

# Remote Monitoring Solutions for Open-pit Mines

Open-pit mining involves the removal of soil and rock to access the mineral deposits. An open-pit mine generally has stepped sides to minimise the risks associated with collapse and a large ramp for mining equipment access. The geotechnical, structural health and environmental monitoring of an open-pit mine is crucial to ensure safety of the people and environment and productivity of the mine. Ackcio Beam can automate the monitoring process, providing decision makers with remote access to critical sensor data in real-time. Here is how that works.

## 01 SLOPE STABILITY MONITORING

Ackcio **BEAM-TM** Nodes bundle Ackcio's long-range wireless mesh technology with Sisgeo's trusted bi-axial self-compensated MEMS inclinometer, monitoring the slope stability around the open pit mine site and the pit wall itself.

## 02 STRUCTURAL HEALTH MONITORING

Ackcio **BEAM-TM** Nodes can be used to monitor the horizontal and vertical movement of the surrounding buildings.

## 03 IN-DEPTH GROUND DISPLACEMENT

Settlement/lateral displacement beside the mine slope is monitored by leading brands of digital in-place-inclinometers (IPI's)/MPBX/extensometers/SAAs in real-time using Ackcio **BEAM-DG** Nodes.

## 04 ACKCIO GATEWAY

The Ackcio **BEAM-GW** receives sensor data from the Nodes within the network. Ackcio's Snape software that runs on the Ackcio Gateway is used to configure and manage the project. It also provides the option to push the data via FTP and/or API server hosting a software (selected) of client's choice.

## 05 INTEGRITY OF SURROUNDING BUILDINGS

On nearby buildings, Ackcio **BEAM-AN-S1** (1 channel) and **BEAM-AN-S4** (4 channels) Nodes ensure real-time monitoring of crack meters and displacement sensors to ensure the safety of the surrounding infrastructure.

## 06 GROUND SETTLEMENT MONITORING

Ackcio **BEAM-AN-S4** (4 channels) Nodes automate the monitoring of a multi-point borehole extensometer (MPBX) that measures vertical deformation at various depths.

## 07 MONITORING TOTAL PRESSURE

Ackcio **BEAM-AN-S1** (1 channel) Nodes automate the monitoring of a pressure cell which measures total earth pressure under the on-site crusher.

## 08 GROUND ANCHOR MONITORING

Ackcio **BEAM-VW-S1** (1 channel) and **BEAM-VW-S8** (8 channels) Nodes monitor strain gauges and load cells inserted in the soil nails/ground anchors, to monitor their tension and bending resistance in real time.

## 09 ACKCIO NODES

Each battery-operated Node acquires data from various sensors and transmits the sensor data wirelessly through the Ackcio Mesh network to the Ackcio Gateway.

## 10 ACKCIO MESH

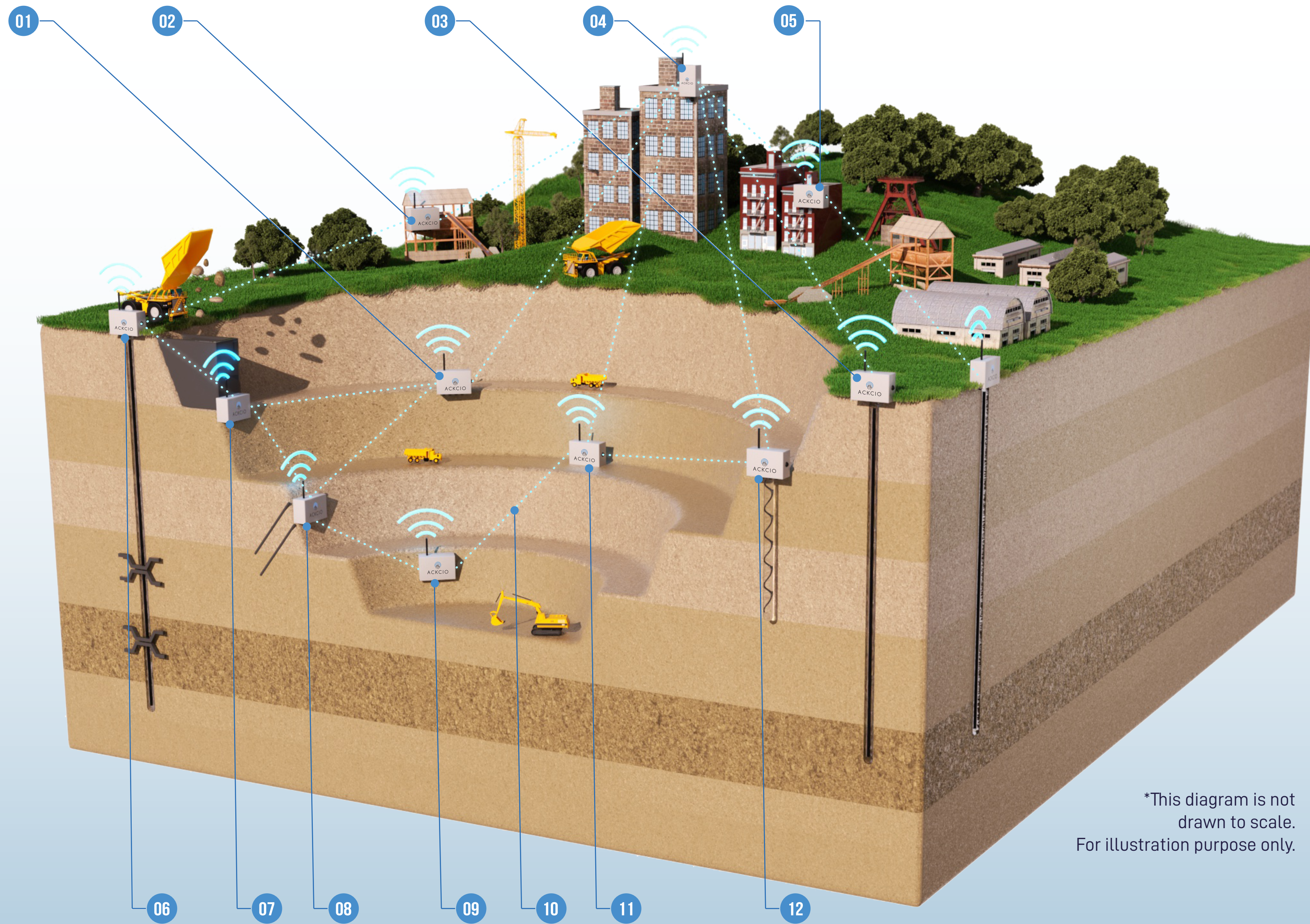
Ackcio's patented long-range wireless **MESH** network connects the Ackcio Nodes to the Ackcio Gateway. The mesh network is self-healing, enhancing the transmission reliability. The ability to 'hop' up to 12 times significantly increases the reliability in complex environments and offers the ability to increase aggregate range if required. The system is highly flexible and scale-able.

## 11 REPEATER NODES

If deployment challenges reduce the range of Ackcio Nodes, Ackcio **BEAM-RN** Nodes assist in extending the wireless range of other Ackcio Nodes within the network.

## 12 MONITORING PORE WATER PRESSURE

Piezometers measuring the pore water pressure are monitored in real-time using Ackcio **BEAM-VW-S1** (1 channel) and **BEAM-VW-S8** (8 channels) Nodes.



\*This diagram is not drawn to scale. For illustration purpose only.