

## VISUAL STORYTELLING: SHOW DON'T TELL!

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Here at the Advanced Technology Studio of Enclos the art of visualization is used to share visions of the future of the building skin. Whether it is realistic concept renderings, storyboarding, or 3D animations, the ATS visualization team is dedicated to providing powerful imagery to aid in all facets of our operations.

### PREVISUALIZATION

Previsualization of the construction process stimulates better decision making. It empowers everyone involved to anticipate and solve problems prior to making costly decisions. Our '*previs*' methodology takes the form of fully rendered 3D animations that accurately depict job sites and unique installation approaches.

Done accurately, this gives the team and clients three core benefits: the first is a solid collaborative understanding of the objectives; the second is the ability to represent multiple solutions to a problem and select the best approach for each condition; and the third is the ability to visualize spatial logistics constraints due to equipment, road closures, and existing structures.

### CASE STUDY: OCEANWIDE PLAZA, LOS ANGELES

Understanding location logistics was a key factor in simplifying the scope of this project. In a concise graphical representation, we were able to illustrate where all the building materials would come from, where they would be manufactured and assembled, and from where the finished assemblies would be transported. On top of that, showing the proximity of our office and facility proves our ability to perform operations with flexibility and fast response times.

Every construction site is a constant juggle of different operations and equipment usage. We used 3D to represent the sequence of facade installation activities on the project. Additionally, motion graphics showed our coordination with multiple crews on the three-tower job site. With just a few seconds of animation, it was demonstrated that nine different crews could operate on the site simultaneously.

Exploring various options is the biggest advantage of animations, as this allows multiple parties to get on board in the same mindset to hash out optimal solutions. With so many ways to pack a bunk, lift a bunk, design a system, and install curtainwall units, the ability to lay everything out and see the time and cost benefits becomes a cornerstone for the success of the project.



Some designs are better lifted using certain methods, while other designs may be more cumbersome to lift, but require less field work. Floor cranes are cheaper and give us more flexibility, but tower cranes allow us to pick from the ground and possibly pick multiple spans and several units at a time. Exploring these options visually not only clarifies certain scenarios, but easily rules out options due to limitations or constraints.

CONCEPT TO REALITY

In April 14th, 2016, the final CAD design for a custom flying gantry was ready to be used at the construction site of a high-rise tower in New York. This construction device was designed to slip two curtainwall bunks onto any floor of a building at the same time. With the help of the operations team, we reduced the complexity of the gantry CAD file and imported it into Maya, our primary animation program.

The flying gantry had multiple moving parts, all controlled remotely by an operator. Thus, the animated film needed to show not just how the device worked, but how workers would control and interact with it. With just two weeks to produce a full minute of 3D animation, the decision was made to 2D storyboard the entire video. Storyboarding is unique in that each sketch acts like a freeze frame of an animated film. This process of showing camera angles and character actions ahead of time became pivotal because creating 3D animation is time consuming and difficult to change.

During a short teleconference meeting, the operations team identified frames that needed adjustments, and requested an additional frame to emphasize the use of a remote control. Even before a single 3D asset was touched, we had successfully worked out the smallest details and found opportunities to eliminate redundant scenes in Maya.



FIGURE 1  
Flying gantry animation in Maya.

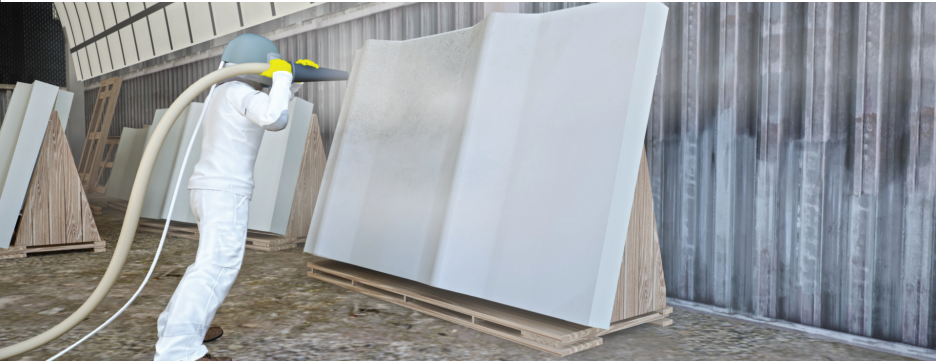
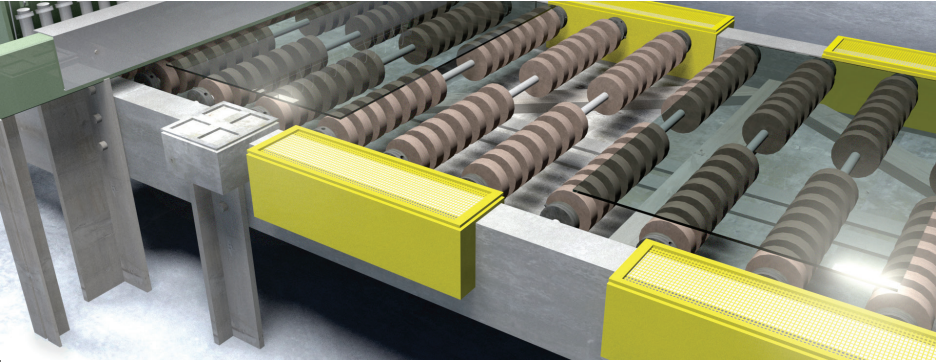


FIGURE 2  
Glass Cut.

FIGURE 3  
Sandblasting of FRP panels on SFMOMA.

FIGURE 4  
Aluminum die 00 to press.

To prevent downstream issues, all equipment and characters were measured to real-world scale not only ensuring that the gantry fit on a standard flatbed truck, but also that it could safely slide in between floor slabs. We went the extra mile by applying physics simulations to its bunk straps to realistically convey the weight and size of the gantry. And since we did not have to animate the straps frame by frame, the decision to use physics ended up saving time in the long run.

The final animation adhered closely to the storyboards, with a few shots combined to reduce camera cuts in the final edit and time spent designing and setting up multiple animation scenes. This combination of old school storyboarding and cutting-edge 3D graphics helped communicate the purpose and capabilities of the flying gantry evident in a visual breakdown.

VISUAL ACADEMICS

The power of visual storytelling offers incredible value in the learning process. The ATS visualization team has the capacity to provide an endless visual library of information and documentation. Visual academics can take the form of, but is not limited to, training videos, project specific documentaries, and conceptual design thinking.

CASE STUDY: BILLET TO BUILDING, SFMOMA FRP, DESIGN PERFORMANCE

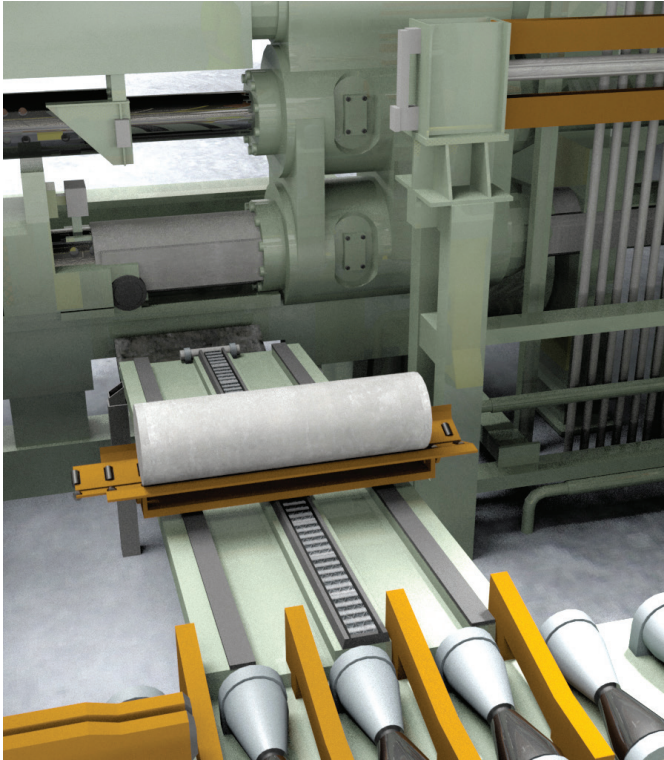
The ATS visualization team launched a series of academic videos called From Billet to Building that show key steps of curtainwall creation, from the early stages of fabrication and manufacturing to the final stages of installation. From Billet

to Building enables people with no prior curtainwall experience to learn the breadth of building skin technology in a matter of minutes. The series was conceived with the intention of being used as an introduction to new recruits. The utility of this learning series is still evolving and the modular design of the series allows itself to change as more technology emerges.

In addition to learning videos, we used animation to document the creation process of the San Francisco Museum of Modern Art panels. The decision to use fiber-reinforced polymer (FRP) panels provided by Krysler Associates was a significant reason for the project's success. This video takes viewers through hand lay-up compositing, sand blasting, curtainwall assembly, and finally the installation. Every project is a learning experience, and by documenting this,

we ensure that future endeavors will explore the best technology to keep us ahead of the competition.

Capturing design performance is another objective of the visualization team. In addition to full-scale seismic and water intrusion testing, we have the ability to pair those tests with 3D simulations. This enables the viewing of testing at the component level where each part can be isolated and viewed individually. For example, one can see the inner workings of seismic racking to understand how the system works before seeing it at a full-scale mockup. Another example is the ability to see water intrusion testing at a micro level, as well as test more extreme scenarios at the click of a button. We take pride in our curtainwall performance and want to be able to convey these technically complex performance issues.





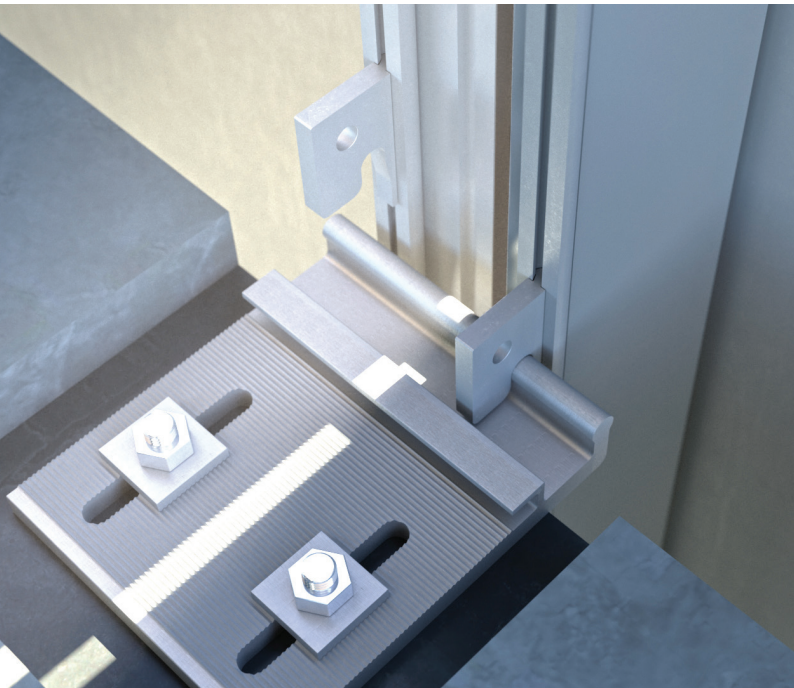


FIGURE 5  
Curtainwall units being set on anchors.



FIGURE 6  
An example of an accurately modeled construction site.



FIGURE 7  
Animation of units being delivered via man hoist



FIGURE 8  
Units being taken directly off a flatbed truck.



FIGURE 9  
Forklifts can be utilized for larger bunks.

## LIGHTING AND EDITING CINEMATICALLY

The physical properties of lighting can be simulated very accurately in 3D animation software like Maya, and our goal when developing still images and animations is to recreate those properties as accurately as possible.

When preparing a 3D scene for rendering, we first establish the time of day, taking into account the geolocation of the scene so that the azimuth and elevation of the digital sun is accurate. While Maya allows for the use of HDRIs, which are 360-degree sphere mapped images of real world environments, the limitation of HDRIs is that they are rarely shot with true dynamic range lighting and are shot on a variety of cameras. Finding reliable HDRIs can be challenging, especially if one is in need of a specific weather pattern in the backdrop. If the exterior source of

light is grounded in reality, then the 3D assets within each shot are much more likely to appear photorealistic.

Due to these challenges, the majority of our animations use what's called a *"physical sky"* object within Maya to get a good lighting base. The physical sky object has a sun that emits light and is visible in reflections, and the sky backdrop has a controllable amount of haze. Next, we add secondary sources of light referred to on movie sets as fill lights. The difference in lighting intensity between sunlit and shaded objects can be multiple exposure brackets, causing unnecessary lighting contrast that could potentially obscure a critical character or object within a shot, such as a flying gantry. Fill lights are large, low intensity lights that cast very soft shadows. By copying the color of the sky, we can use colored fill lights to illuminate dark, shadowed scenes in a believable manner.



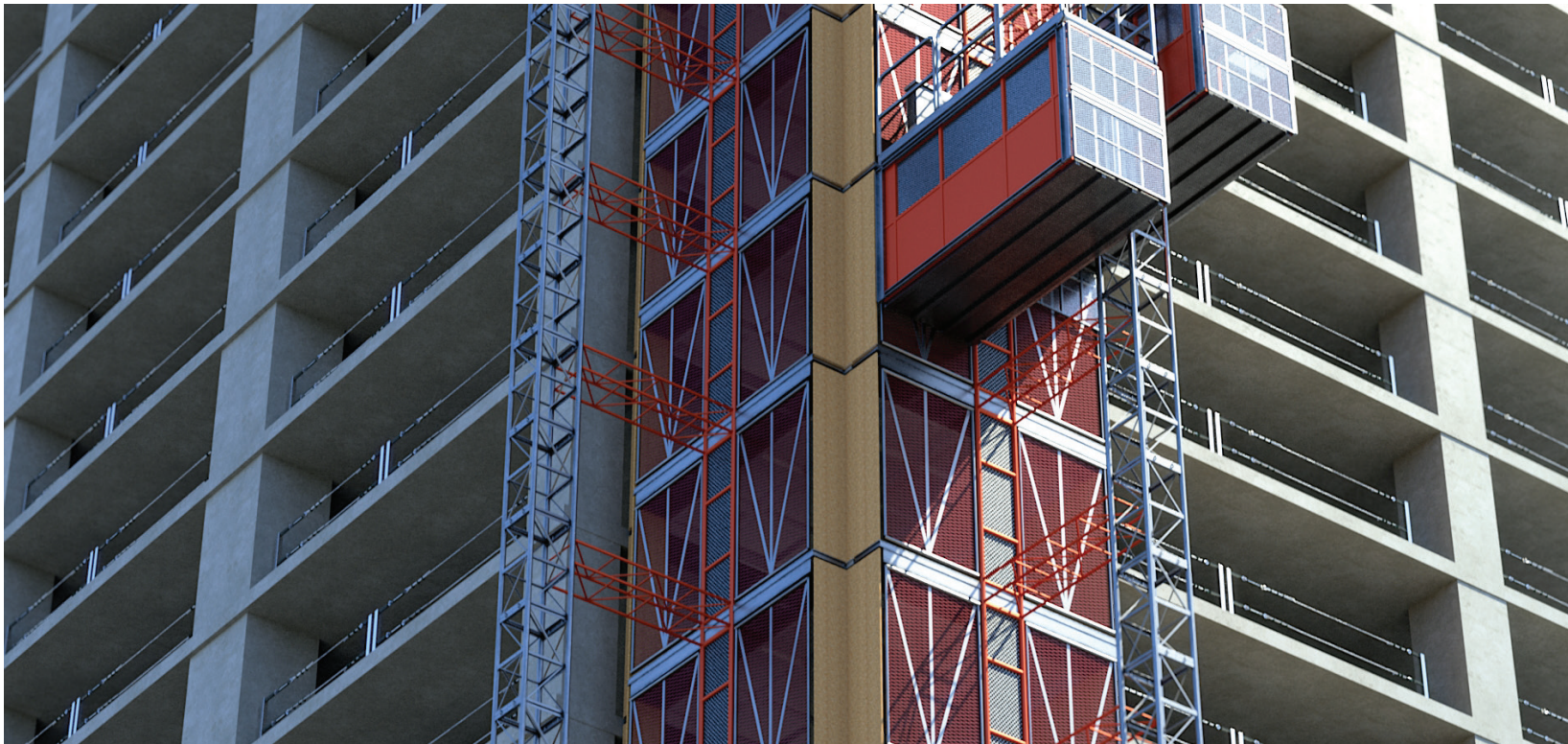


FIGURE 10  
How light blockers and area lights can  
enhance a shot.

FIGURE 11  
Manhoist

Sometimes, unwanted sources of light can negatively affect the composition or even realism of a shot. And digital characters will occasionally move through multiple lighting scenarios within a single shot, such as walking from an interior to an exterior. In these extreme cases, invisible light blockers can be used in Maya. What's great about blockers is that their positions and blocking angle can be animated, which allows the visualization team to make every camera shot as visually pleasing as possible.

While a strong grasp of the lighting tools within Maya are important to understand, the most valuable asset is familiarity with traditional concepts of color theory and film editing. The final animation needs to have as few camera 'cuts' in the edit as possible. Every time the camera cuts to a new position and moment in

time, viewers are forced to reorient themselves within the geography and timeline of the video. While quick, rapid-fire shots are popular in film and animation, we have found that long shots with multiple actions happening in sequence are much easier to follow.

The visualization team has vigorously studied this approach and applies it in scenarios where the object of focus does not change for roughly 15 seconds or more. For example, in one animation a curtainwall unit is lifted 20 stories, moved to its installation location, and then set in place by four construction workers. The first benefit of combining these three actions into one long shot was that fewer digital scenes had to be set up. The second benefit is that by starting with a wide view of the entire building and ending with a close-up view of a single





curtainwall unit, viewers have plenty of time to study every detail as the camera moves through the digital environment. Anchor locations, crane clearance, and safety zones can all be seen at once. No cuts needed.

While film editing is the backbone of animation, color theory is the component that unifies the final edit. What we learned during our study of psychologist Robert Plutchik's "wheel of emotions" is that a consistent progression of time from dawn to noon can evoke a positive emotional response. Lighting at dawn is very blue, and blue tints evoke a feeling of surprise and awe. As orange morning light is introduced, the viewer is inclined to feel interest and anticipation. And when the animation wraps up with strong afternoon lighting with a yellow tint, the viewer is inclined to feel joy and optimism.

This visually induced emotional journey becomes even more powerful if there are fewer camera cuts to distract from the events unfolding on-screen. We are always looking for ways to enhance the quality of our 3D animations by leveraging the lighting and animation tools within Maya. But we have learned the importance of also leveraging traditional art and film techniques to elevate the production value of the final product. We look forward to improving our visualizations even more in the coming years.



FIGURE 12  
Effective use of lighting can both enhance the cinematography and help outline important details, in this case, placing emphasis on a nighttime installation strategy proposed to meet a project schedule.