RAJANT

The Adaptable Network for the **Ultimate Accuracy in Heavy Construction Operations**

The heavy construction industry has evolved over the last decade to become much more high-tech. GPS-equipped machines can now achieve tolerances of less than one-tenth of an inch, real-time telemetry has transformed the efficiency of machine health monitoring and maintenance, on-site video streaming is optimizing remote machine control, worker safety, and security, and autonomous construction equipment is more prevalent than ever.

The challenge is that these advanced applications all require reliable network connectivity to run – but traditional serial radios, Wi-Fi, and even LTE all fall short in either connectivity, capacity, or coverage to effectively support the growing demands of the construction industry. **Enter Rajant Kinetic Mesh®.**

Highway projects, railroads, pipelines and other expansive infrastructure projects often require multiple base stations for high precision earthmoving. If an organization opts for a serial network, they're limited to a base radio and a single repeater – which severely limits the range in which they can receive corrections. If they opt for Wi-Fi, the machines can only be connected to a single access point at a time, which means equipment will lose connection as it roams across a site. This isn't a workable solution from a connectivity standpoint.

LTE has challenges as well. Despite the great coverage maps that cellular carriers publish, many jobs sites still have poor to no coverage. Additionally, even when there is coverage available, the construction site still has no control over network congestion. But Rajant has a simple solution to overcome all of these challenges.

Rajant Kinetic Mesh is a private wireless solution that gives heavy construction jobsites a better network alternative: one that's easily deployable and rapidly scalable to expand base station range in any direction, while also providing high data throughput and continuous connectivity for numerous efficiency-transforming site applications. The organization owns the network—so they don't have to share capacity or pay for machine data.

Blanket Your Site with Dual Layers: **InstaMesh for Machine Connectivity & Wi-Fi to Connect Workers**

With Rajant's network, heavy construction operators are able to solve a core challenge many jobsites face – multiple survey grids causing potential grade mismatch – with greater base station range and additional bandwidth so new applications are enabled to improve worker communications, reduce survey time, minimize machine wear and tear, improve productivity, increase jobsite security, and more.

Expand Coverage for Base Station Corrections

Dozers, road graders, and heavy equipment equipped for GPS guidance depend on exacting 3D survey models to maintain tight tolerances. Unfortunately, since each base station operates in its own survey grid, individual 3D models must be stitched together and reconciled – involving extra labor for surveyors and model builders. Reconciliation errors expose companies to profit loss and liability if the finished product doesn't meet contract specifications.

By deploying Rajant BreadCrumbs with a base station and on high precision-equipped machines, construction sites can easily extend the range of transmitting GPS corrections. By adding occasional network infrastructure nodes, the base station's range can be extended over many miles. This is done without complicated configuration or IT staff on site. Kinetic Mesh performs reliably even in areas with varied topography like rolling hills or dense foliage because BreadCrumbs autonomously manage data routing around physical obstructions and local interference. By reducing base station dependency and subsequently reducing the number of survey grids, surveyors can design models faster with a lower chance of error over significantly larger areas.

Legend:
- - - - Rajant Kinetic Mesh
- BreadCrumb ES1
- BreadCrumb ME4
- VOIP Access
- Base Stations
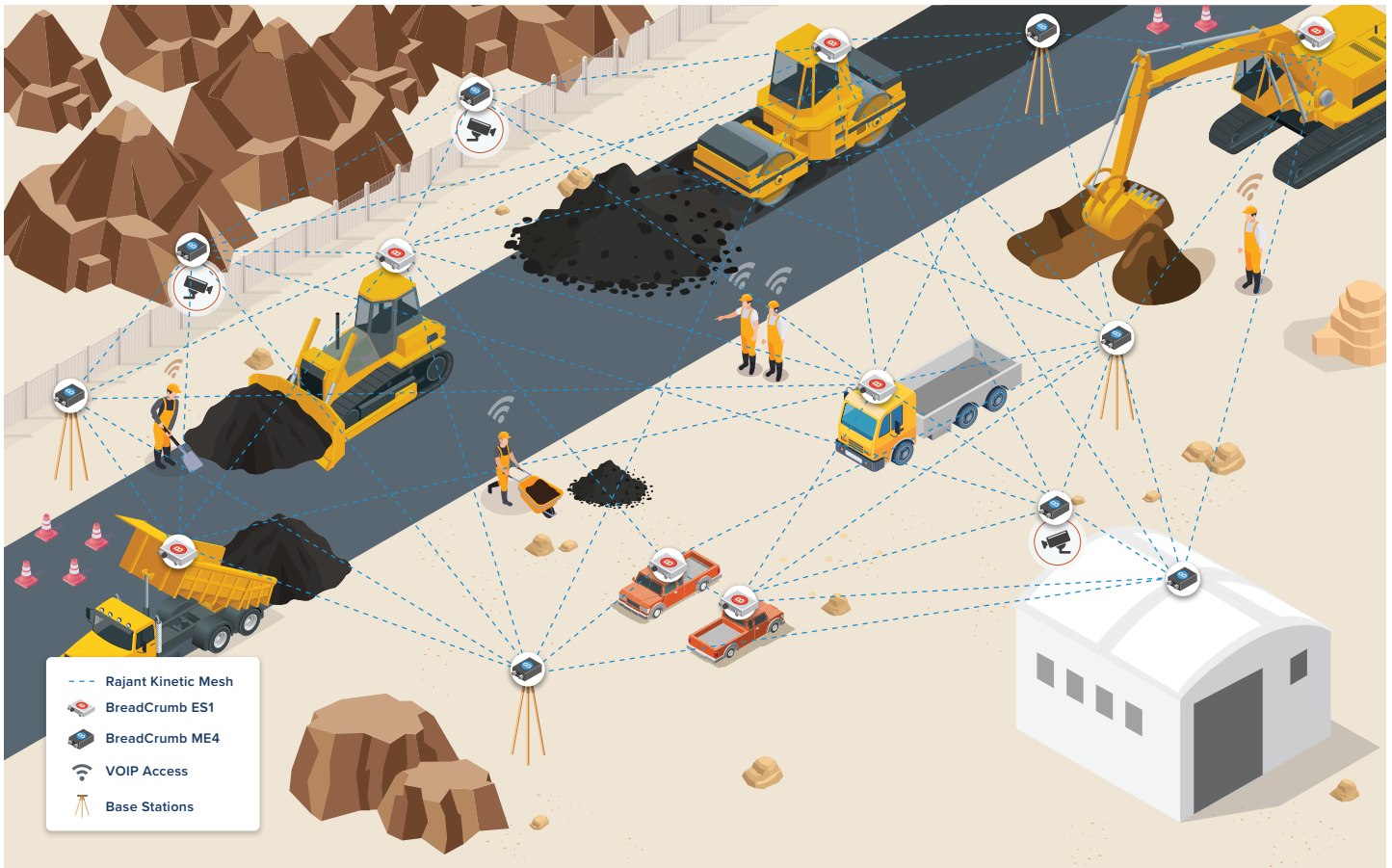
Remotely Load Machine Guidance Models

Manually loading models onto your machines each day is a labor- and time-intensive task. Delays in getting the model to the site, locating the equipment, and uploading the information by hand create efficiency issues, particularly if the site is working on a design-build basis. With Rajant's mission-critical network, the designer can remotely load models onto any machine from their office, provided there's an internet connection at the site. Otherwise, the designer can remotely load models onto any machine from anywhere on the jobsite where there is network coverage. This allows for real-time data transfer, without work stoppage. This process is more efficient for the designer, and more efficient for the operators.

Remotely Monitor Machine Productivity

The continuous mobile connectivity provided by Rajant's network can also be used to monitor machine productivity. This production data from each machine can be freely pulled by the back office from equipment on site for incremental billing purposes.

Enable Streaming Video Surveillance

Video monitoring has become a key component to ensuring both jobsite safety and security. However, many wireless networks are unable to support high definition streaming video due to throughput limitations. Packets get dropped, quality is reduced, and the stream can be rendered ineffective as it stops and starts or lacks clarity.

Rajant's low latency, high bandwidth network provides the capacity to easily stream real-time video from remote sections of the site to either the jobsite office or a corporate office (provided there is broadband connection on site) that wants to maintain oversight of job progress remotely. It handles packet density with ease so leadership can gain a clear picture to readily react to everything happening at the site: from ensuring workers are complying with OSHA regulations to heading off security breaches, equipment theft, and site vandalism.

If It's Moving, It's Rajant:
The Mission-Critical Network to Keep Your Construction Site as Well-Connected as Your Office

Rajant takes a completely different and highly innovative approach to address the shortcomings of traditional wireless architectures in heavy construction environments. Our Kinetic Mesh network is engineered from the ground up for rapid ad hoc deployment, in nearly any outdoor setting with or without existing infrastructure in place, and uses the intelligence of Rajant's InstaMesh® networking protocol to dynamically self-optimize once deployed. In turn, it delivers fully mobile, rapidly scalable, high-capacity coverage to easily expand base station range and enable new data-driven applications on site. **Here's how.**

IDEAL BREADCRUMBS FOR HEAVY CONSTRUCTION NETWORKS

The BreadCrumb ME4 is lightweight but ruggedized in an environmentally sealed, IP67 rated enclosure. It offers two transceivers and four external antenna ports and is ideal for wireless infrastructure and equipment connectivity.

The BreadCrumb ES1 comes in a compact, lightweight, IP67 package ideal for use on pick-up trucks and other light-duty vehicles, providing flexibility with multiple mounting options.

Compact, ruggedized BreadCrumb® nodes can be deployed on fixed or moving assets.

BreadCrumb portable nodes form a Kinetic Mesh network and are ruggedized to operate reliably in even the harshest weather and jobsite conditions. Every node can be fixed or mobile, and can be easily deployed on infrastructure, attached to base stations, and on moving equipment and vehicles to quickly form a mobile mesh network. BreadCrumbs work peer-to-peer and can hold multiple connections over various frequencies simultaneously, creating hundreds of potential paths over which to direct traffic. As one node moves within range of another, they automatically form links that can be used to send and receive data between themselves and other nodes in the area.

Additionally, because BreadCrumb-equipped assets can connect directly to each other, Rajant's network is the only wireless solution that enables true machine-to-machine (M2M) communications.

Multi-radio, multi-frequency redundancy creates resiliency and high capacity.

Every BreadCrumb is infused with the intelligence of Rajant's InstaMesh® software, which works in real-time to orchestrate traffic over the meshed connections, selecting the fastest path(s) for delivery. If a path becomes unavailable or interference occurs, InstaMesh will dynamically route communications via the next-best available path, upholding mission-critical performance with no dropped packets or communications loss.

The network's ability to leverage multiple paths and frequencies also ensures high capacity. InstaMesh will load balance across the entire network to self-optimize data flow. In fact, the strength and capacity of the network actually grows as node density increases, ensuring the ability to scale the network while preserving real-time performance.

Full duplex communication preserves throughput over long distances.

Compared to a Wi-Fi mesh where throughput drops by 50% on every hop, a Rajant network can maintain consistent throughput over many hops. This functionality is vital when deploying a network in a remote area with little to no wired infrastructure. Applications that require low latency like video streaming or remote machine guidance demand consistent throughput. Multi-radio BreadCrumbs are able to receive and transmit data simultaneously, allowing more data to be moved faster. This enables the network to accommodate more applications at the same time, and Rajant's Quality of Service (QoS) provisioning ensures mission-critical data is delivered before lower-priority application data.

Deploy and scale with minimal technical resources.

After initial configuration, when new BreadCrumbs are turned on, they automatically begin communicating with other nodes in the area, autonomously and without outside intervention. The network is easily scalable to hundreds of high-bandwidth nodes, and continuously self-optimizes in line with changing environmental and operational conditions, so there's no need for a team of network engineers to manage the network. You can instead keep personnel focused on the real job at hand.

Enable Wi-Fi to connect workers across the jobsite.

Access Point mode can be enabled on any BreadCrumb, fixed or mobile, on either 2.4GHz or 5GHz. This enables tools like Rovers, Smartphones, tablets and laptops to be used on-site to improve safety, worker productivity, and communications.

Applications Enabled

Kinetic Mesh provides the resilient, high-capacity, mission-critical coverage heavy construction operators need to **maximize productivity and enhance safety across their jobsites,** including:

Site Surveying

- Base Station Correction Broadcasts
- Drone-Based Topographical Mapping

Machine Guidance & Control

- Remote Upload/Download of Models
- Remote Collection of Production Data
- Machine-to-Machine Communications (M2M)
- Vehicle-to-Vehicle Communications (V2V)
- Remote Machine Guidance

Asset Tracking & Optimization

- Fleet Management
- Real-Time Asset Tracking
- Telemetry from Remote Sensors

Worker Safety & Site Security

- Real-Time Voice, Video, and Data Communications
- Video Surveillance
- Live Video Streaming
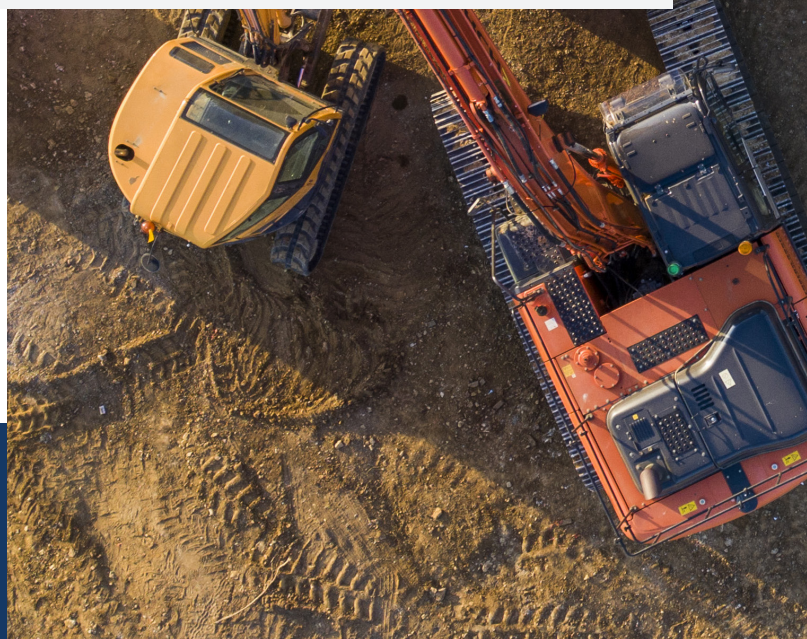- Theft Monitoring
- Man-Down Alerts/Man Tracking

RAJANT IN ACTION

Bringing One Long, Linear Job Under Control

When Rajant's partner SITECH was approached by a heavy construction customer seeking a network solution to reliably cover an extensive, remotely located jobsite, they knew Rajant's technology was up to the task.

The site had no existing LTE or 2-way radio service available, and no nearby reference station to tap into. SITECH deployed a Kinetic Mesh network that tied into the Internet at the jobsite office, and built the network out to cover the entirety of the project which spanned nearly 40 linear miles. What would otherwise have required 10-15 base stations – each with its own survey grid that would need to be reconciled with the next grid – was able to be covered with two base stations and two survey grids.

This saved significant time for the surveyors and model builders as well as resulted in a huge reduction of risk. Because the jobsite is remote, there is no LTE coverage, and because the terrain is so varied, push-to-talk would not work either. Fortunately, the customer's employees are able to communicate via Wi-Fi calling using smartphones over the Rajant Kinetic Mesh network. This provides worker safety and accelerates productivity.

Rajant Kinetic Mesh: The Network with the Strength to Stand Up to Heavy Construction Demands

We'll show you all the benefits that a smart network can bring to your jobsite.
Visit rajant.com/markets/heavy-construction to get started.

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*If it's **moving**, it's Rajant.*
Industrial Wireless Networks **Unleashed.**