Monitoring Tunnel Boring Machine Data in the VDV Cloud.

About SAK
SAK is a national tunnel excavation and pipe rehabilitation contractor based in St. Louis, MO. The company has been in business for over 10 years and currently employs over 300 people nationwide.

The Project
SAK Construction, LLC was awarded a contract to excavate over 10,000 feet of large diameter tunnel by the Los Angeles Department of Water and Power. Tunnel excavation began in June of 2015 and was completed in March of 2017. The contract documents required SAK to develop and maintain a tunnel boring machine data acquisition system. The intent of this system was to gather and visually display data points from over 60 different components and systems that are a part of the overall tunnel boring machine.

Monitored Parameters
Multiple tunnel boring machine data points had to be monitored, i.e. pressure sensors, hydraulic cylinder stroke and pressure, grout, bentonite, soil conditioner volumes, tunnel boring machine alignment information, surface and subsurface settlements, advance rate, cutterhead torque and speed, screw conveyor torque and speed, pressure chamber sensors.

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Dozens of individuals paid close attention to the custom built dashboard which showed live project data being updated every minute.
Hardware and Communication
The project used programmable logic controllers (PLC), pressure sensors and laptop computers. The pressure sensors and PLC were attached at multiple points along the 200 foot long tunnel boring machine. The data was collected underground in a laptop positioned on the tunnel boring machine. The data was then transmitted to a surface computer by cable. Once at the surface, it was electronically transmitted to the VDV Cloud Servers through WiFi and Internet.

Using VDV
VDV received the raw data every minute and visually displayed it on a custom built dashboard that was then reviewed by dozens of individuals working on the project. Downloading raw data for further analysis was very helpful. Automatic notifications when some parameters exceeded limits were also helpful.

Critical Variables
The result with the most impact relates to cutterhead pressure sensors. The client, and their engineers, watched this parameter closely. If these data points were to fall below previously agreed-upon limits, the project would be shut down. If the pressure is too low the soil in front of the TBM could loosen result in ground loss and a possible sinkhole forming on the surface. If the pressure on the other hand is to high the ground could heave on the surface. Having instant access to these pressure values proved to be incredibly useful.

Conclusion
Overall SAK is very happy with the VDV Cloud Service and the level of service provided. We will absolutely utilize this service on future tunneling projects.