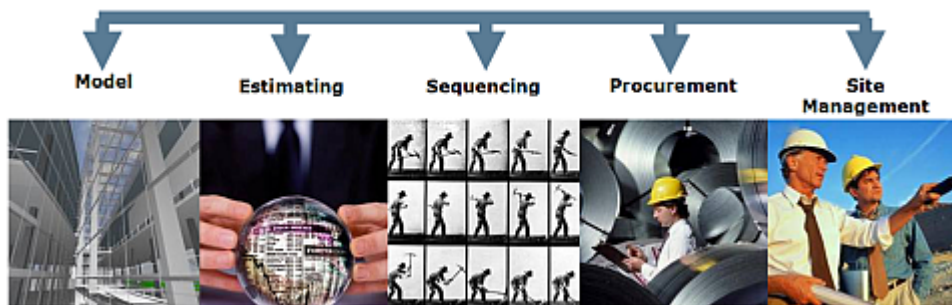


## Mitigating risk with Virtual Construction technology

**By Dominic Gallelo, CEO, Graphisoft**

Today, more and more construction projects are ironing out many potential problems before the first shovel of dirt is actually moved. This is done through 5D Virtual Construction™ technology, which uses a model-based approach for providing better data on projects to increase predictability, reduce risk and, finally, reduce the number of lawyers that are required after the project is completed to determine who owes what to whom.

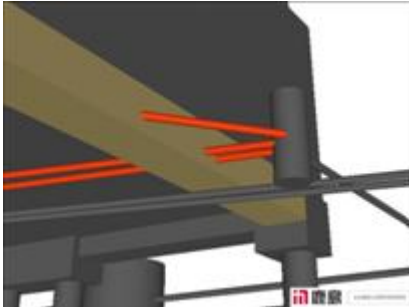
The concept is actually quite simple - a building model provides the only logical connection point for cost and time, identifying all the potential constructability issues. Further, because schedule (4D) and cost (5D) are connected to the model, any changes to the design are immediately reflected in the cost and, to a large extent, schedule changes. The estimate and schedule information is then used to further connect to and drive the downstream processes of procurement and accounting.



So what are the risks that virtual construction technology can mitigate? Of course, the list of risks in a construction process is seemingly endless. However, there are five big ones that immediately come to mind:

1. **Losing the bid risk** - Today, owners are more and more convinced that technology will help deliver their projects better, faster, and cheaper. Construction companies are bidding projects at an ever-increasing rate with a model based, "virtual construction" approach. In fact, relatively speaking, the adoption of model-based technology in construction is actually growing faster than the adoption in the architectural community. Why? Money. Owners are demanding virtual construction techniques on their projects as they know that the likelihood of improving scheduling and driving down overall project cost is high. A year ago, most owners did not know what virtual construction was. Now they are in many cases funding the contractor to employee virtual construction technology, whether the contractor was thinking of doing it or not. The newness of virtual construction will begin to wear off very quickly and move into a stage where some construction companies have now arrived.

Construction companies are now finding clear savings from employing a model-based approach to delivering their projects. To quote Dan Gonzales from Rogers Quinn Construction,



as he responded to a question from a large US federal government owner developer, "We don't charge any extra for applying 5D to our projects, we make money on it!" In June 2006, 40 members of the Association of General Contractors (AGC) gathered in Washington D.C. for a two-and-a-half-day, hands on session to learn how modeling technology can improve their business. The notion of 40 contractors spending two-and-a-half-days of their valuable time on the subject just a year ago would have been hard to imagine.

2. **Construction Documentation Risk** - We are finding over and over again that construction documentation and documentation changes are the biggest enemy to a contractor in terms of attempting to deliver projects on time and on budget. Drawings in which the information in the plans does not match elevations or sections is routine in most building projects. Elevator shafts that do not match up as they move from floor to floor are seen all too frequently. Coordination between trades is in many cases nothing short of impossible. Architectural plans where a column is in one physical location and in a slightly different location on a structural plan is all too commonplace. In many cases, there is just too much missing information in order to properly estimate, schedule, and build.

If we categorize these cases as "discrepancies," we often find up to several hundred discrepancies on large construction projects, sometimes on each phase from schematic design to the construction drawing phase. By taking a drawing and turning it into a model, discrepancies are easily and quickly discovered and can be resolved before the construction phase of a project. In order to deal with these problems, subcontractors have to pad their bids. Additionally, they do not use time and labor savings prefabrication techniques as often as they could because the poor quality of information on drawings makes it unreliable. British Airport Authority and other organizations have determined that they achieve two to three percent savings on overall project costs by just applying 3D and 4D techniques to their building projects in order to understand constructability issues which arise out of drawings. A good example of this was Kajima in the U.K: by employing 3D technology for understanding constructability issues, they saved £250k on a £75m project in Cambridge, England.

3. **Budget Risk** - For contractors, perhaps the biggest bottleneck to contractors winning business is the estimating department. Estimating, the art and science of measuring drawings, calculating quantities and finally calculating cost and margin is fraught with risk. There are never enough estimators that you can trust the really hard projects to and there is never enough time to perform estimates. It is not unusual to hear that all the windows on one side of a building were missed in the counting. With a model-based approach to estimating, contractors are finding that they can model and estimate in the same or even a shorter period of time, but with fewer mistakes. Further, as projects are constantly revised during each of the drawing stages, the ability to update the estimate becomes dramatically easier. "We have completed hundreds of projects with this technology and the results have been dramatic," according to Ilpo Jalasjoki, CEO of YIT Construction. "We have cut our project planning and cost estimating times by up to two thirds and have increased estimating accuracy. There are many other benefits that we have realized in our upstream and downstream construction processes."

4. **Schedule Risk** - According to the FMI/CMAA Fifth Annual Survey of Owners, the time to complete key phases of



construction run 20-50 percent longer than planned. Of course, time overruns impact everyone - from the owner, to the contractor to the subcontractors who have to face the eventuality of costly starts and stops, which invariably crop up on projects. A new breed of schedule and production controls systems are beginning to appear on the market, which do a significantly better job in helping project managers to plan schedules, modify schedules, and most importantly introduce a rigor to production control at the site which has heretofore not been seen.

This new breed of "flowline" applications is based upon two very important pieces of information that can be derived from the model: location and quantity. Location-based schedule and production control take this information to plan schedules with synchronized production rates which minimizes the likelihood of trades interfering with one another. The result is less wasted effort, idle time and fewer on-site conflicts. This helps companies to compress project schedules without increasing risk. It is often the case that schedules created in the industry's typical activity-based scheduling systems can be compressed 10 percent or more using the "flowline" technique without introducing additional schedule risk. Further, by using very specific location-based production control, companies are able to better understand the schedule impact of actual project productivity rates and better forecast early whether corrective action needs to take place on projects. On a 300M+€ city center project, the use of location-based technology for scheduling and production control by SRV Construction led to reducing the overall project time by a full six months on a planned four-year project.

Finally, one of the top two reasons why subcontractors pad their bids is because schedules are normally wrong and there are too many stops and starts on projects, which add to the cost of the project. Subcontractors are willing to lower their bids if they can be assured that the schedule is a well planned and stops and starts will be minimized.

5. **Communication Risk** - The better the tools used to communicate a project to all parties involved, the less risk a project has of going badly. The model-based approach provides for better understanding at every stage in the process. The owners can better understand what they are getting, estimators can have a much higher chance of estimating correctly, schedule planners can receive significantly more information to make a better schedule, contractors can better understand their assignments in the context of the overall project, and laborers on the site, who often cannot read drawings, can quickly understand the task at hand when it is described in a model. Just as T1 lines were brought to the construction site in the 90's as standard business process, models are now being brought to the construction site to ensure that the communication risk is dramatically reduced.

It is often said that construction companies cannot achieve the process efficiency that car companies have achieved because all buildings are one-offs. Although all buildings may be different, the components that make up the building are very similar. This allows for real mass customization process gains. This transformation to connected applications and data that easily flows forwards and backwards is bringing the construction industry into the process efficiency world that automobile and electronic product manufacturers went through in the late '80s and the '90s. As illustrated, the impact is already proving dramatic in a lot more ways than just minimizing risk!

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