4-17-2006

Basics of strip photography

Andrew Davidhazy

Basics of Strip Photography

Andrew Davidhazy
Imaging and Photographic Technology Department
School of Photographic Arts and Sciences
Rochester Institute of Technology

A common way to photograph subjects which are in motion when we wish to blur the background but not the subject, is to pan while the shutter makes the exposure. The effect of panning, or following the movement of the subject, is that it's image is relatively stationary with respect to the film while the image is recorded on the film and thus a sharp image is recorded even with a relatively long exposure time.

Another way to accomplish a similar effect is to keep the camera stationary but move the film while the exposure is being made. If the film is moved so that the image is stationary with respect to the film, a sharp image can be recorded which looks very much like it had been made with a "panned" camera.

It is on this latter principle that photofinish "strip" cameras operate. Specialized panoramic and aerial mapping cameras also depend on the same principle. Many technical and scientific cameras also record subjects in motion by moving the film to record sharp images during a relatively long exposure.

These "strip" cameras have been around for a long time but their application has generally been in engineering or science. Notable exceptions have been the photographs made by George Silk, who made stunning sports photographs at the 1960 Olympics. He used a Canon camera modified by Marty Forscher. Probably the same or updated versions of that camera were used by other photographers associated with the Time-Life photographic team for more recent work.

I am not suggesting here that it is easy to produce work which matches that produced by these photographers. However, I would like to describe the basics of the "strip" system and the equipment necessary in order to at least begin to explore this technique.

Many photographers have shied away from experimenting with strip photography primarily because of the impression that the equipment was too expensive or too specialized to be readily available. My experience has shown both of these notions to be somewhat erroneous or exaggerated, particularly if one is willing to tolerate somewhat less than absolute technical perfection in the results. William Larson's work with a modified 2 1/4 camera is a prime example of "strip" imagemaking where highly creative photographs were produced with very simply modified equipment.

The principal requirement for strip photography is that the camera be capable of moving the film while the exposure is being made. This can be easily accomplished by using the rewind mode of a 35mm camera. The

film is simply rewound into the supply chamber with the rewind knob, either without modification or by attaching an oversized lever to the knob as shown in the accompanying illustration. The film is first transported into the take-up spool by firing off the available number of exposures with the lens cap on the camera lens. Then the shutter is opened on "B" with a locking cable release or lock on the camera and the rewind button is pressed in. Now the film is free to be rewound into the supply cassette past an open camera gate. So much for moving the film.

At first glance it might seem that a camera which has the shutter open all the time and in which the film moves during that time might not be able to record anything but a very blurred picture, if any at all. However, by analyzing the situation a bit further, it will become clear how quite acceptable pictures can be made by this method. First of all, if the subject at which the camera is aimed is motionless, then its image (if the camera is not moved) will also be motionless as far as the camera's image gate is concerned. However, since the film is moving inside the camera, with respect to the moving film the stationary image appears to be moving. In this case, a blurred, or streaked record will appear on the film upon development.

However, if the subject is moving as such a speed that its image is moving at the same speed as the film, then with respect to the moving film the moving image is stationary. Thus, since during the time it takes the film to go from one side of the camera's image gate to the other, the image appeared to be stationary, a normal looking record of the moving subject will appear on the film upon development.

Exposure time, in this situation, is the total time it took a particular point on the film to traverse the gate of the camera. If the film is rewound by hand, it is apparent that exposures will be rather long.

It is possible to reduce exposure time and increase sharpness when image and film speeds are unequal by installing a mask inside the camera so that the normal 24 x 36mm gate is narrowed down to a 25 x 2mm or 24 x 1mm gate. This mask should be placed between the focal plane rails of the camera so that the distance between lens and film is not altered. The mask can be made out of any thin opaque material, and temporarily taped in place as shown in the drawing. This way at a moments notice the camera can be back to its normal self for regular shooting. Leaving the "slit" at one side of the frame allows one to quickly aim the camera's slit field of view at the desired spot in space where the action is to be recorded is to take place. It can also be placed in the middle of the frame, however.

In order to take photographs with the camera modified in this fashion, it is best to chose an area where there will be predictable motion. People walking by on a sidewalk are ideal beginning subjects. Place the camera on a tripod, load the camera with film and with the lens cap attached to the lens advance all the film to the take-up side. Then push in the rewind knob and setting the shutter on "B", lock it open with the camera lock or a locking cable release. Then, as people walk past the camera in the opposite direction the film will

be moving, so that their image moves in the same direction as the film, slowly rewind the film past the open slit back into the supply chamber.

When people walk past the camera at just the right speed, they will leave an impression on the moving film which will resemble the original persons. When they move too slowly, their images will appear stretched. When they move too quickly, the images will be compressed. In any case, each roll of film will contain images which are, by normal standards, quite unusual and it is exciting just to scan the developed film for that unique image.

You can determine the time it should take the rewind knob to turn once to properly record any object which moves in front of the lens by timing with a stop watch the time it takes your subject to travel from one side of the viewfinder to the other and multiplying this number by 1.5. This time will actually be correct for only one point on the film since the rewind spool changes in diameter as more and more film is rewound onto it. For most experimental applications, this is not a serious problem. Commercial cameras of this type, however, generally use a pinch drive system similar to that built into tape recorders to ensure the film is always moving at a constant and presettable speed.

Because in your camera the speed of the film may be further changed by small changes in drap within the camera, you will probably find some exposure "banding" along your film. As you can see from the accompanying examples, this is not always a great problem and in certain instances, these bands can be made to work for you as elements of composition.

What about exposure? With a slit size of approximately 1mm, and a rewind rotation rate of one complete turn about every 5 seconds, assume a "shutter speed" of 1/10 second. Meter the light and set the aperture to the aperture required at this speed for the particular film you use. The approximate exposure time for any other rotation rate of the rewind knob is equal to slit width in millimeters divided by 50 and this then multiplied by the time in seconds required for one turn of the rewind knob.

Strip photography has many technical applications as mentioned earlier. However, it has many more creative applications and after experimenting with the manual model described above, you may wish to look into the process further. Improvements in film drive can be accomplished by motorizing the rewind knob with a high torque geared DC motor. You might want to build a separate wire frame finder for your camera so that when the mirror is up which you use your strip camera, you'll be able to reposition the sensitive area in space.

Advanced projects might include peripheral photography, panoramic photography, trying your hand at photofinish pictures, taking pictures out of moving vehicles or of very long moving vehicles, such as trains, etc.

In any case, take a look at examples which illustrate these applications and I think you'll agree that there is potential for creative experimentation. Good Luck!

PERIPHERAL AND PANORAMIC STRIP PHOTOGRAPHY

Items one needs to know in in order to achieve some level of control over the "system":

For PERIPHERAL PHOTOGRAPHY

1. subject height
2. subject circumference
3. image (of subject) height
4. time it takes the subjects to make one complete rotation
5. slit width

For PANORAMIC PHOTOGRAPHY

1. vertical angle of view of lens
2. KNOWN - the horizontal angle will USUALLY be 360 (if not then need to know)
3. KNOWN - the vertical film dimension is 24mm
4. time it takes the camera to turn once
5. slit width

This allows us to calculate the time required for one revolution of the rewind knob and the exposure time. Calculations are based on the requirement that subject proportions need to be maintained in the reproduction.

PERIPHERAL - to determine final IMAGE LENGTH (for 1 rotation of subject)

$$1.\quad \frac{\text{Known subject height}}{\text{subject circumference}} = \frac{\text{measured image height (mm)}}{\text{image length to be found}}$$

PANORAMIC - to determine final IMAGE LENGTH (for a 360 degree pan)

$$1.\quad \frac{\text{vertical angles of lens } *}{\text{360 degrees}} = \frac{\text{24 mm}}{\text{image lenght to be found}}$$

* vertical angle of lenses can be found from tables or calculated

NOTE: For Panoramic photography, the IMAGE LENGTH or length of film required to cover a given number of degrees can also be found by:

$$1.\quad \frac{\text{\# degrees required } *}{\text{360 degrees}} \times 2 \times \text{lens focal length} \times \pi \quad (\pi = 3.1416)$$

360 degrees

* for a 360 degree panorama this value is 360 degrees

The consequence of 1. in every case above is that every time the subject or camera turns once a length of film equal to calculated image length must be drawn past the slit in the camera. Therefore, the speed or rate at which film must move is:

PERIPHERAL

$$\text{2. speed or rate of film movement} = \frac{\text{image length}}{\text{time it takes subject to turn once}}$$

PANORAMIC

$$\text{2. speed or rate of film movement} = \frac{\text{image length}}{\text{time it takes camera to turn once}}$$

The time required to turn the rewind knob once in order to achieve a certain speed or rate of film movement is:

$$\text{3. time for one revolution of rewind knob} = \frac{\text{(about) 50 mm}}{\text{speed or rate of film movement}} \quad \{\text{from 2 above}$$

The 50 is a constant which is an average since the spool diameter changes with time. It is the average number of mm drawn past the slit per revolution of the rewind knob.

Finally, the exposure time (which determines the f stop required for a particular ASA film) is given by:

$$\text{4. exposure time} = \frac{\text{slit width}}{\text{speed or rate of film movement}} \quad < \text{from 2 above}$$

NOTE: image length is in millimeters

LINEAR STRIP PHOTOGRAPHY

To make pictures of subjects moving past camera or camera moving past still subject need to know:

1. Distance from subject to lens { in same units
2. Focal length of lens
3. rate at which subject (or camera) is moving in mm per second
4. slit width

This allows us to determine how fast the rewind knob must be turned and the exposure time.

$$\text{1. the speed or rate of film movement in camera} = \frac{\text{focal length} \times \text{rate of subject (or camera) movement}}{\text{distance from lens to subject}}$$

The time required for one revolution of the rewind knob to achieve a specific (approximate) speed or rate of film movement in the camera is:

$$\text{2. time required for one revolution of rewind knob} = \frac{50\text{ mm}}{\text{speed or rate of film movement in the camera}}$$ < from 1 above

The exposure time (this will determine f stop for particular ASA film speed) is equal to:

$$\text{3. Exposure Time} = \frac{\text{slit width}}{\text{speed or rate of film movement of camera}}$$ < from 1 above

OR

1. need to know time it takes subject (actually it's image) to traverse finder
2. slit width

This _also_ allows us to determine how fast the rewind knob must be turned and exposure time

A) The time required for one revolution of rewind knob = time for subject to cross finder (36mm) x 1.5

$$\text{B) exposure time} = \frac{\text{slit width} \times \text{time for subject to cross finder}}{\text{(36mm) x 1.5}}$$

OR

$$\frac{\text{slit width x time for one rev. of rewind knob}}{50} < \text{from A above}$$

PANORAMIC STRIP PHOTOGRAPHY - another approach.

To make 360 degrees (or more) horizontal (or variation thereof) coverage wide angle pix need to know:

1. time it take a subject detail to traverse the 36mm wide viewfinder
2. slit width

The calculations are the same as for the A) and B) determinations associated above with Linear Strip Photography.

If you are thinking of motorizing a tripod head to do panoramic photography a practical tripod head rotation rate of 4 to 6 RPM is suggested. If you are thinking about somehow motorizing the rewind knob, a sugestion is that you consider making the rewind crank turn from 6 to 60 RPM or somewhere in this vicinity. Make sure to use heavy duty gearhead motors ... you will need plenty of torque.

END>