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Multimedia Collection Databases

1 HIGH RESOLUTION DIGITAL IMAGE STORAGE AT THE NATIONAL RAILWAY MUSEUM, YORK

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This paper describes a project which is currently in progress, to make accessible, through electronic means, the 750,000 images in the photographic archive at the National Railway Museum (NRM). The circumstances surrounding the present storage and use of the photographs is described, together with the case for electronic storage. At the outset it was felt that electronic methods would have advantages over the present manual systems, and that in any case it would not be practical to use the existing methods for a significantly greater number of photographs. The paper reviews the available image storage technologies, and describes why a high resolution digital system was chosen. The operation of the system is described.

The collection

The National Railway Museum's photographic archive contains images of Britain's railways from 1866 to the present day with a distinct concentration in the 1890 to 1950 period. Most of the images are held as negatives. The negatives originate from the railway companies themselves who employed photographers to record the output of the railway works and developments along the system and from private individuals with an interest in railways and locomotives. The official railway negatives together with some 200,000 negatives in various private collections acquired by the NRM, constitutes one of the most comprehensive and outstanding railway photographic archives in the world.

The collection covers a very wide range of social, economic and technical subjects and is of interest to a number of academic disciplines. Included are views of:

Landscapes and areas served by the railway
Urban and industrial scenes
Stations including major termini and branch lines
Railway road, air, shipping and dock facilities

Wartime services
Major civil engineering works
Locomotives and rolling stock
Railway workshops
Railway staff in all grades
Floods and snowdrifts and their effects on the railway
Accidents
Storage

In 1975 when the present National Railway Museum was set up in York, about one third of the official British Railways photographic collection came to the Museum under the provisions of the 1968 Transport Act. British Rail has now released the remaining two-thirds of the collection to the Museum, bringing the total number of negatives held by the museum to around three quarters of a million.

The collection of negatives at present at York is stored in an environmentally controlled store. There is no public access to this area of the Museum as researchers are not allowed to work with the negatives themselves.

The remainder of the collection is at present stored in a Science Museum store in Kensington, London until the NRM can raise the necessary money to equip a new negative store to the required standard.

Access

About 25,000 images from the collection stored at York are available to the public as reference prints mounted in ring binders held in the Museum Library. The images are grouped by railway company and then by locomotive class or carriage type or in broad subject groupings such as accidents, stations, war. The prints can be consulted during reading room opening hours by any interest parties. Many more images are listed and the lists are also available in the Library.

As an aid to finding images there is a rudimentary card index by subject and locomotive type which refers the reader to the relevant guard books. There is no detailed cross referencing system to indicate for example that a certain locomotive is standing in a certain station. The photograph will have one entry in the card index either for the locomotive or for the station depending on what the cataloguer thought was the main subject. Orders for prints from researchers, authors and publishers are provided by the Museum's own photographic studio.

As only a fraction of the negatives held by the Museum have been printed access to the collection has always been a live issue at the Museum. It was in an attempt to tackle this problem that electronic imaging equipment and a computerised text record were investigated.

The arguments for not continuing as before are compelling. Firstly there was the problem of space. To store prints, mounted on card, in binders in the Reading Room occupies a considerable amount of space. We would have had to provide thirty times the current shelving space to house three quarters of a million prints in this way.

Secondly there was the problem of studio time required to make acceptable prints from the glass plates. It can take up to fifteen or twenty minutes to produce a print from a glass negative and the existing studio staff and darkrooms are fully occupied with public orders and record photography. Additional photographic staff and more darkroom space would

have been required to undertake a printing exercise of this magnitude or an outside contractor would have had to be employed, with all the difficulties that that involves.

Thirdly there is what can be described as "the Science Museum factor". This is the fact that the National Railway Museum is part of the Science Museum, and as such there is a view that we should be taking a lead in the use of new technology for making our collections available. This was, we felt, a fairly strong influencing factor.

Fourthly there was the view that in the not too distant future there will be a strong market for images on CD and the National Railway Museum wished to be in the forefront of any such developments.

These factors taken together determined the Museum to investigate electronic imaging. At the outset it was decided that any system adopted must be capable of standing the test of time, producing high quality images which could be copied without degradation.

Imaging technology survey

Having decided that some form of image system was desirable a survey of the available technology was carried out with the aid of an independent consultant, Peter Cheese of Cambridge Multi-media Plc. The full range of technologies which may have been appropriate were investigated:

Low resolution digital imaging can be supported on a system based around an IBM PC or clone. The technology is easily available, well understood and relatively inexpensive. The system in use at the National Gallery in London is based on the Apple Macintosh Computer and has a resolution of 700 x 700 pixels. A low resolution digital system would provide a good means of storing images where text and image need to be mixed on the same screen and where image quality and the quantity of images on-line are not important

Broadcast quality analogue is the type of image which appears on European television sets. It equates to 768 x 575 pixels and may be stored on video tape or disk. The system provides a convenient means of enabling a large number of images to be on-line at once, at an acceptable quality but there is some degradation when the images are copied. A separate PC is required to control the disk device to facilitate indexing and the display of text associated with an image.

High definition television is likely to become the domestic norm of the future. This analogue technology is the equivalent of a digital image of 1920 x 1035 pixels. Such systems are likely to have similar advantages and disadvantages to the current Broadcast Quality Analogue but at a much higher definition.

High resolution digital images of at least 2000 x 2000 pixels are of a similar quality to High Definition Television and approach the quality of a 35mm conventional photograph. Digital images can be copied without degradation. Such systems however are costly and few images can be available simultaneously on-line.

Kodak Photo-CD stores images in digital form at a resolution of 2048 x 3072 pixels. At the time the survey was carried out, input was from 35mm negatives and transparencies only. Images are of similar quality to conventional 35mm photographs. Full colour images occupy 2.5MB for storage on a CD-ROM at a density of 100 per disk. Kodak are aiming this product at the domestic market in the first instance. Latterly Kodak have introduced a range of products which are aimed at professional users, including scanners for negatives at larger formats than 35mm. However, there is still no direct means of importing images from glass negatives such as those at York.

Pre-press technology is used to provide input to photo-lithography. The images, in digital format, are of high resolution. The systems are very specific to the printing industry and generally lack the database facilities needed to manage a library of more than a few hundred images. Having reached the required standard for the printing industry, the technology shows little sign of developing further.

The survey suggested that we should look at the project as a two stage operation, one image capture and archive, the other image display. The image display system would be required to make available a large number of images of at least Broadcast Quality Analogue. Both the Philips Laservision and the Sony CRV technologies offered the required quality and quantity of images. The Philips system is less expensive but would require laservision disks to be mastered away from the Museum. It was therefore felt that the Sony Worm discs might be preferable as images could be transferred to this media as required.

The image capture system would be required to record and store high quality images which could be copied without degradation. 35mm photographic quality would be acceptable. It was therefore decided to reject low resolution digital imaging because the quality was below the present threshold of domestic television and would certainly become unacceptable once HDTV had become commonplace. Broadcast Quality Analogue technology was also rejected on the grounds of quality and durability. Pre-press technology had no obvious development path, lacked database support and flexibility of output. Kodak Photo-CD offered the necessary quality but involved the costly production of a 35mm internegative. In addition it lacked the database functions necessary for a large library of images and most importantly, it was not available at the time of system selection. However because Photo-CD seemed likely to become the standard of the future, it was felt to be desirable to select a system which could eventually transfer its images to Photo-CD.

High resolution digital imaging was selected as the most appropriate technology as it was a stable medium, at high quality. The capture equipment could be operated by staff without photographic skills, as the images could be seen and manipulated directly. The images could be readily transferred to other systems, whether digital or analogue. The production of high quality output was possible directly from the digital image.

Imaging equipment operation

The imaging equipment purchased by the National Railway Museum was supplied by Primagraphics of Royston. The system is a monochrome imaging archive system which captures and stores images at 2500 x 3500 pixels. It is capable of enhancement to 5000 x 7000 pixels and can be upgraded to full colour. With the addition of an appropriate interface and driver a colour printer may be added. The Varsity system incorporates an MC68030 based host processor and has both a VME bus and Primabus, a proprietary high speed bus capable of data transfer speeds of up to 60Mbytes per second. Specialist graphics hardware within the system, which links to both busses, provides facilities for image capture, display, handling and processing, compression (to the JPEG standard) and storage. The operating system is Unix version 5.3, which is used in conjunction with Primagraphic's own image processing and graphics library called Primalib. The system is also equipped with a 638Mbyte Winchester disk drive, two 940Mbyte optical disk drive units, and a 3.5inch floppy disk drive. The monitor is Sony 19inch high resolution colour display monitor. Scanning is carried out by Primascan, a 5000 x 7000 pixel scanning camera developed by Primagraphics, mounted on a specially constructed operator console incorporating the camera stand and light box.

The first step in scanning a negative is to position the camera and focus on the image. This is accomplished by means of a focusing chart and a graph on the screen. It is not as easy as it might seem to get the chart in focus. With the aid of the museum photographer and a mathematical formula, we have now established a chart of settings for both camera height and bellows extension for the various negative sizes.

Exposure time and contrast can be set for each individual negative or preset values can be used for negative type, whether dense or thin, contrasty or flat. The negatives do vary considerably in quality and it is important that the operator manipulates the settings to achieve the best possible image.

Once the settings are satisfactory, the image can be scanned. Each image is described by its collection code and negative number. The two together form a unique identifier which, at some stage, although not necessarily at this stage, is also entered into the text database.

Further manipulation of the image brightness and contrast can be achieved at this stage if desired by use of the brightness and contrast buttons or by changing the grey scale. The latter allows selected tones to be changed without affecting the image as a whole. This is very useful for bringing out detail in darkened corners for example.

Once the image is regarded as satisfactory it can be stored on disk by selecting that option from the menu. The image is stored compressed. With a compression ratio of 13:1, approximately 1300 images can be stored on each disk. At the point of storing to disk the image is given a disk and frame number which is linked to its negative number.

Two copies of the image are saved simultaneously, one on the master disk and one on the back-up disk. The Museum therefore has two copies of the master digital archive which it can store on separate sites.

Retrieving an image is done by entering the negative number of the required image. The machine then displays a message indicating the number of the disk containing that image. Disks have to be changed manually and the machine informed that the operation has taken place. The image is then retrieved, de-compressed and displayed on the screen.

The first collections entered onto the imaging system are those with few existing reference prints. Included is at least one collection which requires a great deal of work in identifying locations in the North of Scotland. Once the image is on the machine, the intention is that prints which can be easily produced from the disc will be sent to members of the Highland Railway Society who have volunteered to help with the identification task.

Once a few thousand images have been stored on the master disk, the Museum will copy these to an analogue system for public access. Analogue systems can store up to 36,000 images on one disk and by linking ten disks together, 360,000 images can be made available on-line at any one time. The text database will be linked to the analogue system allowing the public to question the database and view selected images on screen. It is also planned to have printing facilities available so that copies of photographs can be purchased and supplied within minutes.

Conclusion

In spite of initial teething troubles, the Museum staff who are working on a rota, scanning negatives and describing images are very excited about the digital system. The potential of the system is obvious and the benefits to both staff and public of quick and easy access to the photographs is well appreciated. The project is in the early stages but we are looking forward to the day, we hope in about a year, when the first electronic images become available to the public.

In view of the Museum's decision to adopt digital storage at a similar resolution to Kodak's Photo-CD, the initial success of the Kodak product has been encouraging. However Photo-CD is yet to offer all the facilities which are required for the input and storage of such an archive, and it may be that for some years to come, a system such as that in use at the National Railway Museum, will be the best means of image storage where quality and longevity are significant considerations.