

## PROGRAM TITLE: DRONES – A MODERN PUBLIC WORKS TOOL

**NARRATIVE DESCRIPTION:** San Joaquin County initiated a program to help improve productivity and increase the efficiency of various tasks while promoting a safer work environment for the employees and residents of San Joaquin County.

**OVERVIEW:** The Department of Public Works now utilizes unmanned aerial systems (drones) to decrease the occupational risks, provide pre and post site conditions and increase efficiencies of surveying and inspection activities.

**CHALLENGE:** As all other Counties in the nation, San Joaquin County faces greater budgetary constraints in maintaining and enhancing Public Works infrastructure. The County maintains approximately 1,660 miles of roadway and 265 bridges. As biennial inspection of the County’s bridges is required, traditionally the Department of Public Works has utilized a boom truck with a self-constructed cage to perform these inspections. Mobilization and demobilization of equipment and traffic control was required for inspections using the boom truck, which could take several hours to complete. The sheer number of employees and time necessary to perform these inspections made them very costly and potentially dangerous for crew members, and directly impacted the traveling public.

After years of faithful service, the time had come for the Department to replace its boom truck with a new vehicle designed for this application. However, at a cost of \$600,000, the County could not justify such a large purchase. The Department needed a way to safely and efficiently inspect infrastructure and collect data in areas where access is a challenge, such as bridges over deep channels, high traffic areas, remote large areas, enclosed spaces, and steep embankments with dense vegetation. The Department researched further and initially purchased a drone that could not only perform the bridge inspections, but could also perform aerial photographic and digital terrain model topographic surveys!

**INNOVATIVE SOLUTION:** By using the drone’s high-resolution camera, we are able to capture critical inspection areas on bridges without placing a single employee in harm’s way.



*Figure 1: Left: County crew performing bridge inspection with a boom truck. Right: County drone approaching truss of bridge for inspection of structural members.*

Instead of mobilizing a small army of employees to control traffic, operate the boom truck, and inspect the structure, a two-man crew visits the site while remaining outside of the traveled way, and obtains the same information in a fraction of the time. In addition, staff identified several other practical applications for drone use in various areas within the Department.

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The Department manages four landfills (two operating and two closed) and oversees the construction of other earth moving projects, which require accurate topographic surveying data in order to compute quantities of material placed and removed. These large areas require extensive time and resources to survey using conventional surveying methods due to their limited line of sight and potentially adverse geographical conditions. Drones can collect survey data as far as one mile away from its home base on a single setup.

In addition, the Department realized drones would allow us to view damage to County infrastructure, record traffic behavior at critical intersections from vantage points not previously available to us, and capture images and videos of project sites for design and construction purposes. Documenting these features and activities were essential for historical records and real time traffic analysis. In addition to the initial drone purchased for bridge inspections and topographic surveys, the Department purchased a second drone capable of high-resolution video and still pictures, which is primarily used for traffic surveillance and data collection, and aerial pictures and videos.



*Figure 2: County has two drones: One is primarily utilized for collection of topographic data while a second drone is for monitoring construction and traffic activities.*

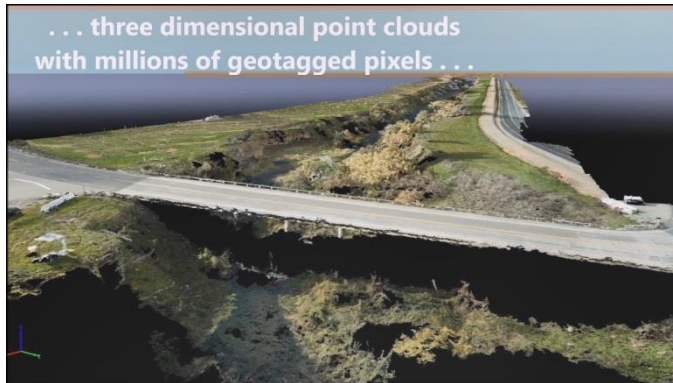
San Joaquin County's deployment of drones for data collection, including topography for roadway and landfill project sites, monitoring existing landfill capacities, bridge inspections, levee inspections, and traffic surveillance is an innovative tool, which can easily be replicated and implemented in other jurisdictions.

**COST EFFECTIVENESS:** The County had previously appropriated \$600,000 to purchase a Bridge Inspection Truck to facilitate under bridge inspections. The Department decided to invest in drone technology because the initial capital cost was approximately 1/10th the cost for an inspection truck, and traffic management required during operation would either be eliminated or minimized. In addition, the aerial survey of the County's landfills can cost as much as \$20,000/year. Utilizing the drone to perform these surveys is anticipated to save the Department over \$12,000/year. By the end of the year, the project savings are projected to exceed \$70,000 for utilizing the drones in lieu of conventional methods and outsourcing to perform the work, which more than offsets the original investment.

**RESULTS:** The County has utilized the drones for various tasks, and the results have exceeded expectations. The time and cost to collect survey data and perform site inspections have been slashed

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by approximately 50 percent. A typical project topographic survey previously averaged about seven days, has been reduced to approximately three days with the drone.



*Figure 3: Data collection of Mormon Slough at Escalon-Bellota Road and State Highway 26 in the Linden area.*

Bridge inspections using the boom truck with traffic control typically require six (6) hours, while inspections with the drone can be performed between 2-3 hours. Not only are the survey and inspection times significantly reduced by utilizing the drones, but the amount of data collected by the drone is unrivaled when compared to conventional inspection and surveying methods.

We are in the process of obtaining topographic data of the Foothill Sanitary Landfill in the Linden area for the construction of a new waste module. The drone will also be utilized to monitor the settlement, compaction, and available air space for the County's four landfills. Other intended uses relative to the Foothill Sanitary Landfill include a documentation of pre-construction, during construction and post-construction conditions via aerial photos and videos.



*Figure 4: Monitoring and data collection of the North County Landfill in the Lodi Area.*

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San Joaquin County Drones: Site Monitoring/Data Collection



Figure 1: Photo and data collection at North County Landfill in the Lodi area.

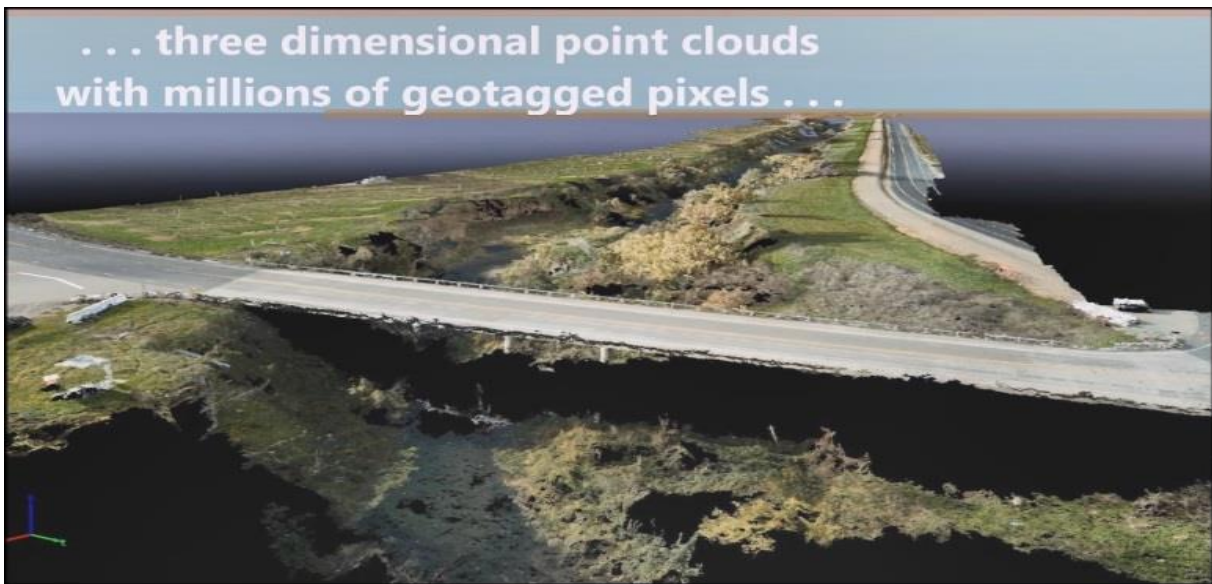


Figure 2: Data collection of Mormon Slough at Escalon-Bellota Road and State Highway 26 in the Linden area.

San Joaquin County Drones: Site Monitoring/Data Collection



Figure 3: Drone footage of construction progress at McHenry Avenue over the South San Joaquin Irrigation District Canal in the Escalon area. Replacing the existing bridge with a double-box culvert.



Figure 4: Bridge inspection of structural members at Eight Mile Road over White Slough in the Stockton area.



Figure 5: Drone footage of construction progress at McHenry Avenue over the Stanislaus River Bridge in the Escalon Area near the San Joaquin County and Stanislaus County line. Replacing the existing bridge. New east side can be seen adjacent to the existing bridge, which will soon be demolished to construct the west side of the bridge.

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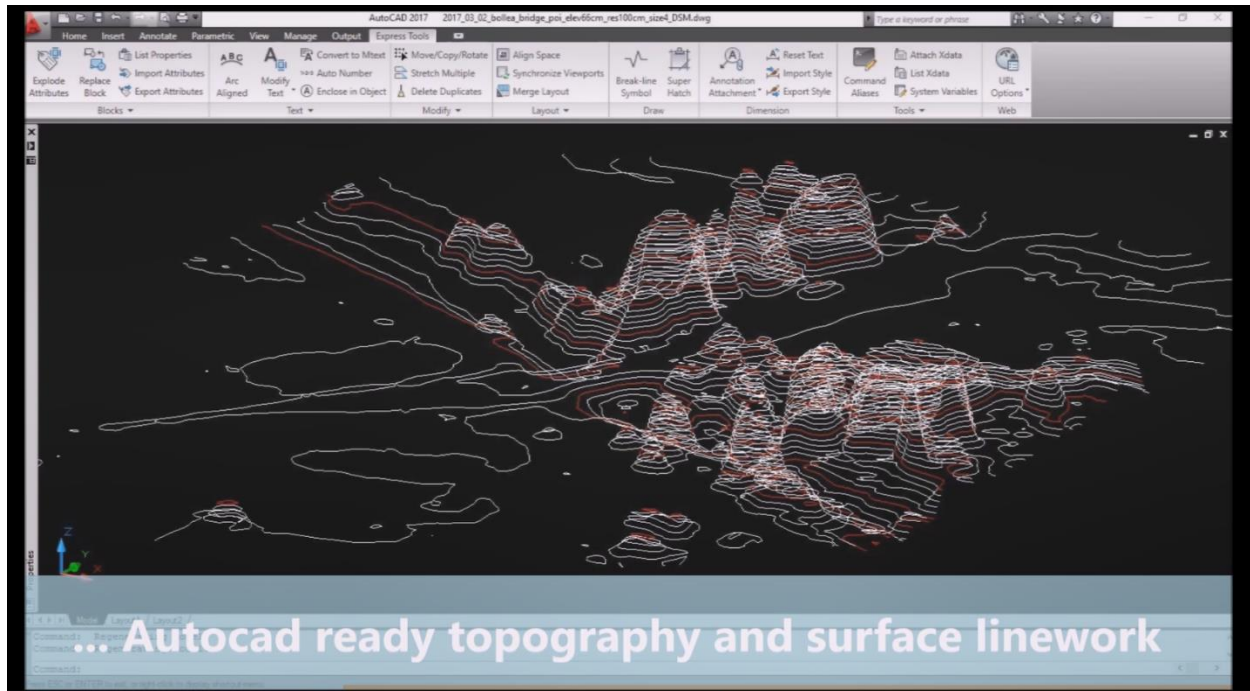


Figure 6: Topographic data collected at Bollea Road in the Wallace area.

San Joaquin County Drones: Site Monitoring/Data Collection



Figure 7: Traffic monitoring at the River Road and McHenry Ave intersection in the Escalon area.