



Alasdair Kirkwood of L&M Survey Services reviews the state-of-play of HDR camera technology and how it is revolutionising data-usability, efficiency and safety in the surveying sector

Visual asset surveys using High Dynamic Range (HDR) imaging was, until recently, one of the last remaining frontiers for advancement in the surveying sector. Prior to HDR, when the only available technology was Low Dynamic Range (LDR), the limiting factor with visualisation surveys was that the actual scene being surveyed had a huge dynamic range that couldn't be completely captured in a single exposure.

That meant, when using LDR cameras for surveys, the image obtained was either overexposed in the bright areas but captured the dark regions well, or *vice versa*. As a result, the images contained areas that were under or over-exposed, leading to significant loss of data. Conversely, HDR surveys are able to enhance the dynamic range of traditional imaging 'sensors' resulting in better pixel-level detail and no loss of scene information. For instance, HDR avoids the loss of colour vision in dim lighting conditions - a significant improvement on current imaging technologies.

The result are real-world images

that are brighter and more colourful than traditional methods and which present much high levels of contrast between different objects. In simple terms, it results in better quality visual surveys equivalent to what is seen by the human eye.

CGI pedigree

Advances in HDR imaging have come directly from the CGI industry, with more than 600 cameras already in service worldwide. This pedigree is one the reasons why the use of HDR is gaining impetus in the surveying sector, helped by the fact it can manipulate and store all colours and brightness levels visible to the human eye and beyond, resulting in a greater level of detail and clarity.

For instance, HDR SceneCam cameras and content management software from Spheron-VR AG of Waldfishbach-Burgalben in Germany lend themselves to a wide variety of roles such as dilapidation

HDR: all in a night's work

and inspection services, VR content capturing, 3D from photogrammetry, and site familiarisation and documentation.

The technology provides a highly cost-effective and efficient solution for general on-site scene documentation and simplifies on-site communication by linking high quality pixel visualisation technology to real business asset data. This can significantly improve on-site awareness as well as aid the proficiency of users.

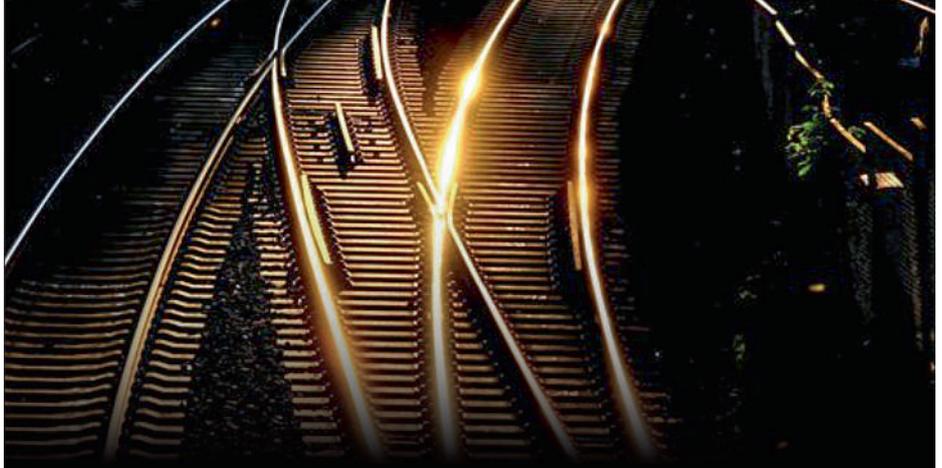
New workflows

As well as their ability to capture in detail under varying lighting conditions, the latest HDR cameras and software are also able to interpret, analyse and report on locations, sites or assets. For example, new workflows have already delivered benefits for our clients in terms of an ability to react, discuss and improve site communications and reduce the need for continuous costly onsite visits. These kinds of platforms build consensus with colleagues about a location and facilitates effective collaborative decision making, allowing users to virtually visit sites plus exchange and distribute information instantly all via their desktops.

In addition, being able to map the site as a 360° full colour tour and take dimensions from anyone's desktop means more efficient use of time and reduced schedule on site. This can improve productivity by around 20 per cent, equivalent to adding an extra day's work for each person – a significant saving for any business!

So, we can see that being able to interpret, analyse and report on sites or buildings remotely dramatically improves business efficiency, whilst reducing costs by avoiding continuous onsite visits. It achieves this through remote virtual location access, whilst the collaboration tool between multiple users provides a shared communication platform.

Authorised personnel are able to explore a scene remotely via an online database portal. An added feature of



Case Study: Rail tunnel inspection survey

L&M was asked to complete an inspection survey of a working railway tunnel in the East Midlands. For this purpose, the surveyors used a 32-bit High Dynamic Range (HDR) 'SceneCam' camera and battery powered 'ScanLight' lighting system because of its ability to capture all the detail present despite the complete darkness.

A two-person team, using three HDR cameras, was deployed and completed the survey of the approx. 1000m long tunnel over three nights. Image-pairs were recorded every ten metres at chainages that had been marked out with survey chalk and referenced to a mile-marker, located just outside the tunnel. Three image locations were captured simultaneously and the cameras then moved on to the next three locations.

The HDR camera captures a single, continuous image around a full 360 degrees in the horizontal and 300 degrees* in the vertical, using a slit aperture and a fish-eye lens. No stitching of images was required. The camera captures 26 F-stops simultaneously. In

daylight, this captures all the prevailing lighting conditions, allowing the viewer to look into the darkest shadow yet still clearly see detail in the brightest areas. On this occasion, it allowed the viewer to brighten the data from dark conditions to a detailed, vibrant dataset.

Once the fieldwork was complete, the processing began. The images require no 'cloud-processing', so all data is retained by the operator. The spherical images were imported directly into Spheron's own SceneCenter software, with project deliverables being a complete visual tour of the tunnel. The spherical data set was augmented by importing the additional images, PDF drainage reports of the catch pits, as well as other reports, all of which can be viewed within the software.

Once complete, the report allows the viewer to navigate through the tunnel in a similar way to Street View. The viewer can increase the brightness, zoom in, open reports and also measure dimensions straight from the images thanks to the capture of stereo-pairs at each location.



The author, pictured at this year's GEO Business Show, with the latest version (2.0) of the SceneCam camera. It is shown here equipped with the plug-and-play Scanlight. The latter employs a narrow and focused white light LED illumination to capture accurate documentation, even in low or no-light conditions.

Photo: GeoConnexion

the system is its ability to provide a collaborative environment for users to maintain the integrity of all visual assets and their associated information. The SceneCam software enables users to access both locally and or via an online database portal, providing virtual site access 24/7 from anywhere in the world.

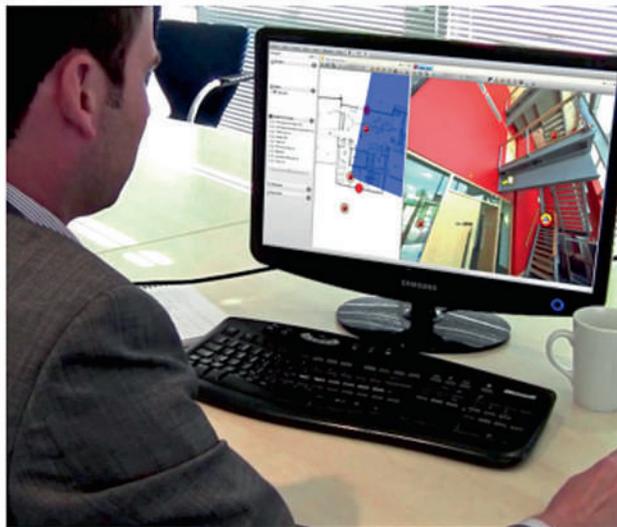
There are important health and safety benefits, too; For example, HDR camera and software technology enables surveyors and their clients to familiarise themselves with the site access points and track conditions from the safety of their desks, before they try to find, park and access in the middle of the night.

In terms of asset management, HDR establishes a visually based central database storage facility for all recorded digital asset and facility information. This encompasses documenting and communicating aspects for many applications such as restricted access visuals, condition survey assessments,

maintenance reports, asset care, fire risk assessments and insurance inspections. In addition, training, dilapidation and inspection services, VR content capturing, 3D from photogrammetry, site familiarisation, site security and asset audit reports, plus many others can all be carried out using the HDR technology.

Investing in the future

The ability of HDR to make a step change in effective rail surveying was good reason for Kilmarnock-based L&M Survey Services to invest £1.2m in SceneCam Cameras and SceneCenter 2.0 content management software. The initial decision was based largely on the perceived benefits of reducing risk to its own staff while working on-site and which is particularly important in rail surveying, the company's primary area of expertise. The technology allows its survey teams, clients and their partners to visit sites, familiarise themselves with site access points and track conditions



– all from their desks, thereby reducing risk and saving time on-site ... the biggest single contribution to rail staff safety since the invention of hi-vis.

L&M clients are constantly asking for more site information as they realise the savings in time and money to be enjoyed at every stage of a project. HDR technology has the ability to meet this need and it has already become a valued addition to the company's normal topographic survey deliverables, 2D, 3D drawings and Revit Models. Any documentation can be attached to the spherical images, from survey data and drawings, as-built information and reports, to safety notes and handover documentation. All can be achieved using an interface that anyone can use without having a CAD licence or specialist software from wherever they sit.

1 www.vam-is.com

Alasdair Kirkwood is the Commercial Director at L&M Survey Services (www.lmsurveys.co.uk)

L&M acquired 22 SceneCam cameras (far left) and associated SceneCenter desktop content management software (left) for its game-changing 'night to day' Visual Mapping service.

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