System administrators use satellite map images to determine actual boundaries.

Geofence boundaries can be set by dropping pins and dragging lines to the correct shape.

Different colored pins can differentiate between boundaries and vehicles within the site.

The technology increases safety and can improve efficiency for producers.
Geofencing and Telematics

In simplest terms, a geofence is an area of land — for instance, a quarry — that has been mapped via computer into a virtual “zone.” The entire quarry can be a zone, and certain specific areas within the quarry can also be zones or subzones. Vehicles and equipment that have been outfitted with a telematics device can be tracked within the zone(s).

“Mostly, a geofence will tell you where your equipment is and what it’s doing at any given point in time,” says Bill Smith, principal consultant at B&H Equipment Services. “If you use loaders, excavators, bulldozers, the geofence will tell you their locations and the tasks they’re doing, based on the zone.”

In order to provide this information, Smith says that the geofence system must work in conjunction with telematics. He explains that telematics is the integrated use of telecommunications with information and communications technology. It is the science of sending, receiving, and storing information relating to mobile objects — such as vehicles — via GPS and telecommunications devices. “You have to have telematics, because that is what allows your machine to talk to the fence,” Smith says.

Most major mobile equipment manufacturers have developed their own telematics systems that not only work with geofencing to track machines’ whereabouts, but also to work with the equipment’s electronic control modules. The systems can notify fleet managers of equipment issues and provide diagnostic information.

In a quarry environment, a geofence can allow managers to compare how long it takes individual operators to move between the quarry face and the primary crusher. It might show that one driver takes 10 minutes to travel between the loadout area in the pit and the primary hopper, while another takes 13. Breaking that information down over the course of a shift, the slower driver is taking fewer trips a day, which leads to lower production rates and higher operation costs.

“At Luck Stone, we use telematics and geofencing for our hauling fleet that delivers materials to the jobites,” says Ryan Emmons, director of information technology for Luck Companies. “Our system tells drivers what to pick up and where to take it. We also use it to measure turnaround in our yards. If we see trucks are waiting too long, for instance, this tells us we might need to add another loader. It’s really all about visibility into the efficiency of our yards.”

Geofencing with telematics also may be used to track on-road haul trucks as they enter a site and pick up materials. Telecommunications can help drivers to locate the correct stockpiles. The administrator can see at all times how many trucks are within the facility and where they are.

In addition to signaling the entrance and exit of vehicles, the use of geofences can also help provide information to aggregate producers about where equipment or vehicles are within the site, how much time they spend in an area, and what tasks they are providing. The system can improve security for a facility, and it also can help the operation increase its efficiency and reduce operating costs.

“Mostly, a geofence will tell you what’s going on at all times how many trucks are within the facility and where they are. In a quarry environment, a geofence can allow managers to compare how long it takes individual operators to move between the quarry face and the primary crusher. It might show that one driver takes 10 minutes to travel between the loadout area in the pit and the primary hopper, while another takes 13. Breaking that information down over the course of a shift, the slower driver is taking fewer trips a day, which leads to lower production rates and higher operation costs.”

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“Because the system can be set up to track timing of the haul trucks onsite, the producer can determine, for example, if there is a need for a second loader. As a truck leaves the boundary of the geofenced site, GPS technology used in telematics can help communicate to the driver on the road where the load is to be delivered, even providing directions.”

Some producers provide drivers with mobile devices, such as a tablet computer, to communicate with them. The GPS technology in the device works in conjunction with, and is critical to, the geofence. It involves the use of GPS technology installed or placed in a vehicle, which sends a signal to the administrator as to where the vehicle is and what it is doing within the boundary. It also can be used to transmit information back to the vehicle operator.

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Ryan Emmons is the director of information technology at Luck Companies. He started out as a summer intern with Luck’s electrical engineering department before joining the engineering team full-time the following year. Over the last 13 years Emmons has been with Luck Companies, he has served in different roles including engineering, marketing, information technology and IT. Emmons graduated from Virginia Commonwealth University with a bachelor’s degree in computer engineering. Additionally, he has earned a master’s degree in business administration, also from VCU.

As principal consultant/heavy equipment manager for B&H Equipment Services, Bill Smith is a lead consultant working with heavy civil construction companies, aggregates, producers and scrap steel. Smith is certified by George Washington University as a heavy equipment manager professional. He is the founder of the Association of Equipment Manager Council of America and has extensive experience in heavy equipment and crane operations, safety, OSHA, environmental, and asset management. Smith has an associate’s degree in diesel technology from Lincoln Technical Institute.
Luck Stone has its own proprietary geofencing system for its aggregate operations and uses it with its on-road hauling fleet. “We have contracted haulers to deliver material to jobsites. We’ve provided them with iPads, which have a mobile app that works with our geofences,” says Ryan Emmons, Luck Companies’ director of information technology.

He explains that the drivers keep their iPads in their trucks. The iPads are sensed by the geofence surrounding an operation to let Luck track when and where trucks are onsite. “We can see when they enter the plant, if they’re in the parking lot, the loading area, or the scales, and how long they’re spending in each area,” Emmons says.

The geofencing system and mobile app have been developed in-house by Luck Stone. “At Luck Stone, we strive to innovate and provide our customers the best experience possible. Our geofencing system and mobile app support our customers’ needs through thoughtfully designed, leading-edge technology,” Emmons says. The geofence structure is operated and monitored by administrators. Geofences can be created or changed by simply pointing and clicking to drop yellow pins, and then dragging the fence between pins to the exact shape desired. As the administrator monitors truck traffic onsite, different colored pins indicate trucks, which are also assigned numbers for precise tracking.

The app uses the iPad’s GPS and has dispatching and communication capabilities. Not only does it track the trucks’ locations for Luck, but when the drivers go home at the end of a shift, they can open the app and know what materials need to be picked up the next day and where the load is to be delivered.

“When the driver enters the geofence zone in one of our operations, it starts a timer so that we can track turnaround. If we see that trucks are waiting or spending too much time onsite, it helps us know if we need to add another loader,” Emmons says. “The app also gives GPS directions to the delivery site,” he adds.

While the system is user-friendly enough for one administrator to monitor all traffic, Luck Stone has divided its markets and uses three separate administrators, based on location. “Across the company, we have between 40 and 50 geofences we’ve created. Our haul fleet that utilizes our system consists of about 350 trucks, all of which send us information through their iPads every 30 seconds.” Comparing its geofence administrators to air traffic controllers, Emmons adds, “If we used only one centralized administrator, it would be a pretty crazy day for that person.”

According to Bill Smith, principal consultant at B&S Equipment Services, geofencing is a tool that works in conjunction with telematics technology to track devices or vehicles. “Telematics have been around for 12 to 15 years now,” he says. “Qualcomm is probably the first company to introduce it for heavy equipment management. With the introduction of geofencing in the last five years or so, the top has blown off with the technology. It’s the way to go. Equipment managers in today’s world would have a difficult time trying to manage their equipment without telematics,” Smith adds.

Smith says that OEM telematics systems for heavy machinery can provide information such as when a machine starts up or help with error code diagnostics. With geofencing as an added tool, managers can track where the equipment is and what it is doing — i.e. if it is idling or working. “You can see where it is, and then determine your needs and change the equipment out as necessary for stockpiling, loading, or production needs,” he says. The technology works well for aggregate operations, where machines are constantly on the move.

“Most mobile machinery today comes with built-in telematics and geofencing systems for managing it,” Smith continues. “Caterpillar, Komatsu, John Deere – they all have their own systems. Each provides a way to receive a signal from a particular machine.”

He explains that the Association of Equipment Management Professionals (AEMP) has worked with manufacturers in an attempt to settle on one universal telematics system amongst them, so that producers and contractors aren’t required to use multiple systems between manufacturers for their fleets. “But it’s understandable that manufacturers don’t want to share their proprietary coding,” he says. “There are aftermarket systems available, too, but the downside to those is that most don’t have the ability to run diagnostics for you.”

Geofencing with telematics can provide additional benefits beyond tracking equipment’s whereabouts. As a tool for security, an administrator can be alerted if machinery starts up after hours, and also show where the equipment has moved. It can work to keep machinery out of certain zones — such as hazardous or environmentally sensitive areas — and alert the driver and/or a manager if a machine enters one of these zones. If a driver or operator is practicing unsafe behavior, the telematics can also send an alert.

“Working in conjunction with telematics, a machine’s electronic control module (ECM) can help determine if a driver is braking too hard, shifting too often, traveling too fast, shifting from forward to reverse too fast. It will tell you everything you need to know,” Smith says.