

SOLIDWORKS VISUALISATION

A guide to getting the most out of real time rendering with RealView
and ray trace rendering with PhotoView 360 in SolidWorks 2015



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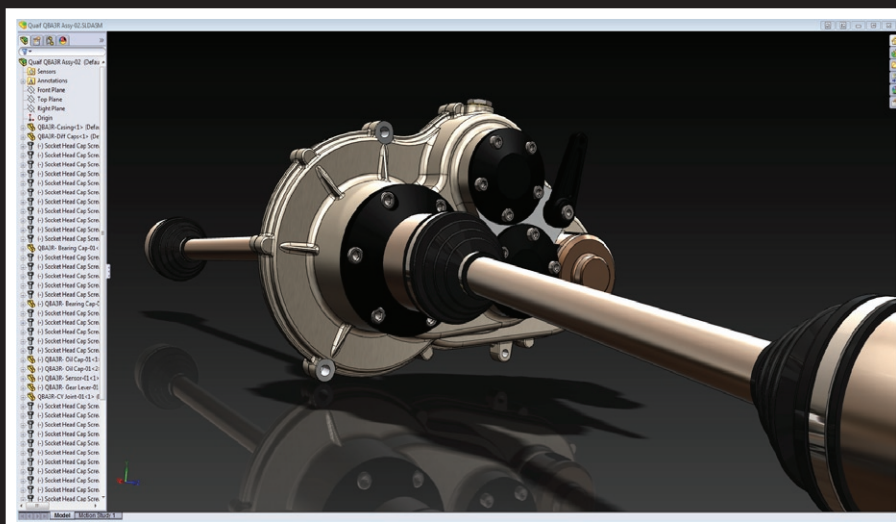
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DESIGN VIZ: KEEPING IT REAL

SolidWorks 2015 places a big emphasis on real time rendering with RealView playing a key role in its powerful design visualisation toolset



Long gone are the days when visualisation was only used to showcase final designs. Advanced rendering technologies and powerful workstation hardware now mean it can be an integral part of the design process. Visualisation can help designers and engineers make informed decisions at every stage of a product's development. SolidWorks PhotoView 360, the high-

quality ray trace renderer which comes with SolidWorks Professional and SolidWorks Premium, can produce stunning lifelike visuals. However, ray trace rendering, which simulates light and how it reflects and refracts off objects, can be very CPU intensive and take a considerable time to generate stills and animations.

But visualisation doesn't have to interrupt the natural flow of design. Real

time rendering makes it possible to get instant feedback on new design iterations. Designers and engineers can explore new forms and materials in tandem. Feedback from participants in design / review sessions can be investigated interactively.

Inside SolidWorks, real time rendering is enabled through SolidWorks RealView, which delivers realistic interactive models directly inside the viewport.

Each new release of SolidWorks raises the bar in terms of the visual quality offered by RealView. This is through new technologies such as Ambient Occlusion for more realistic lighting (right) and Order Independent Transparency for rendering semi-transparent objects (below).

RealView requires a workstation-class Graphics Processing Unit (GPU), such as AMD FirePro. As more effects are switched on a greater load is placed on the GPU so more powerful graphics cards help designers maintain full interactivity with the model.

RealView is not designed to replace PhotoView 360 but, when used together with the ray trace renderer, it gives SolidWorks users access to a powerful design visualisation toolset that can be used from concept to final design all the way to product marketing.

FASTER AND MORE ACCURATE TRANSPARENCY

SolidWorks 2015 features a display technology called Order Independent Transparency (OIT) that uses the GPU to render semi-transparent objects faster and more accurately.

OIT helps ensure that overlapping transparent faces blend properly, resulting in a much more accurate rendering of the model. As everything happens in real time inside the SolidWorks design environment it can help support better decision-making throughout the product

development process.

Prior to OIT, the CPU was used to sort transparent objects into order, but this could be slow and prone to errors. Every time the view changed the calculation needed to be re-done.

With OIT, objects don't need to be sorted before they are rendered and, because everything is done on the powerful GPU and less information needs to pass between CPU and GPU, the performance is much better.

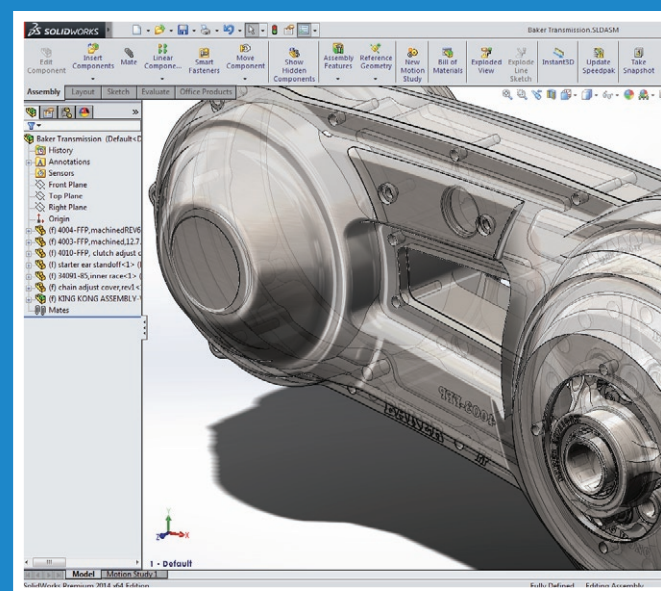
To get the best out of

OIT AMD recommends a GPU with at least 2GB of on-board memory, such as the FirePro W5100 or above.

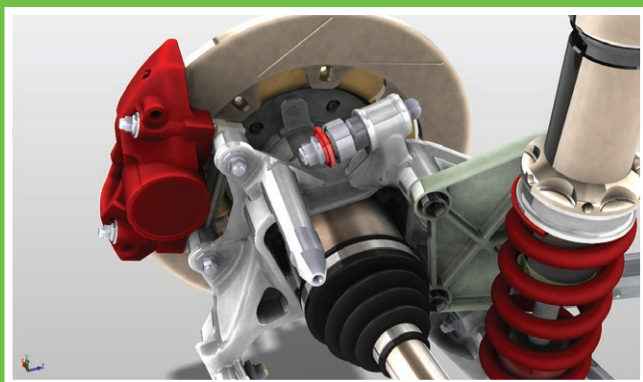
New for SolidWorks 2015 is the ability to use OIT as a part and assembly preview from the feature tree. This provides the user with useful information without having to enable all the parts. As the information is stored on the GPU performance is fast.

Left: Order Independent Transparency (OIT) turned ON

Right: Order Independent Transparency (OIT) turned OFF



ENHANCED REAL TIME LIGHTING



Ambient Occlusion (AO) is a real time lighting effect designed to better simulate the way light radiates in the real world.

In SolidWorks it can be enabled on top of RealView to further increase the realism of models inside the viewport.

AO controls how ambient light impacts shadows in hidden (occluded) areas. More sheltered corners of the model appear

darker than those that are more exposed. Objects appear as they would on an overcast day.

AO delivers the best results on non-reflective surfaces of solid colours and it is important to go easy on the lighting as too many lights can reduce the impact of the shadows.

As with SolidWorks RealView, a professional graphics card such as AMD FirePro is needed to enable AO.

PHOTOREALISM WITH PHOTOVIEW 360

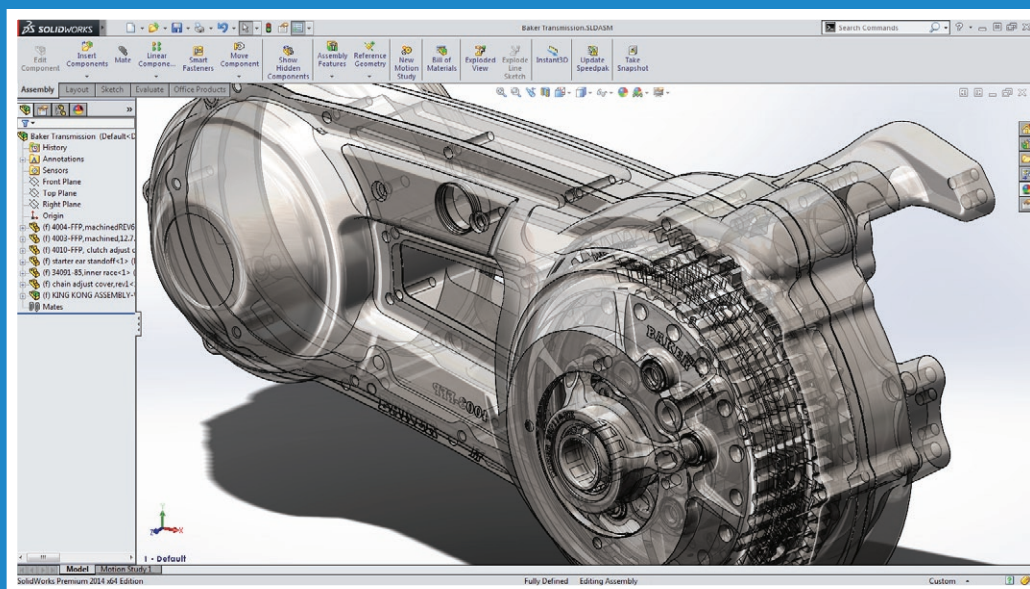
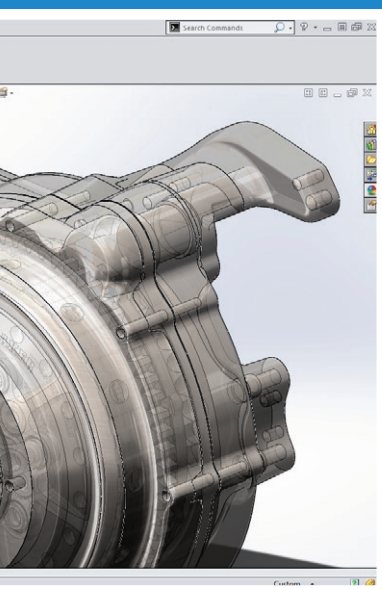
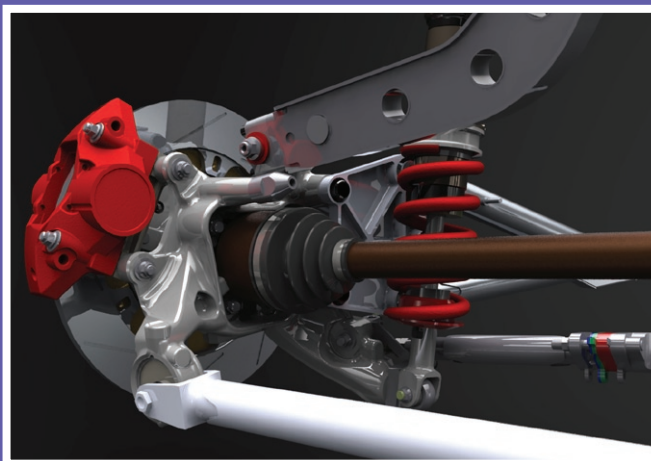
Highest quality photorealistic visualisations can be created with SolidWorks PhotoView 360, which is included with SolidWorks Professional and Premium.

The CPU-based ray trace renderer uses the same appearances, decals and scenes applied in the SolidWorks viewport so it is easy to use RealView and PhotoView 360 in the same workflow.

Ray trace rendering, which calculates how rays of light

bounce off objects within a scene, can be very processor-intensive. It uses all of the available CPU cores, so adding more cores to your workstation can dramatically cut render times.

Renders can be previewed in the integrated preview window so tweaks can be made before committing to a high-quality render. It is also possible to schedule renders to run overnight, making best use of available workstation resources.

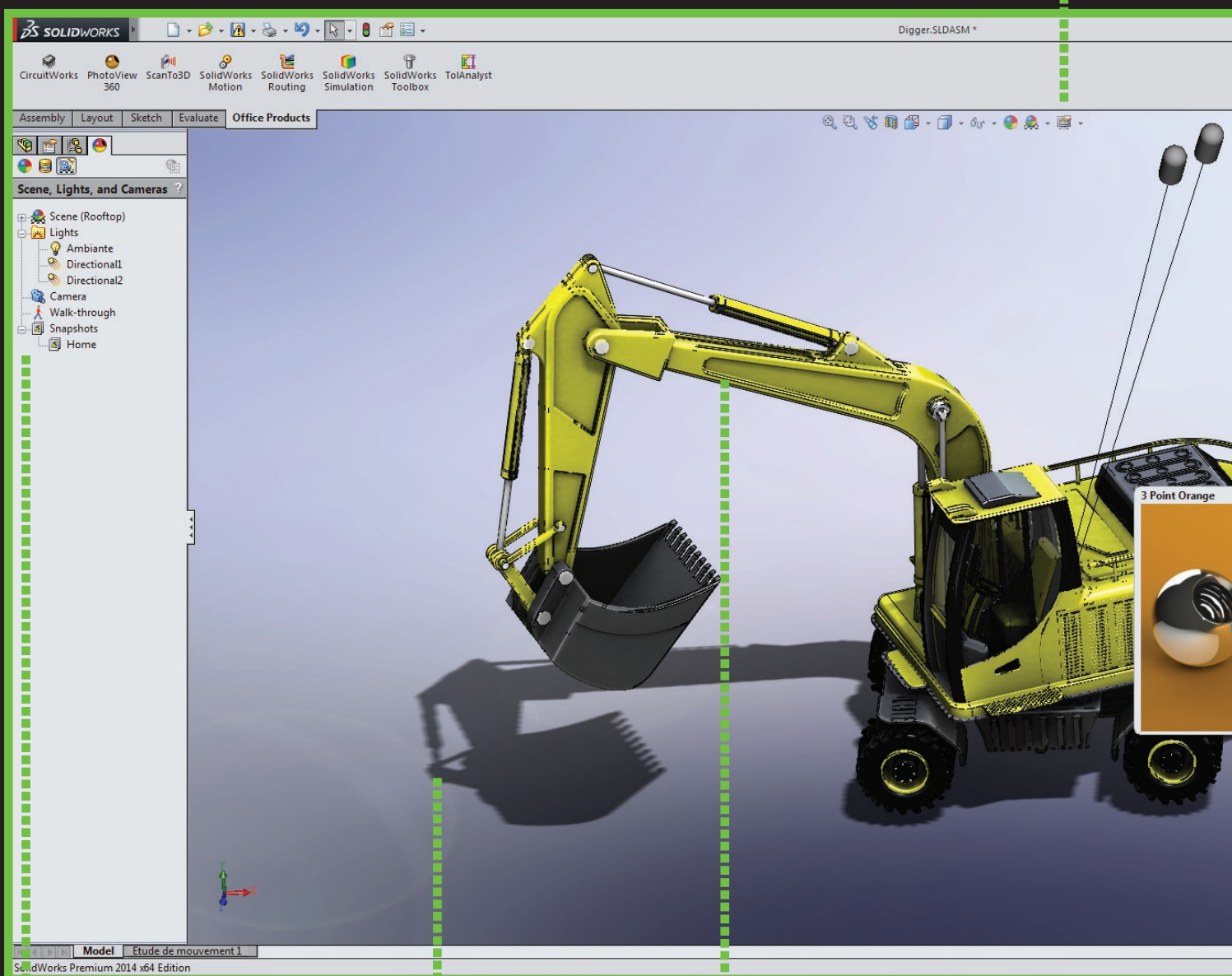


ANATOMY OF A SOLIDWORKS

Time spent setting up a scene in SolidWorks can pay dividends when looking to bring models to life with RealView or PhotoView 360

PERSPECTIVE

Orthogonal views are great for precise design, but they don't match how a product would look in real life. Switching to perspective view makes for a much better visualisation. Those looking to bring even more realism to their view should investigate the camera functionality (see right). This offers greater control – just as you would get with a physical camera.



PROPERTY MANAGER

The PropertyManager can be used to control all aspects of a visualisation including lights, cameras, scenes, material definitions, and appearances.

It is often easier to control the whole process from here, rather than trying to navigate through the model. The PropertyManager also allows gross edits to be made to appearance definitions applied across the model, saving a lot of time during set-up.

FLOOR

To achieve accurate shadows, it is essential that the floor position is defined correctly. This is found under 'Edit Scene, Floor position'. The easiest method is to add a work-plane at the required position as this will adapt to any subsequent changes and save you having to redo it.

APPEARANCES

When a part is given a physical material it is also assigned a default appearance which emulates the look of the material. These are consistent across SolidWorks so what you see in RealView should give a good approximation of what to expect in a PhotoView 360 rendering.

Appearances can be changed by dragging and dropping them onto parts or faces. This can be useful when parts are painted or have different finishes. Appearances can be customised and saved in a materials folder, which can be shared on a network. It is important to learn how the hierarchy of the assembly tree

WORKS SCENE

LIGHTS

By default, scene lighting is derived from the scene environment (see below) but it is also possible to add in additional lights. This could be to 'guide' shadows, highlight specific aspects of a design or replicate real world lights.

Lights in SolidWorks mimic real world sources and include basic omnidirectional lights and targeted lights (such as spot lights). It is also possible to replicate the Sun using geographic and time-based inputs.

CAMERAS

Models can be moved into position using standard SolidWorks navigation but cameras offer a lot more control. They also have the added benefit that they can be animated.

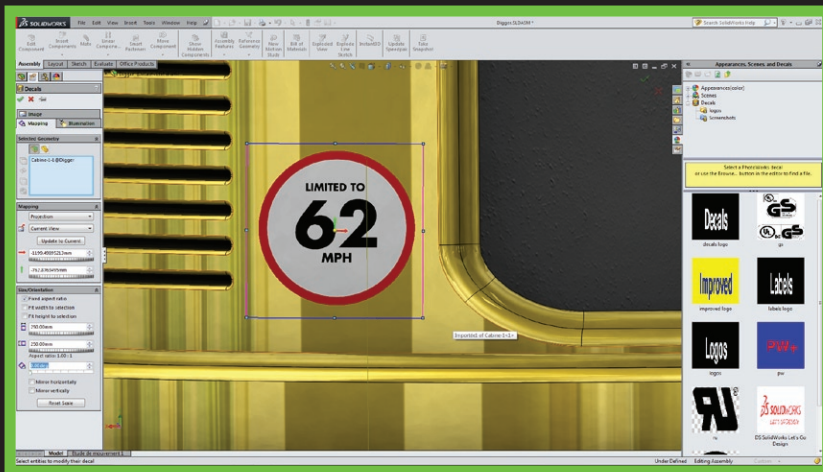
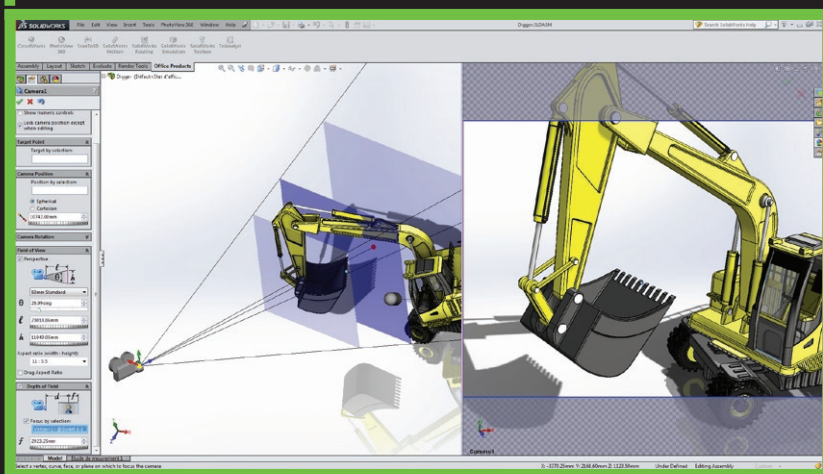
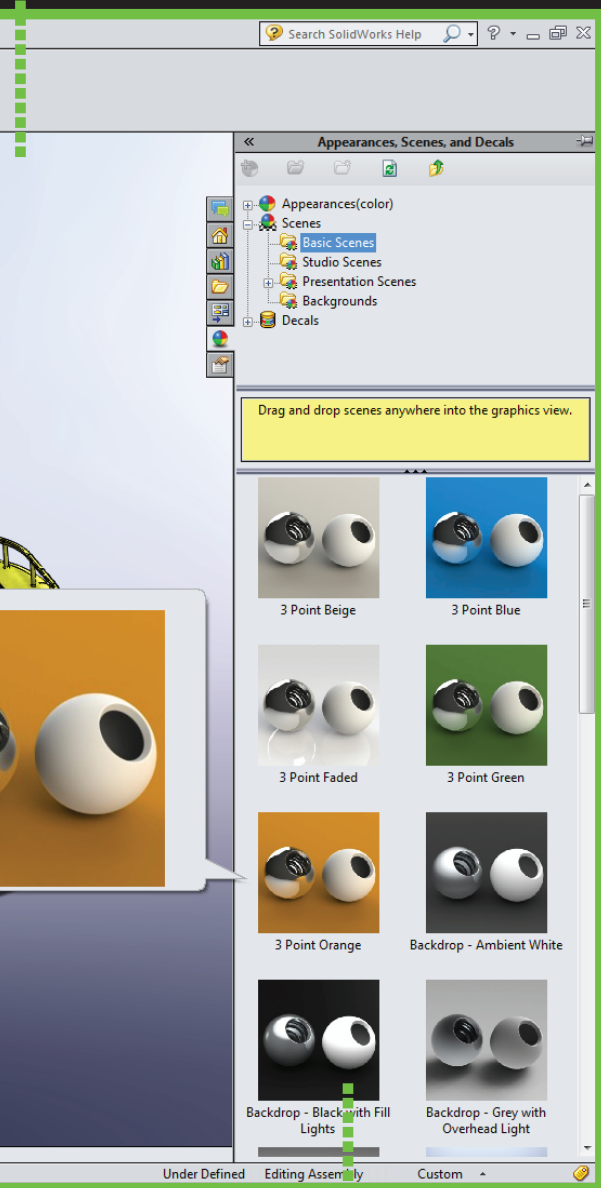
SolidWorks cameras are analogous to physical photographic equipment and there are controls for aspect ratio, focus and camera position.

Focus snapping is particularly handy as you can link the camera to specific portions of geometry so model updates can be handled very quickly.

In PhotoView 360 (but not in RealView) Depth

of Field (DOF) can be applied so objects in focus appear clear and crisp, while others are blurred. This is particularly effective when rendering out larger products or when you want to focus on specific features or areas of a design.

DOF in PhotoView 360 mimics real cameras and provides the same level of control over what's in focus and where the blurring starts (the focal length of the camera). Pick up a book on traditional photography as this will give you an excellent grounding to help you get the most out of cameras.



DECALS

Appearances allow gross textures to be applied to faces, parts and bodies. However, there are occasions when additional details are needed — perhaps for branding or certification logos (think: CE marks) or to add context and realism. These are called decals.

SolidWorks allows decals to be placed in relation to specific geometry. Users also have control over transparency so use an image format that supports this (PNG or TIF).

Decals can be added ad-hoc or shared for repeat use across a design group using the SolidWorks appearances manager. They can then be dragged and dropped into position. Any changes to the underlying decals (such as shift in standards requirements) can then be propagated throughout the visualisation workflow more easily and consistently.

SCENES

SolidWorks comes with a number of pre-set scenes to help visualise designs in terms of lighting and context.

Basic scenes offer a variety of colour backgrounds and lighting conditions. Studio scenes are designed to replicate photography studios. Presentation scenes add real-world backgrounds.

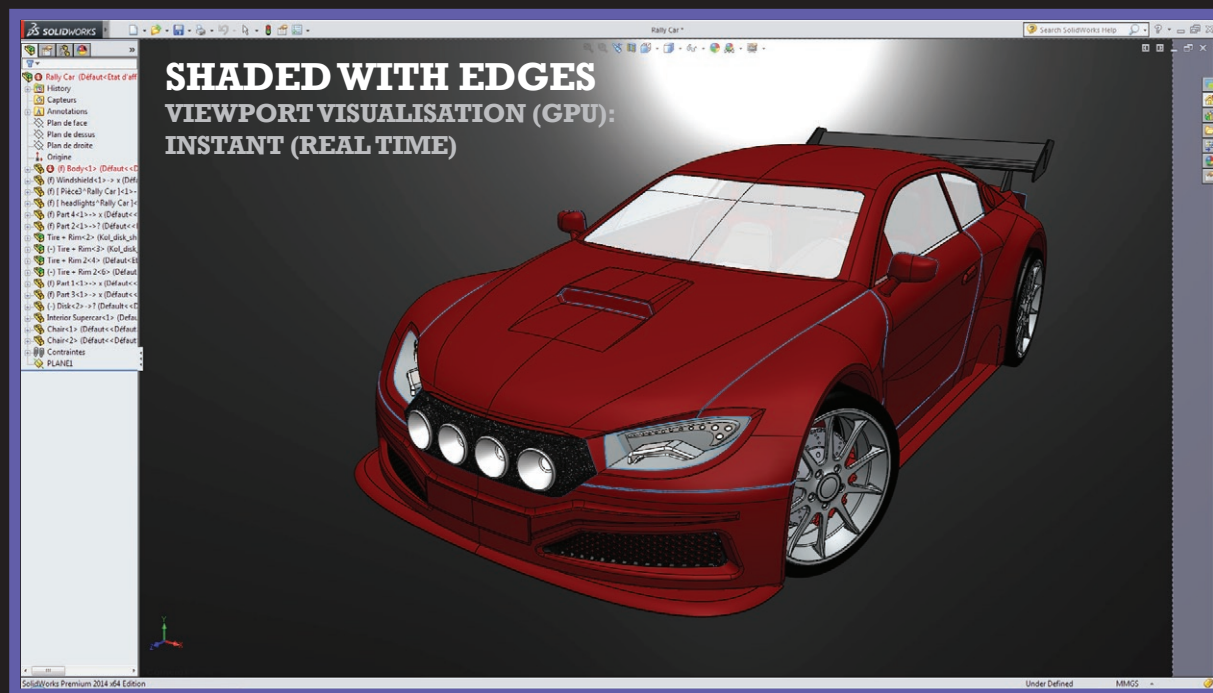
Each scene is directly transferable to PhotoView 360, adding lighting conditions based on HDR images.

HDRi-based environments and scenes can also be imported from externally sourced HDRi libraries to better match your requirements and the context for your product. Often, matching back places can be acquired to add greater realism.

affects appearance definitions, as there is an order of priority. Additional materials, including higher quality procedural textures, can also be downloaded from the PhotoView 360 asset sharing web-site. However, it is important to note that these may look significantly different when visualised in RealView.

COMPARISON OF VISUALIS.

SolidWorks features a number of ways to visualise your 3D models: interactively inside the viewport or photorealistically with an offline render. Below we present an automotive model in four popular modes.



Shaded with edges is a popular rendering mode for 3D modelling. It helps highlight the topology of a model, clearly showing how parts interact with each other.

In this automotive model users can get a very good understanding of the complex surface-based geometry.

Depending on model size most modern professional graphics cards, including the AMD FirePro W4100 or W5100, coupled with a CAD workstation such as the Dell Precision Tower 5810, should deliver good performance in this mode.



RealView delivers much more realistic effects inside the viewport. This helps bring SolidWorks models to life in an interactive 3D environment ideal for presentations or design / review.

RealView supports environment reflections, floor shadows, and multi-coloured effects such as car paint. In this automotive model shadows add realism and depth.

RealView requires a professional 3D graphics card, such as AMD FirePro. 3D performance should increase with higher-end cards, such as the AMD FirePro W7100, housed inside a Dell Precision Tower 5810 workstation or similar.

ATION MODES



Ambient Occlusion (AO) can be switched on in addition to RealView to add more realism to models through enhanced shadows.

With our automotive model the shadows cast as a result of AO add more drama to the scene. This is particularly noticeable around the wheels, windscreen, headlights and bonnet where darker shadows appear in more occluded (hidden) areas.

Turning on AO puts bigger demands on the GPU so a higher-end card, such as the AMD FirePro W7100 is recommended.



PhotoView 360 is used to produce highest quality visuals for stills or animations. It is a ray trace renderer which means it simulates how light bounces off objects within a scene.

With this automotive model the details around the headlights and wheels and the interior appear much more realistic.

The downside of ray trace rendering is that it is computationally intensive and can take minutes or hours to render a scene. It will benefit greatly from a dual CPU workstation such as the Dell Precision Tower 7810.

¹ Test machine: Dell Precision T3500, Intel Xeon W3520 (2.66GHz) (quad core), 12GB RAM ² Max quality gives best results with highly reflective materials

SOLIDWORKS: WORKSTATIONS

To get the best 3D performance when visualising scenes with RealView make sure you kit out your workstation with the right GPU



SPECapc for SolidWorks 2013 (bigger is better)¹



In basic SolidWorks viewing modes such as 'shaded with edges' most professional 3D graphics cards with 2GB or more of on-board memory should enable designers to navigate models smoothly.

However, when RealView and Ambient Occlusion are switched on, or model size increases, frame rates may slow down with lower-end 3D graphics cards.

AMD recommends two main

FirePro GPUs for use with SolidWorks 2015. It positions the FirePro W5100 for mainstream workflows and the FirePro W7100 for those that work with particularly complex assemblies or demand model

interactivity is maintained when top quality real time rendering modes are enabled.

The chart above shows the performance of the AMD FirePro W7100 relative to its predecessor, the FirePro W7000.

The Dell Precision Optimizer (DPO) is a free utility for Dell Precision workstations that allows SolidWorks users to tune their machines

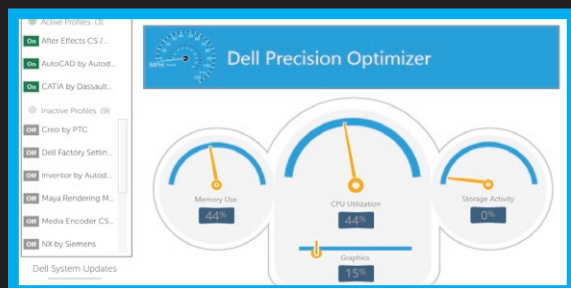
The Dell Precision Optimizer dynamically configures your Dell workstation helping ensure it is optimised for your workflow. It includes a range of CAD application profiles that optimise the CPU, GPU and systems settings.

By switching on the SolidWorks

profile, Dell has reported graphics performance increases of up to 57% in SolidWorks 2012.

Memory, CPU, storage and GPU utilisation can be monitored to help identify bottlenecks.

Drivers can be automatically updated, sometimes resulting in better 3D performance thanks to graphics optimisations.



Dials showing how each workstation component is being utilised in real time



Dell Precision T1700 MT workstation

Single processor mini tower desktop recommended for entry-level to mainstream SolidWorks workflows



Dell Precision Tower 5810 workstation

Single processor desktop recommended for more demanding SolidWorks users with real time visualisation workflows



Dell Precision M4800 mobile workstation

Powerful desktop replacement with 15.6" display and AMD FirePro M5100 workstation graphics. Ideal for mainstream SolidWorks users

¹ VIEWING MODE COMPARISON IN SOLIDWORKS 2013. TESTED USING THE SPECAPC 2013 BENCHMARK (HIGHER SCORES = BETTER MODEL INTERACTIVITY)
TEST MACHINE SPEC: INTEL XEON E5-1660 CPU (3.30GHZ, 6 CORES), 16GB RAM, AMD FIREPRO W7000 GPU (13.352.1014 DRIVER) AMD FIREPRO W7100 GPU (14.30 DRIVER), WINDOWS 7 X 64 (SP1)

CONTACT

Dell Precision
www.dell.co.uk/precision
Call Dell now: 0-844-444-3480
Dell Products, c/o P.O. Box 69, Bracknell,
Berkshire RG12 1RD, United Kingdom

AMD FirePro
www.amd.com/uk/firepro
Mark Andrews, Workstation Graphics
E: mark.andrews@amd.com
M: +44 (0) 7795 486 366

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