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## **How the Use of Drones and 3D/BIM Modeling is Changing the Defense of Construction Defect Litigation**

### **I. Why technology is important**

#### **An Increase in data types and volumes**

Whether it's digital cameras, data loggers, laser measuring devices or drones, no one can argue that advancing technology is not beneficial to our industry. The type of data, and amount that can be collected using many of the modern devices available, has had a significant effect on the way we work through construction defect cases. New types of data allow experts to consider other factors and scenarios when analyzing problems within a building. What was possibly only considered a theory before can now easily be considered factual.

#### **Cold hard evidence**

The implementation of this technology also allows our industry to bring factual evidence to the table. Expert analysis and opinions will always be a huge part of the equation, but the factual data we can collect using new technology significantly effects the expert opinions in our modern day industry, and helps in determining the real cause and origin of the issues. Many of the new devices available help in the discovery period by allowing experts to gather base information before conducting exploratory openings and destructive testing.

## **II. Drone Technology**

### **Up, up and away!!**

Drones are the newest and most popular tool being put to use in building inspection. Mainly because they are a huge time and money saver when it comes to inspecting and documenting areas and components. Within a short period of time, a drone can zoom around a large high-rise building and scan multiple areas with its high-resolution camera to identify potential issues. In the past, this task required the installation of a swing-stage or the rental of a high lift. Both of these aerial work platforms are slow and require personnel to be suspended high in the air and today, are not considered the safest method for accomplishing the task.

### **The advancement of the modern drone**

Drones have come a long way from the self-assembled kit with a GoPro camera duct taped to the front of it. Today's drones are ready to fly straight from the manufacturer, have extremely smart GPS and flight control systems, as well as some of the most advanced camera technology available on the consumer market. They are much safer utilizing technology such as return to home that allows the unmanned craft to return to its take off point if communication with the transmitter is lost, as well as obstacle avoidance sensor technology.

Building inspectors also have drones designed specifically for industrial applications available to them, which offer cameras with 30x optical zoom so one can zoom in on a sealant joint 350 feet up a building's elevation to see if the failure is adhesive or cohesive. There are also infrared cameras and LiDAR sensors designed specifically for mounting on drones, which grant the ability to analyze a building's energy performance or take measurements with centimeter-grade accuracy.

### **Drones during course of construction**

Many projects currently under construction are putting these tiny flying computers to use. Whether it's to simply capture progress tracking photos every month to visually convey progress to the investors, or to completely scan every area and then convert the data into 3D B.I.M. models to share real time as-built information with the projects designers for comparison with design specifications.

Drone data can also be very beneficial down the road if defect litigation should come into play as it provides documentation of construction at certain phases in the building process. This allows CD professionals to potentially see areas and assemblies and extract crucial information on how an assembly was put together.

### **A sea of red tape**

Of course it hasn't always been possible to use drones for commercial purposes. In fact, it has been fairly recent that the federal government has begun to allow people to put drones to use in the way they are currently being used. Just a few years ago there was a strict ban on the commercial use of drones and violators faced stiff penalties for breaking this law.

With heavy pressure from Congress, the FAA enacted section 333 exemptions, which allowed licensed pilots to request an exemption from the rules and legally fly drones for commercial use. This process was confusing and no one (even most FAA employees) really understood the process. So it was quickly replaced by part 107 which are the current federal regulations surrounding commercial drone use. It has greatly reduced barriers to entry and simplified the licensing process. And now, we are finally moving towards full integration of unmanned aircraft into the national airspace system.

### **III. Data Loggers**

#### **“Did you just put a pen inside my wall?”**

Temperature and relative humidity information is extremely beneficial in a CD case, as it allows experts to document and analyze the changing conditions not only inside of a dwelling, but also in other areas such as attics, inside wall assemblies or even down in a crawl space. With the information extracted from a data logger, one can compare how any given wall assembly is actually performing against its intended design performance. This is also known as a hygrothermal analysis. Data loggers also allow the ability to document and analyze how lifestyle habits and occupancy loading can be potentially affecting issues within building components. A dwelling with an occupancy loading over its designed limit, can be susceptible to high relative humidity as each occupant is constantly adding moisture into the interior atmosphere through perspiration, showering, cooking, etc. In the past it was fairly difficult to document the effects of occupancy overloading, but data loggers allow experts to log the temperature and humidity percentages over a predetermined period of time and log the times the sample was taken, as well. Since the data can be displayed on a graph, it allows a visual representation of peak times and a correlation to moisture content in the dwelling and the amount of possible damage to the building assemblies.

There are several types of data loggers available on the consumer market. Some are small pen shaped devices that can be set to record temperature and humidity information at predetermined intervals, while some can be connected to a cellular network and can send alarms to an individual if temperature becomes too low, or humidity levels too high. This information can be crucial to CD cases as they allow the ability to analyze how an occupant may be influencing potential issues on a buildings components which may otherwise be attributed to assumed deficiencies of some other building component.

#### **IV. Animation and the CD industry**

##### **Conveying information visually**

The CD industry is filled with technical terms and industry jargon that even many CD attorneys have a hard time following, let alone the average Juror who has little to no experience with construction or building related terminology. It can be difficult to convey information to people what specifically is happening at a project when it comes to CD cases. Most people living in today's world are visual learners, as we constantly have visual information depicting one thing or another on a daily basis. Animation allows CD industry professionals to visually convey a certain perspective to a jury, judge or mediator that would potentially confuse them if presented verbal in technical terms.

The theory of "micro climates" and "vapor drive" has always been difficult to explain to those outside the industry, or even to some inside it. But with animation technology we can now visually explain how they form, work and affect a building. Animation has also been extremely beneficial in conveying an individual's perspective on water infiltration sources, travel routes and ultimately the final accumulation point. Since these perspectives can often be difficult and long to explain verbally, a visual depiction in the form of computer animation is often a much better method.

Animation and drones are joining hands to accomplish a set task, as drones have the ability to capture actual conditions and topography of a site, from which an animator can build upon to set out in animating a point of view, scenario or theory.

There are several animation programs available. They can be very expensive for the versions that offer the most capabilities. The learning curve to be able to start from a blank canvas and end at a professional looking finished product can be extremely long. Luckily, there is a large pool of technically savvy people that can execute these jobs for you.

## **V. The CD industry going forward**

What does the CD industry look like going forward? Perhaps experts and inspectors will have their own drone hover board that allows them to fly up the side of a building 50 stories to look at a curtain wall assembly. Or perhaps we will have small flying robots that can reseal or repaint a building, significantly reducing repair costs.

No matter what, technology will continue to heavily influence the way collect, the amount we collect, and the types of data we can collect. Invasive openings may become a thing of the past once every smart phone has x-ray vision. We now have thermal imaging cameras specifically for smart phones. It seems like only a matter of time before we have x-ray vision for them, as well.

As technology becomes smarter and more affordable, we will begin to see it used during the course of construction to document critical processes and assemblies. In multi-family residential construction, builders are often using digital video cameras to document the air space in between units for use down the road should a claim arise. We are now reviewing job files in CD cases that have aerial progress photos from drones, which provide great documentation of the subject properties at critical points in the building process. In summary, the more data that can be acquired and analyzed in a CD case will always be extremely beneficial to the experts involved. Technology has and will continue to play a crucial role in the process.