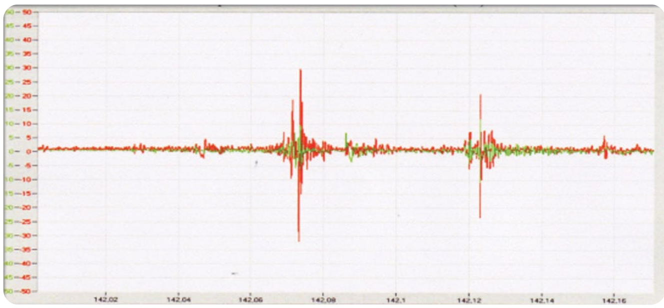
Location: Le Mans, FRANCE
Site monitored since : June 2012

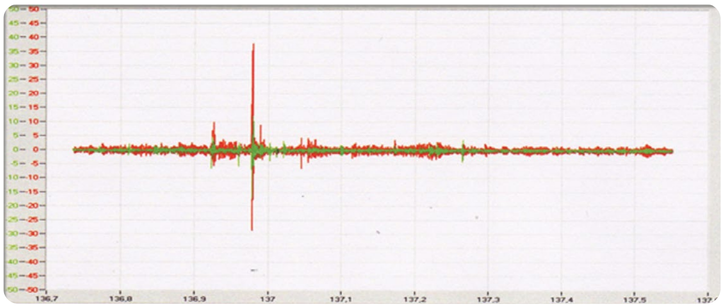


The Beandevice® AX-3DS passed successfully all the EMC Stress tests performed by the end user SNCF (French Railway) :
- Voltage impulsion testing with a rising time of 1us and 1/2/4/6kV of voltage rating
- Electrical Field tests at 50Hz and 1/3.6/6/10/15 kV voltage rating
- Magnetic field tests

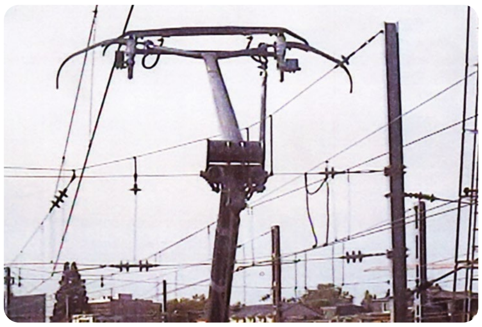
Current Rating	Frequency	Position	Duration	Results
4,5A (180A/m)	50Hz	Vertical	30s	OK
7,4A (280 A/m)	16,7Hz	Vertical	30s	OK
1,6A (64 A/m)	150Hz	Vertical	30s	OK
1,2A (48 A/m)	200Hz	Vertical	30s	OK
0,8A (32 A/m)	300Hz	Vertical	30s	OK
0,7A (28 A/m)	350Hz	Vertical	30s	OK
0,4A (16 A/m)	600Hz	Vertical	30s	OK
12,5 (500A/m)	uninterrupted	Vertical	30s	OK

Caption 9: EMC Stress test curve applied on BeanDevice® 2.4GHz AX-3DS – Wireless Shock sensors



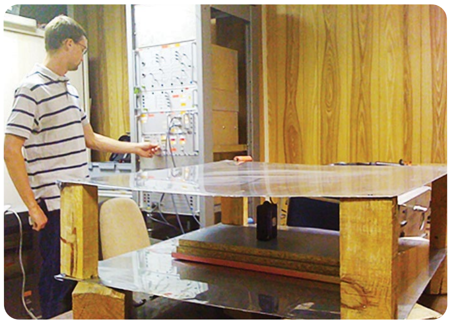


Caption 10: High shock on the Vertical Z-axis (red color)



Caption 11: Train Pantograph (Overhead line with 25kV AC)

Caption 12: Magnetic field testing



Caption 13: Electrical field testing

WIRELESS IIOT SENSORS

APPLICATION

Location: Paris, France
Site monitored since : 2010

RAILWAY SLEEPERS MONITORING

OVERALL TASKS

During the extension of Paris suburb line RER-C, it was urgent to monitor railway sleepers due to construction works at several train stations in the North-West of Paris.
The main target was to monitor soil stability and to notify in real-time the field workers if deformation was observed on rails.
The monitoring system was deployed between 2010 and 2014, a long battery life was required by the rail operator.
Wireless inclinometers were used with external primary cell for a longer battery life (Ref: Beandevice® 2.4GHz HI-INC Xtend).

EQUIPMENT USED

BeanDevice® 2.4GHz Hi-INC Xtend
Wireless Inclinometers

BeanScape® 2.4GHz Premium
Wireless IIOT sensor supervision software

BeanGateway® 2.4 GHz 3G/4G/LTE
Wireless coordinator

Caption 1: Wireless inclinometers are sticked / screwed on rail sleepers

APPLICATION

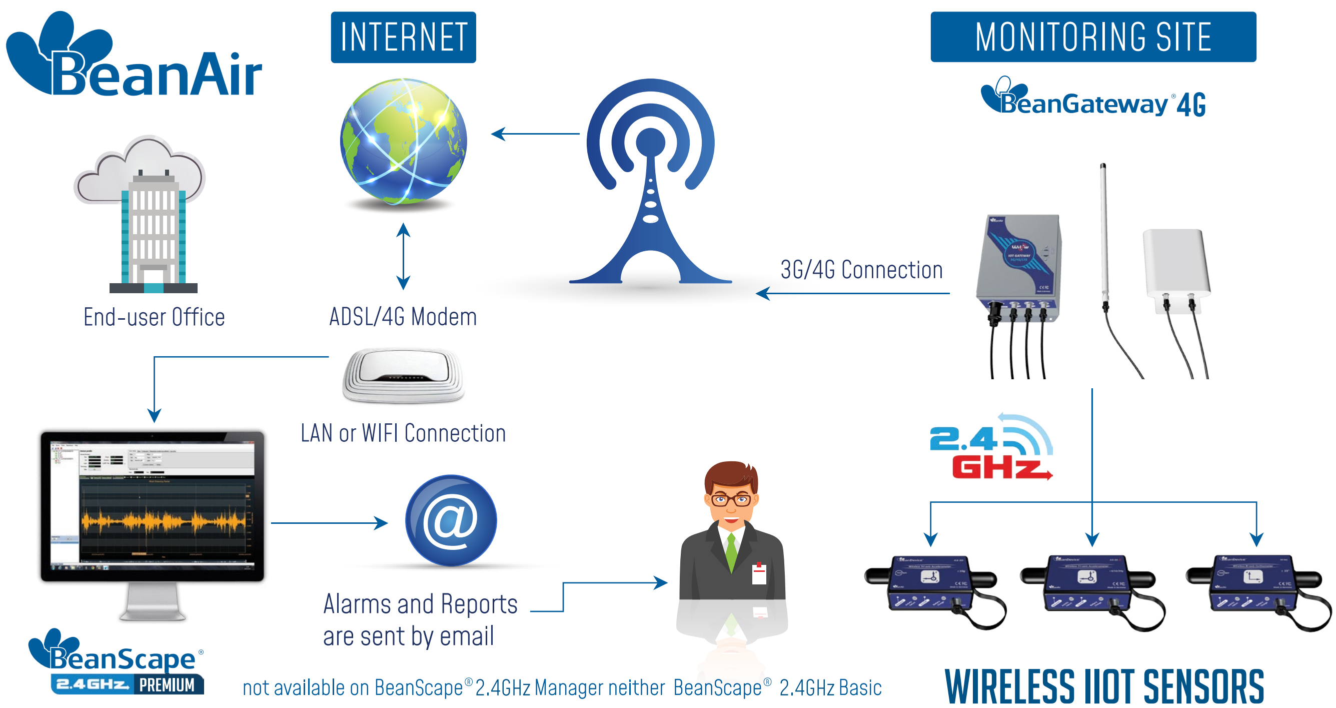
Location: Paris, France
Site monitored since : 2010

OPERATION MODE

- DAQ Mode: Survey mode with a notification cycle of 30 minutes
- Inclinometers accuracy: ±0.05°up to ±0.02° on the Full Scale
- Alarm thresholds: ±0.3°
- Remote access: 4G/LTE connectivity
- Battery life : 4 years with 6500 mAh Primary Cell

Caption 2: Overview of Saint-Ouen (Paris Region) train station

REMOTE MONITORING AND ALARM GENERATION BY EMAIL



WIRELESS IIOT SENSORS

APPLICATION

Location: Bugey, France
Site monitored since : 2009

WEIGHT MONITORING ON COOLING TOWER | NUCLEAR PLANT

OVERALL TASKS

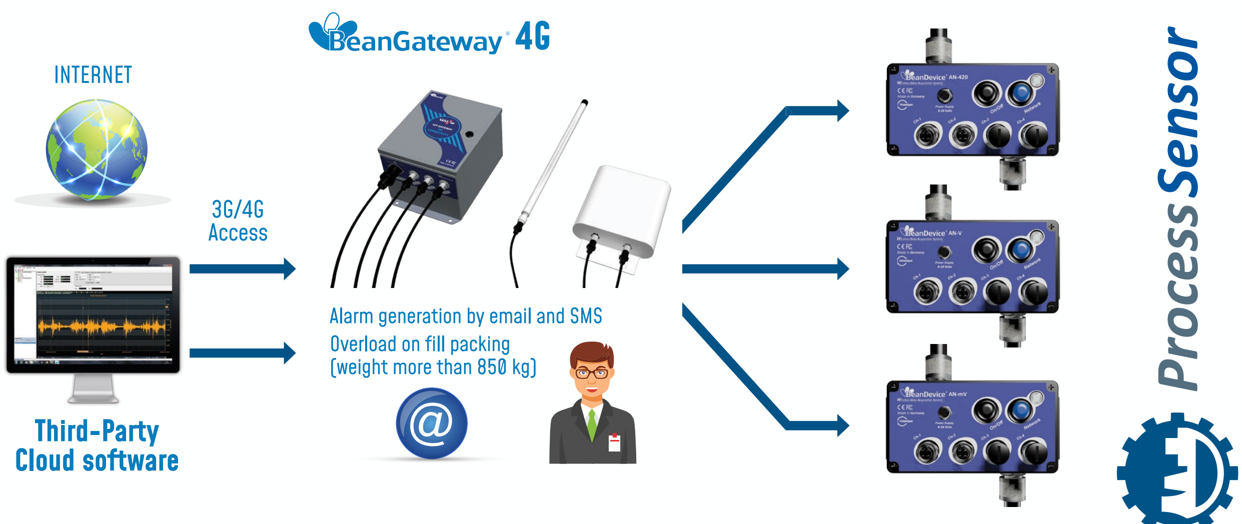
On Nuclear power plant, cooling tower rejects heat to the atmosphere through a cooling of a water stream to a lower temperature. Fill packs provides a large surface area for evaporative cooling to take place. It's located beneath the water distribution layer and above the sump of the cooling tower. Anti-Legionnela packing are used and impregnated with a non-leaching biocide that lasts for the lifetime of the packing, and provides additional protection against bacteria. The fill packs weight need to be monitored in real-time and cleaned during annual maintenance.

On each cooling tower, 24 load sensors connected to our wireless DAQ system were used to monitor the fill packs.
Due to the extreme humidity (more than 99% for a temperature more than 45°), a double casing design with epoxy potting was used. To reach a battery life of 4 years, each Wireless DAQ system was powered by 6 x D Size Lithium Cells

EQUIPMENT USED

BeanDevice® 2.4GHz AN-mV Wireless DAQ

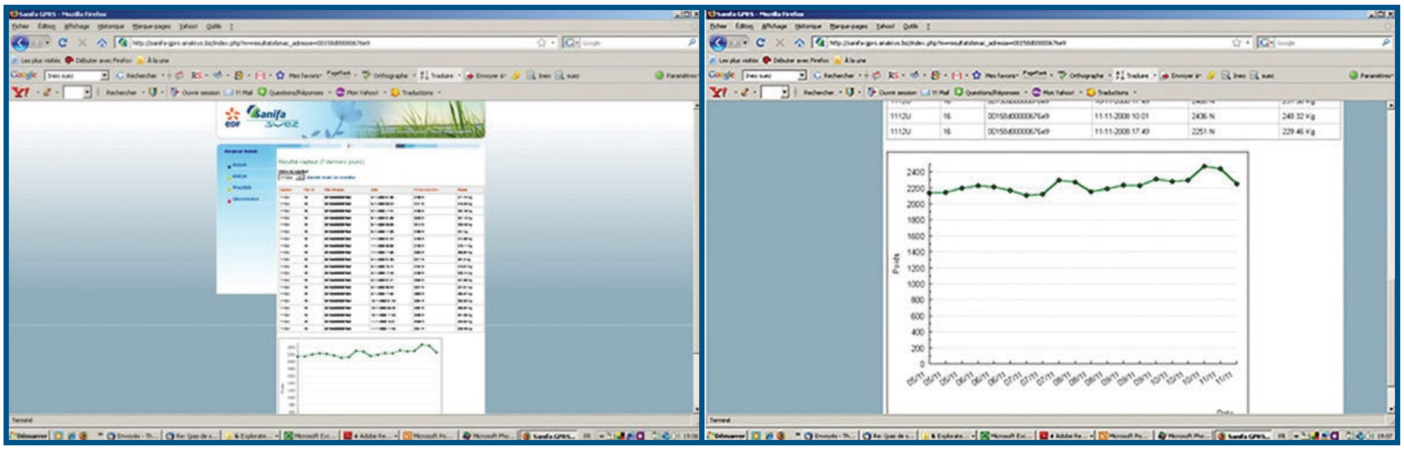
BeanGateway® 2.4GHz Outdoor 3G/4G/LTE Wireless coordinator



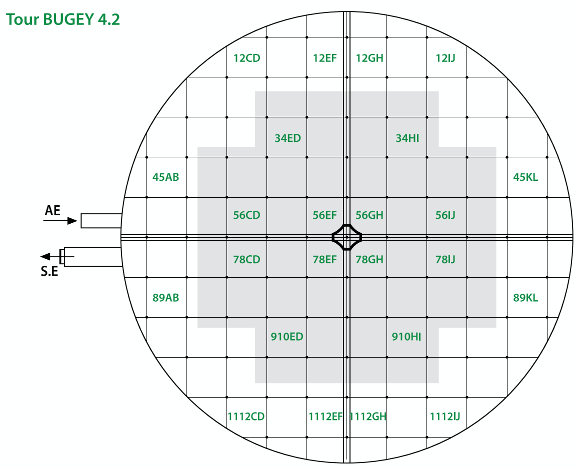
Caption 1: Network Topology - from sensors to alarm reporting

APPLICATION

Location: Bugey, France
Site monitored since : 2009



Caption 2: Collected data measurements can be viewed from a third-party cloud software



Caption 3: Top view of wireless sensors deployed on cooling tower

Caption 4: Load cell is used to monitor fill packing weight (counterflow water/air)

Caption 5: Load cell is connected to a Wireless DAQ (BeanDevice® 2.4GHz AN-mV)

Caption 6: BeanGateway® 2.4GHz Outdoor with 4G connectivity

APPLICATION

Location: Bugey, France
Site monitored since : 2009

Caption 7: External view of fill packing (counterflow water/air)

Caption 8: Hyperboloid cooling tower

Caption 9: Aerial view of Nuclear power plant of Bugey (France)

BeanAir

RETHINKING SENSING TECHNOLOGY

IIOT

- STRUCTURAL HEALTH MONITORING
- GROUND VIBRATION MONITORING
- TEST AND MEASUREMENT
- ENVIRONMENTAL MONITORING
- CONDITION MONITORING
- LAND SURVEYING

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