A Partial Guide to Managing a Film Archive

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fiaf

International Federation of Film Archives
Dedicated to the preservation of and access
to the world's film heritage since 1938

FIAF tries to set the standard for how to manage a film collection, but in real circumstances it may be difficult to achieve perfection.

FIAF Code of Ethics:

1.3. Archives will store material, especially original or preservation master material, in the best conditions available to them.
If those conditions fall short of the optimum, archives will strive to secure better facilities.

FIAF Code of Ethics:

1.4. When copying material for preservation purposes, archives will not edit or distort the nature of the work being copied.
Within the technical possibilities available, new preservation copies shall be an accurate replica of the source material.

FIAF Code of Ethics:

1.5. When restoring material, archives will endeavour only to complete what is incomplete and to remove the accretions of time, wear, and misinformation.
They will not seek to change or distort the nature of the original material or the intentions of its creators.

FIAF Code of Ethics:

1.6. When providing access to material by programming, projection, or other means, archives will seek to achieve the closest possible approximation to the original viewing experience…

FIAF Code of Ethics:

1.8. Archives will not unnecessarily destroy material, even when it has been preserved or protected by copying.

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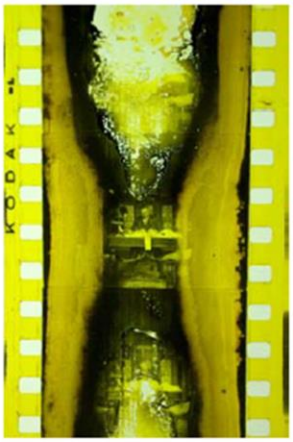
Film Preservation Strategies

Film Degradation and Storage



Nitrate film is well known to decay.

Image IWM

Image IWM

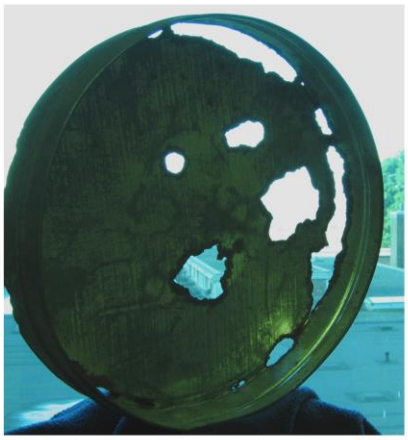
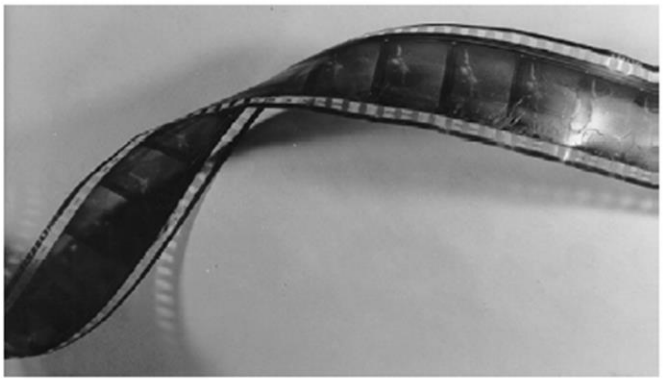
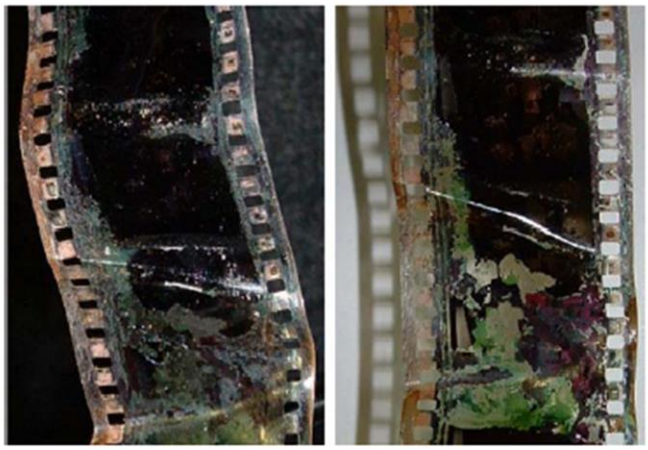


Image John Reed

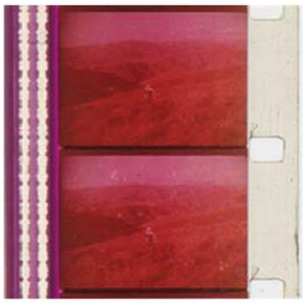
Image IWM



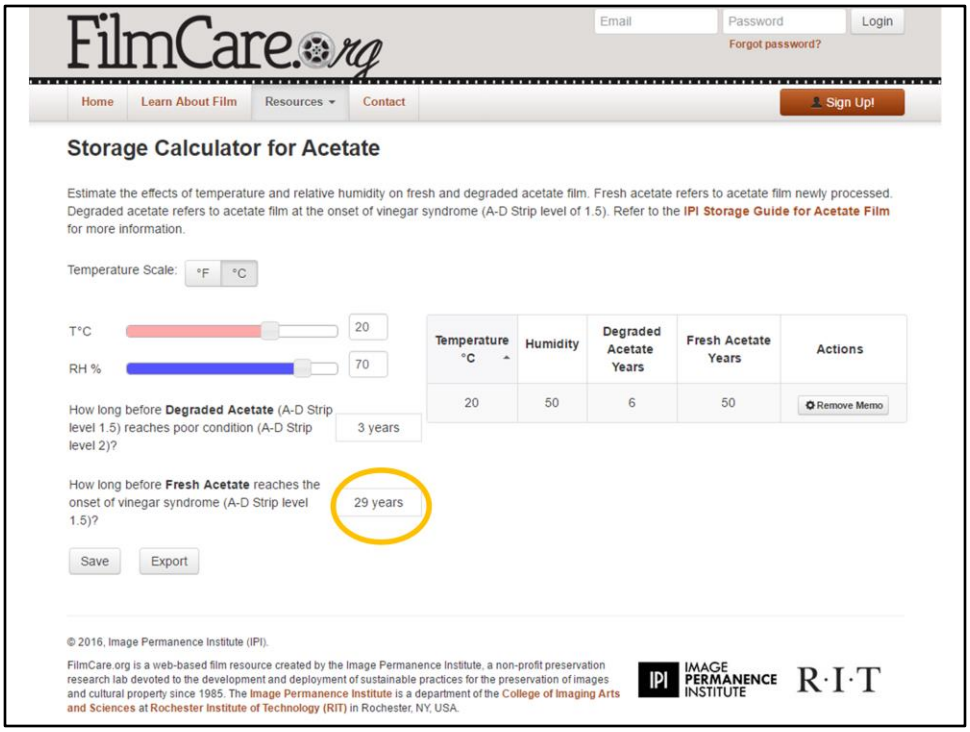
But so is acetate…



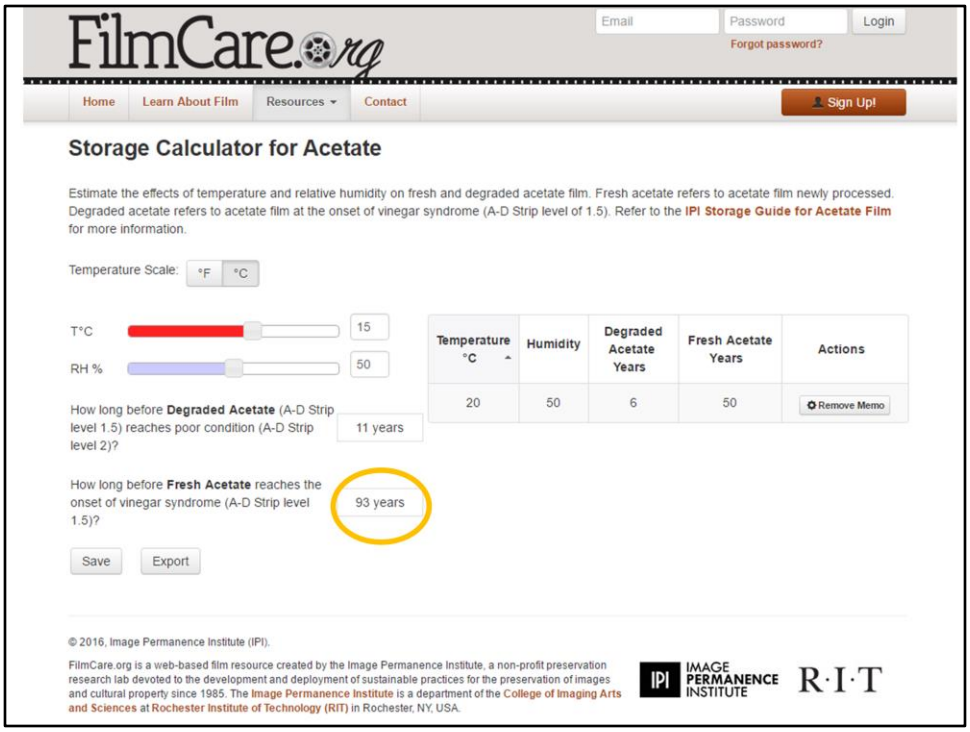
…and especially magnetic tracks on acetate stock.



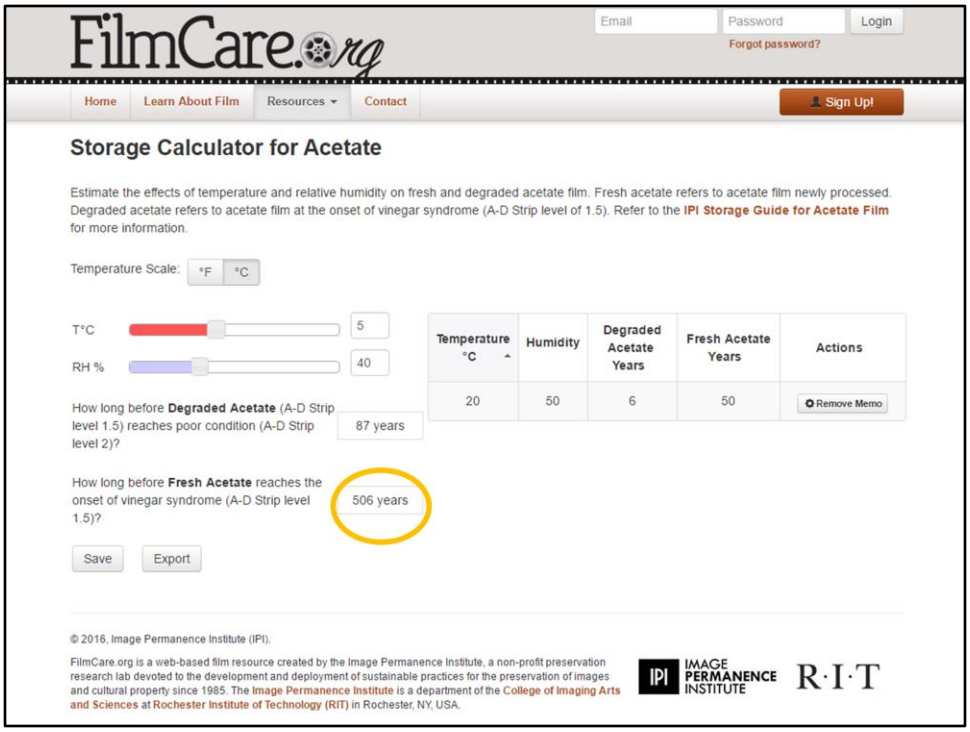
Colour films fade.



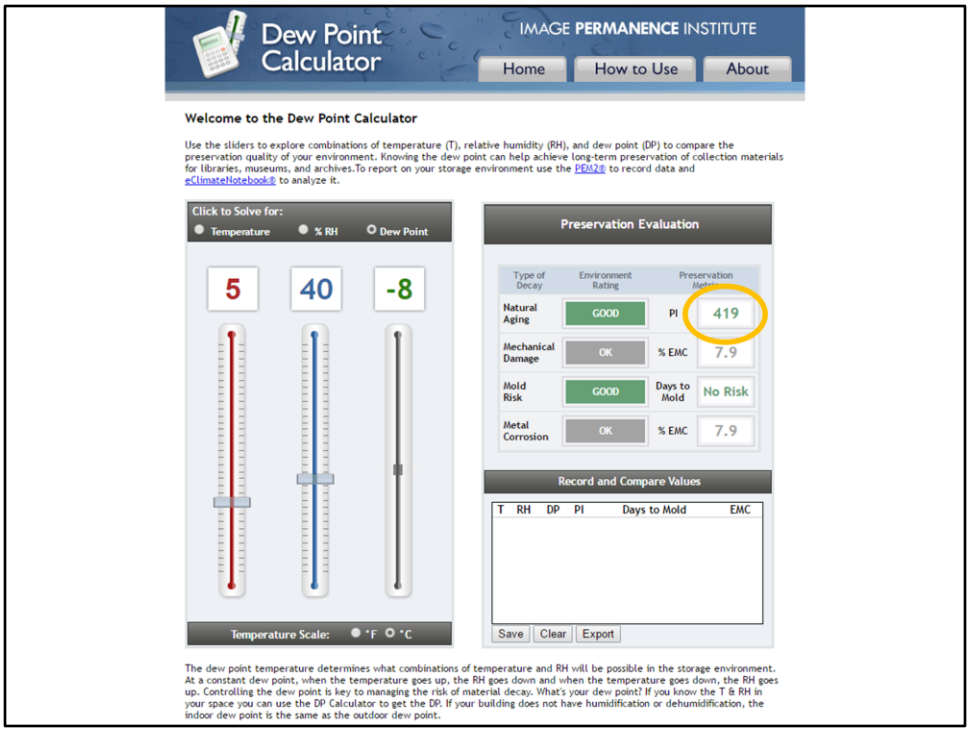
FilmCare.org has some online calculators for life expectancy.
Fresh acetate predicted to reach serious acetic decomposition level in around 30 years in ambient conditions (20 C and 70 RH – autumn conditions in Albania).



But has a much longer lifetime in cool, drier conditions.



And has a proper ‘archival’ lifetime in cold dry conditions.

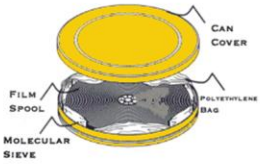


Note that the IPI's Dew Point Calculator gives similar results, although the precise figures are a little different. These figures are intended for guidance only.

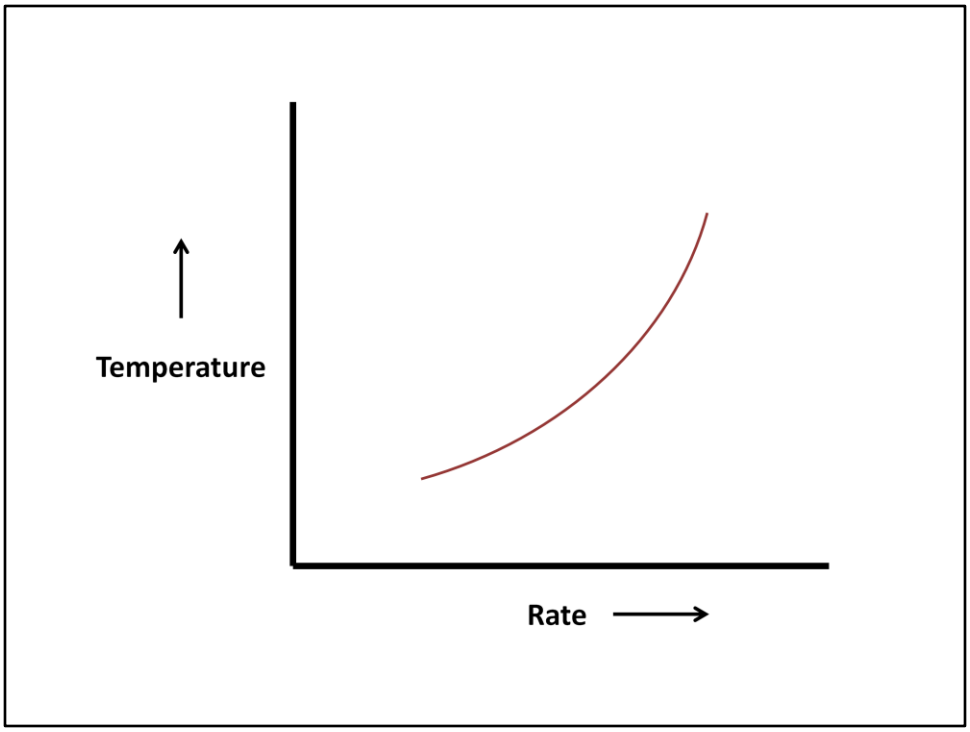
ACTIV-V Carbon Filter

General purpose, activated carbon filter unit to meet the air purification requirements of air conditioning in accordance with DEO Specification 037 – 1997

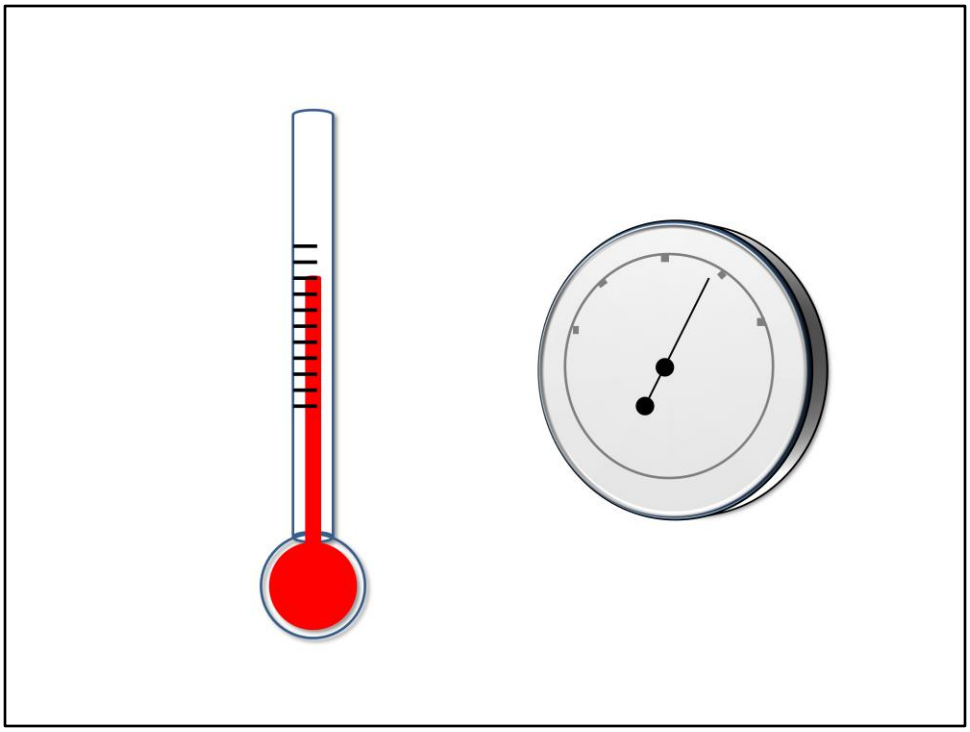
Dancan Film Cans



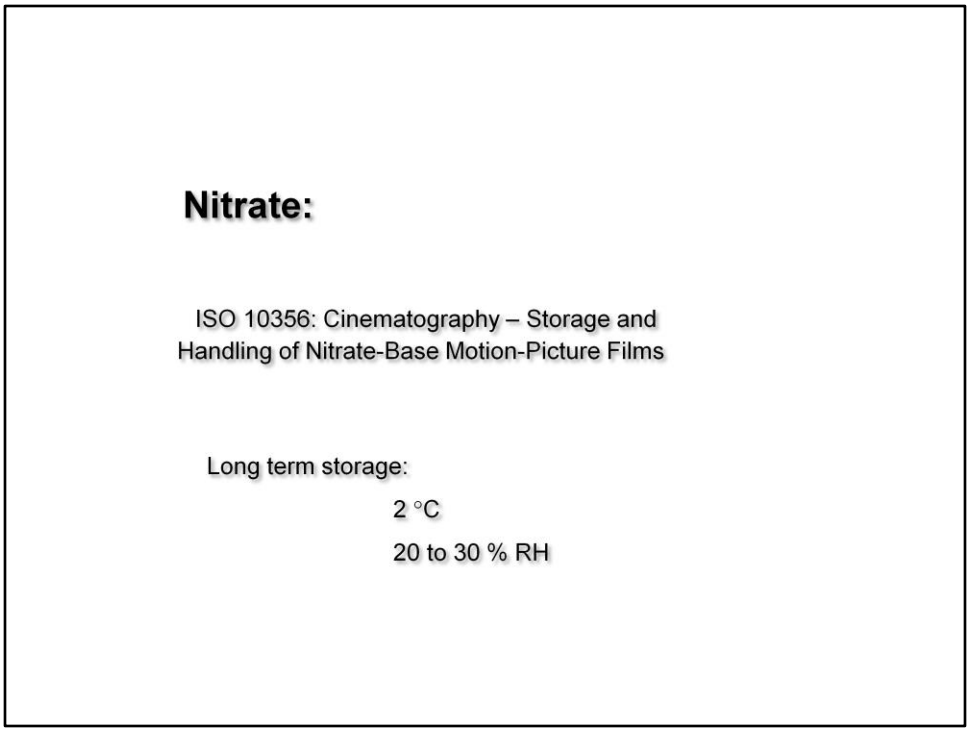
How important are the other aspects of the environment: air-changes, venting in containers, material used in the containers, molecular sieves, regular rewinding, etc? All these may add a small percentage increase in the life-expectancy, but temperature and humidity remain the most important.



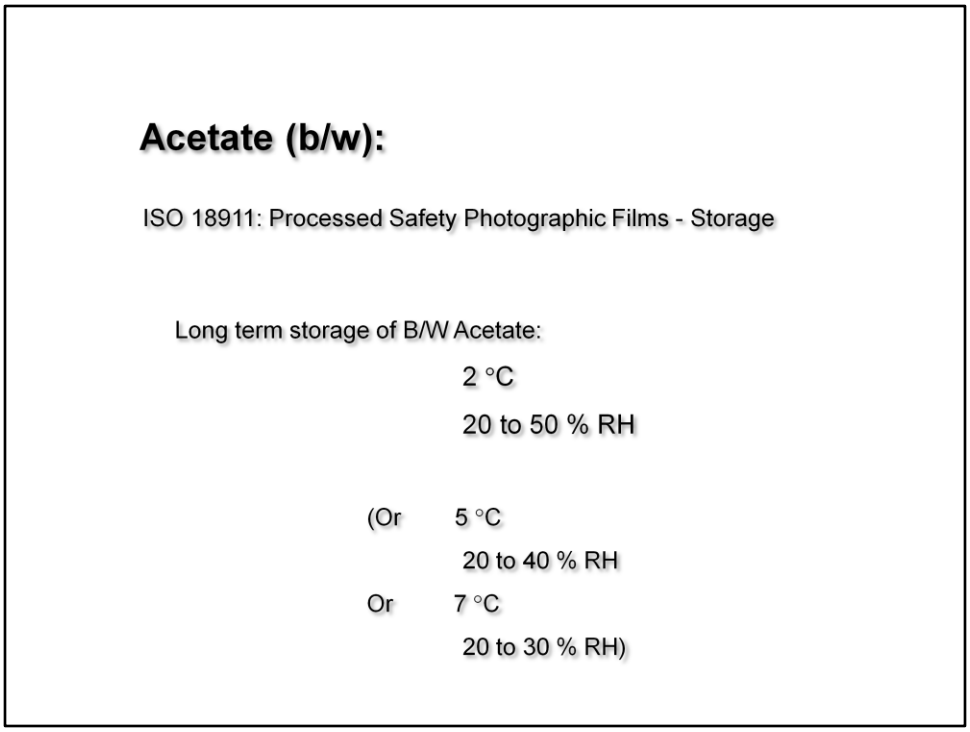
You can’t change the basic chemistry. The higher the temperature, the faster the decomposition.



So it’s temperature and humidity which really matter for long-term preservation of these sorts of media.



As all nitrate films are now more than 60 years old, and this standard is for new (or as-new) film, the optimum storage conditions for nitrate now are more stringent. Nitrate film **must** be stored at below-zero Celsius if the life-expectancy is to be prolonged to an archival span.



ISO recommendations for fresh b/w acetate (or butyrate etc etc). For already degraded acetate which has not reached the critical point, these conditions are probably acceptable, but the life-expectancy will be less than that of new film.

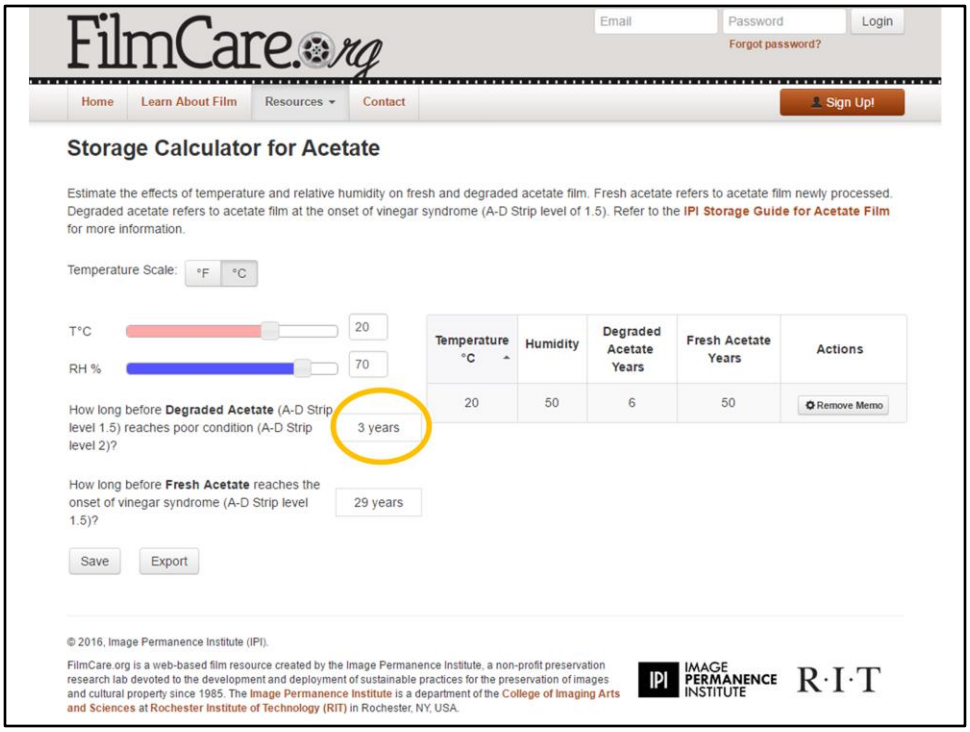
Colour:

ISO 18911: Processed Safety Photographic Films - Storage

Long term storage of
Colour (chromogenic) Film:

-10 °C
20 to 50% RH
(Or -3 °C
20 to 40 % RH
Or 2 °C
20 to 30 % RH)

For ‘chromogenic’ colour films (ie. those where the colour is produced by the creation of colour dyes from chemicals already in the emulsion, such as Eastmancolor), these are the recommended conditions for new film, which also apply generally to any film prone to fading, including films such as Dufaycolour. Older film will have a reduced life-expectancy, and in general the colder the conditions the longer the life-expectancy.



If the film is already degrading, the outcome is far worse.

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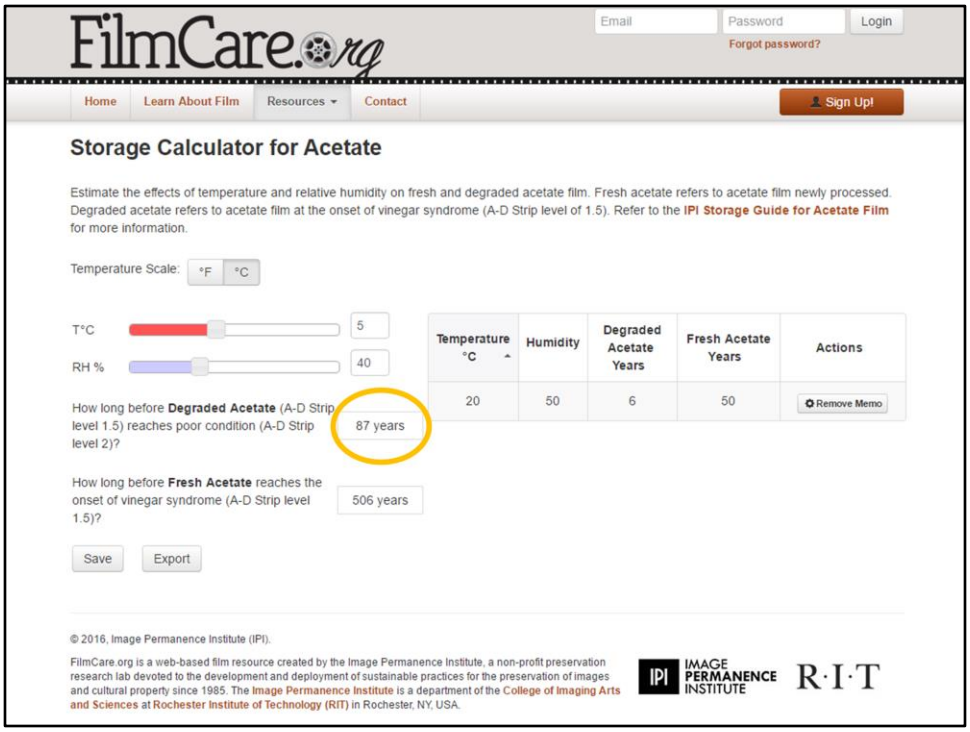

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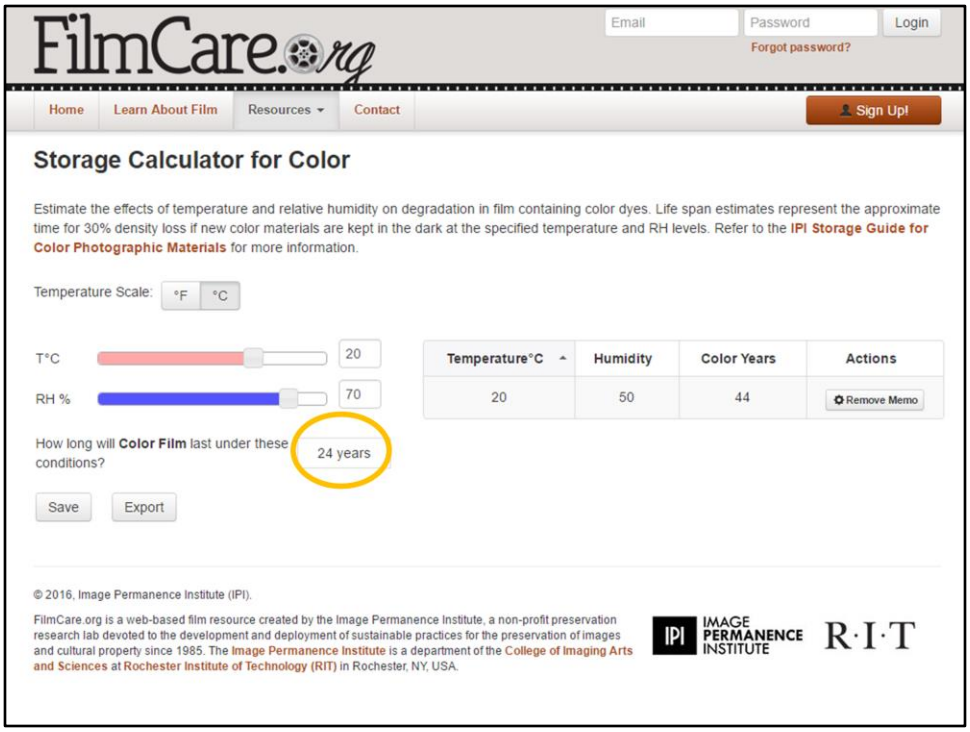
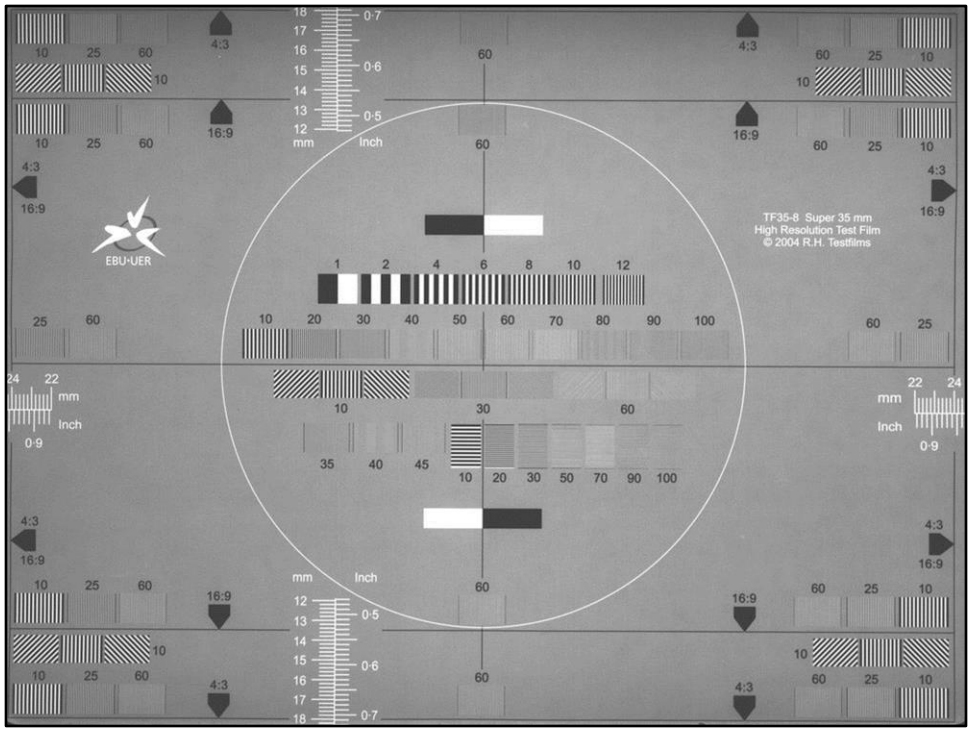
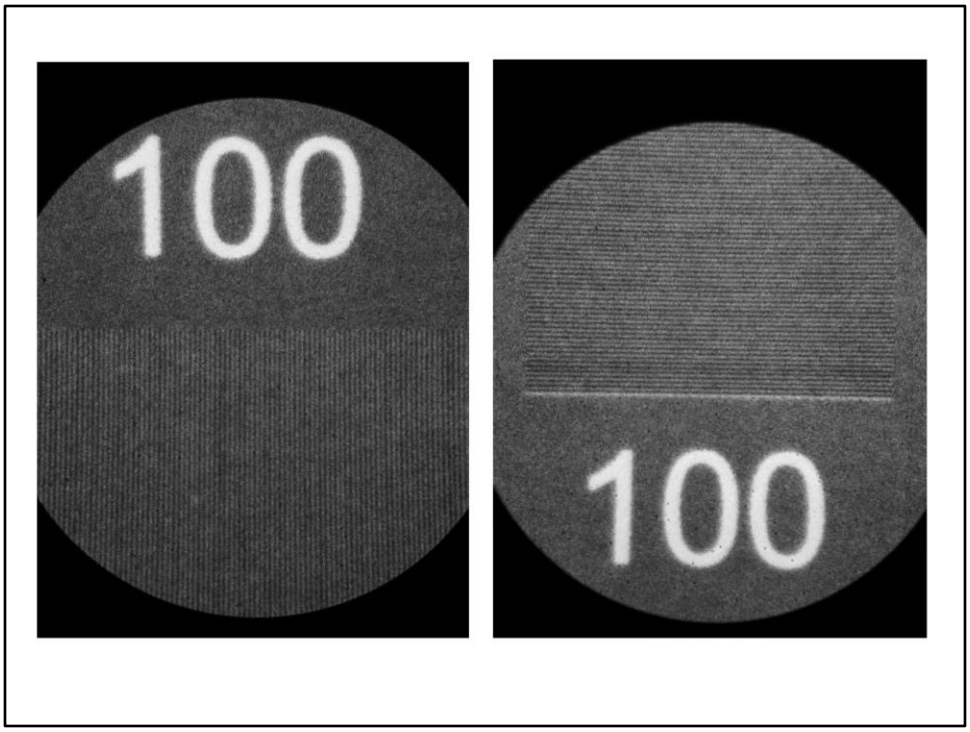


The position is much the same for colour film.

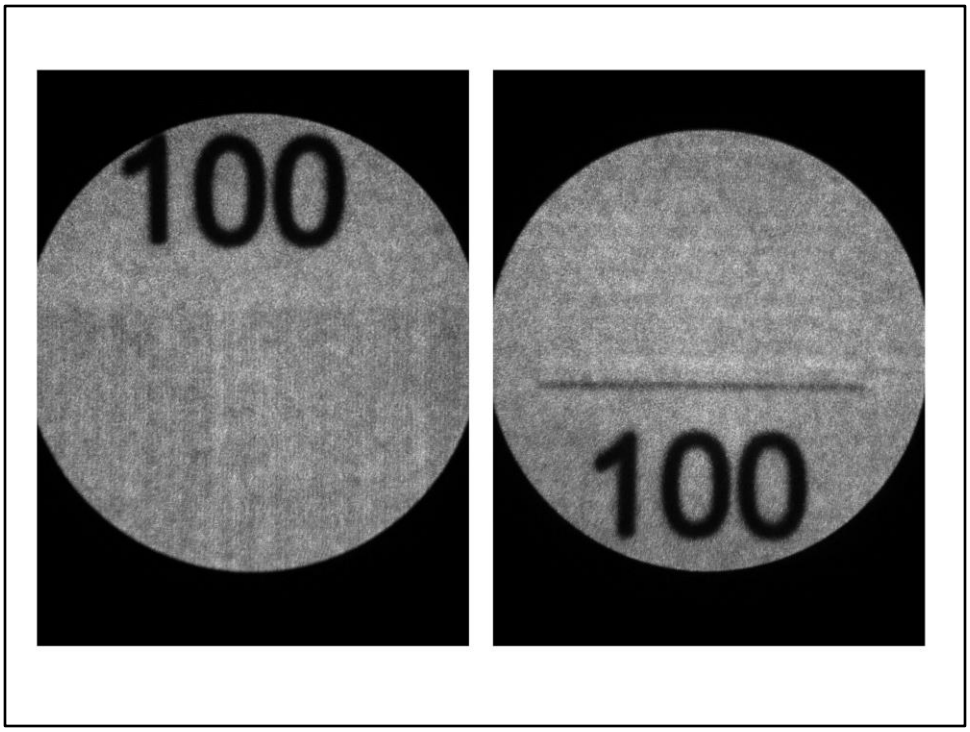
Making a Preservation Copy



FIAF carried out some tests which can be found here: http://www.fiafnet.org/ (click on Film Duplication Resolutions Tests).



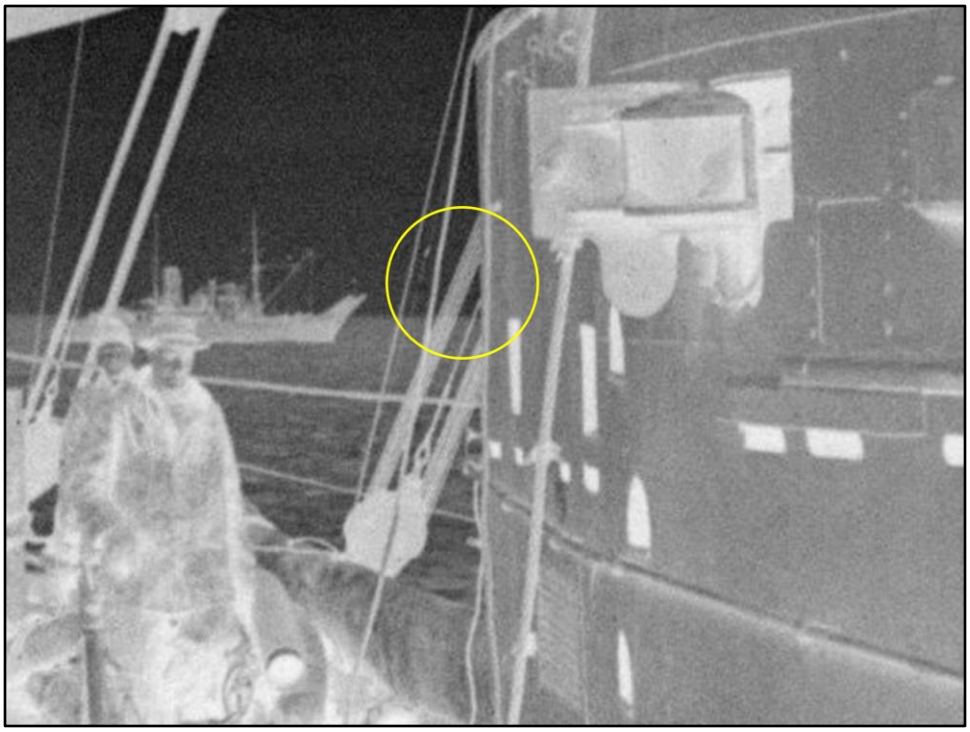
This is a photomicrograph of the original test chart, at 100 line pairs per millimetre.



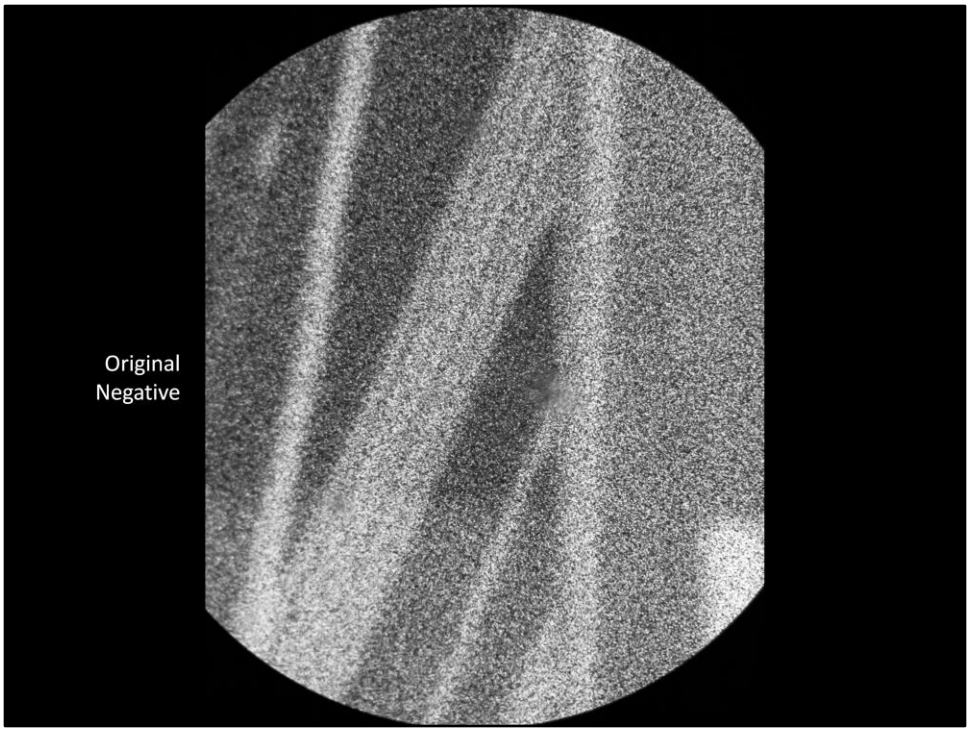
Fine grain duplicating positive copy of original chart, made on BHP continuous printer. Horizontal resolution is much worse than vertical (this is normal for this type of printer).

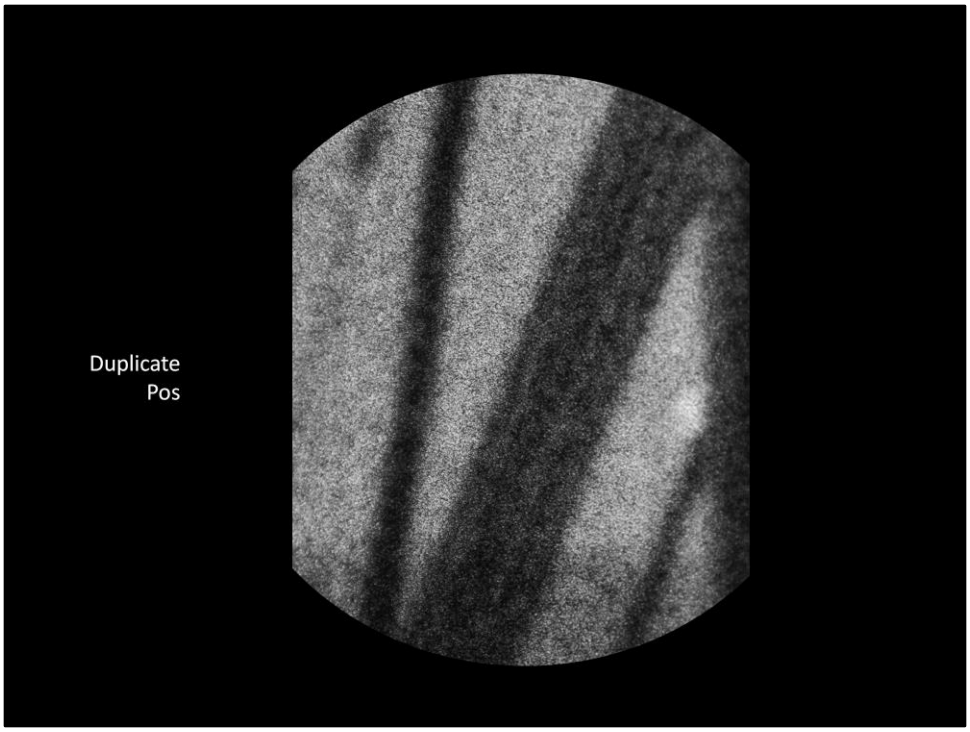
This is a frame from an original nitrate camera negative from 1950.

This is a fine grain duplicating positive copy made on a Bell and Howell Model C printer. Note the presence of unwanted marks and blemishes.

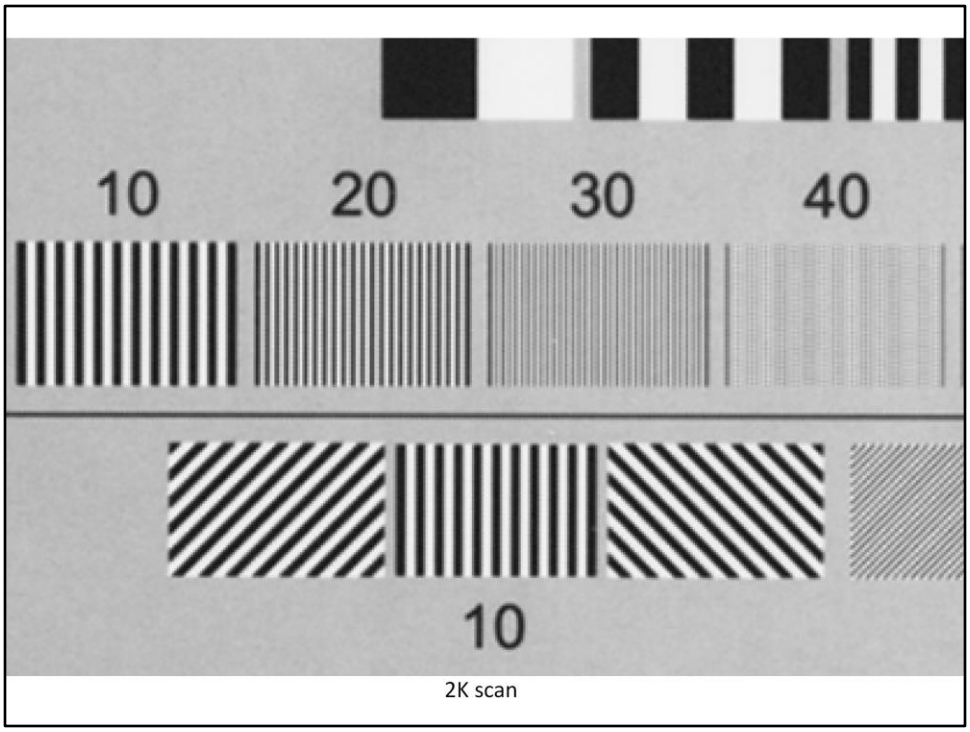


This area examined under a microscope.


Original
Negative

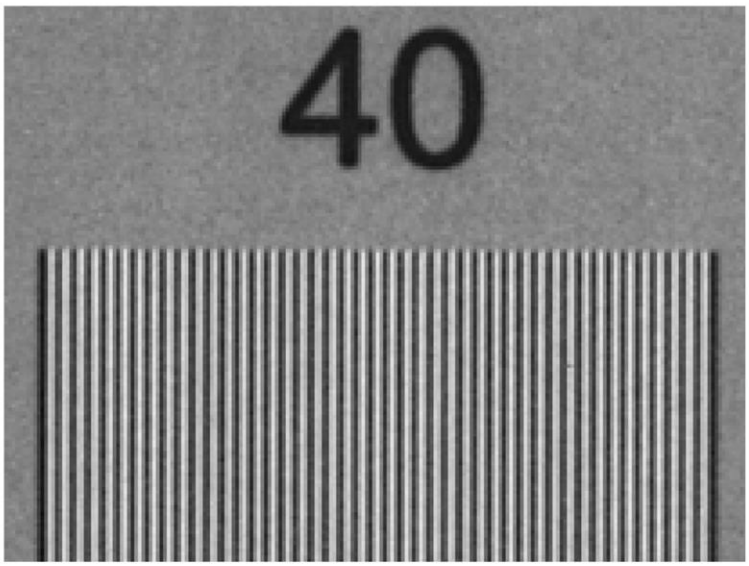


The resolution of the copy is just good enough to resolve the strands of the cables.



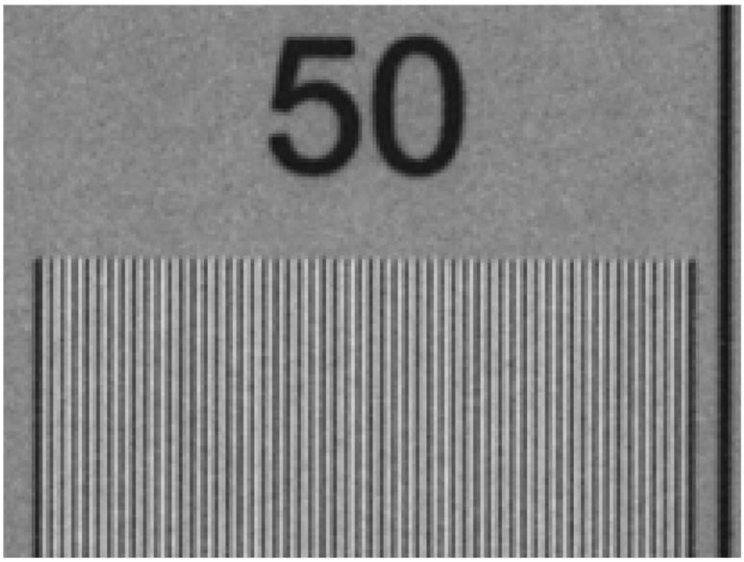
2K scan

A 2K scan of the test chart. The resolution is pretty poor, and worse than the photochemical copy, at least in the vertical direction.

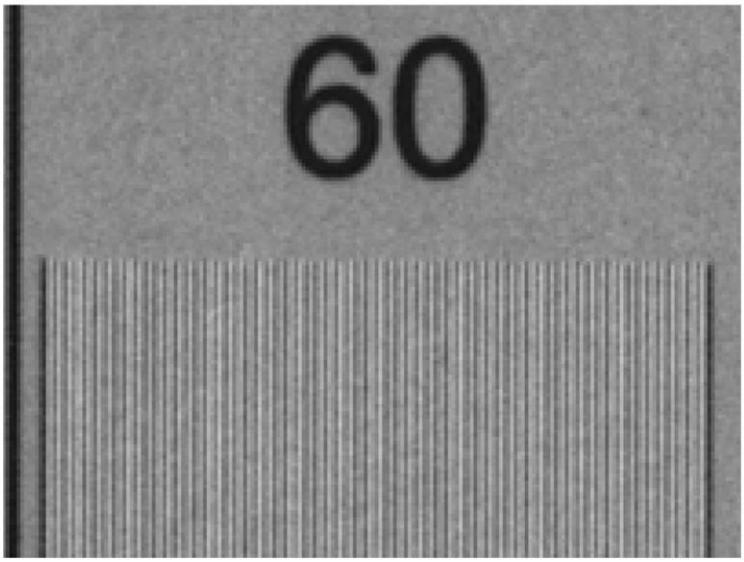


4K scan

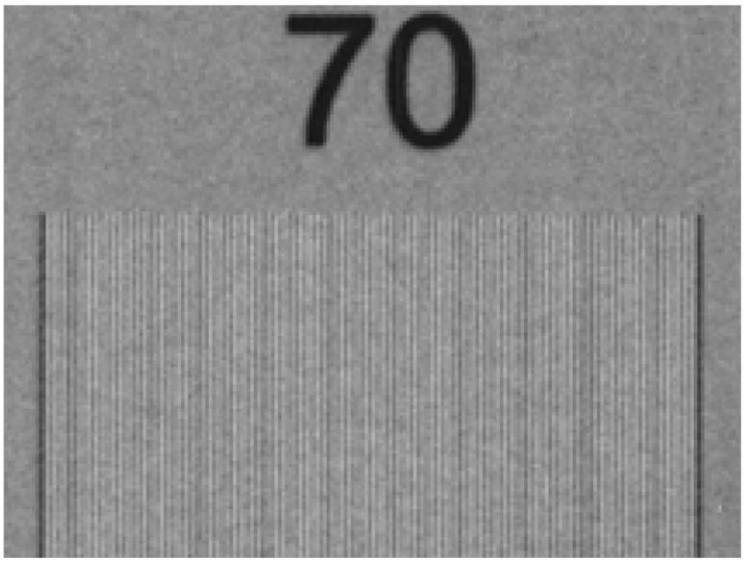
A 4K scan is better (obviously), but still far from good enough to capture the full resolution of the original chart.



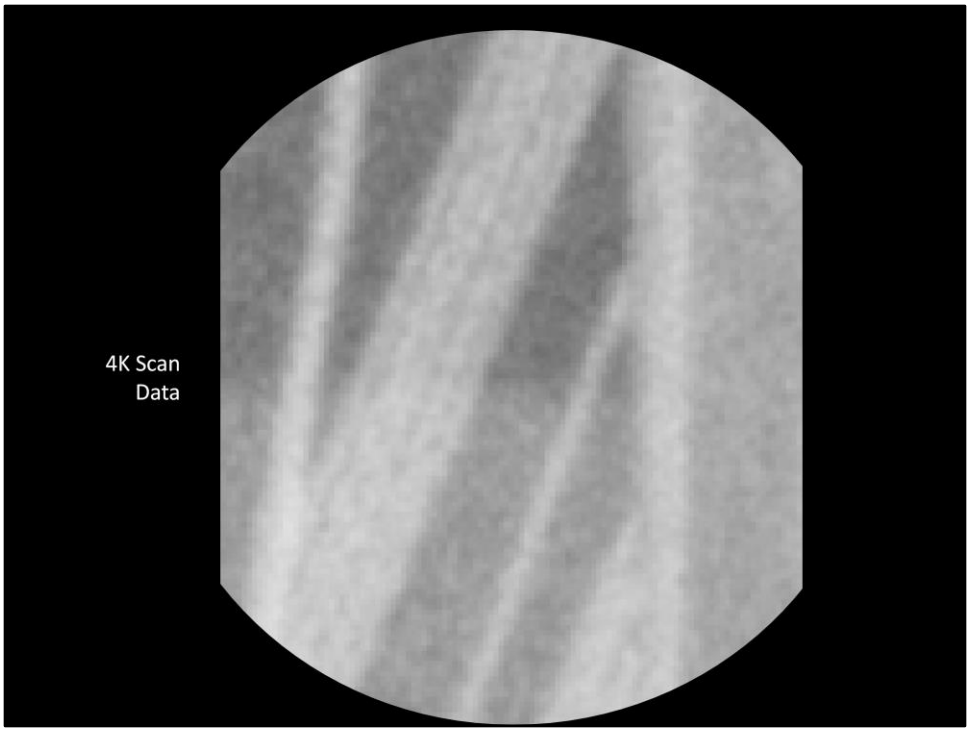
4K scan



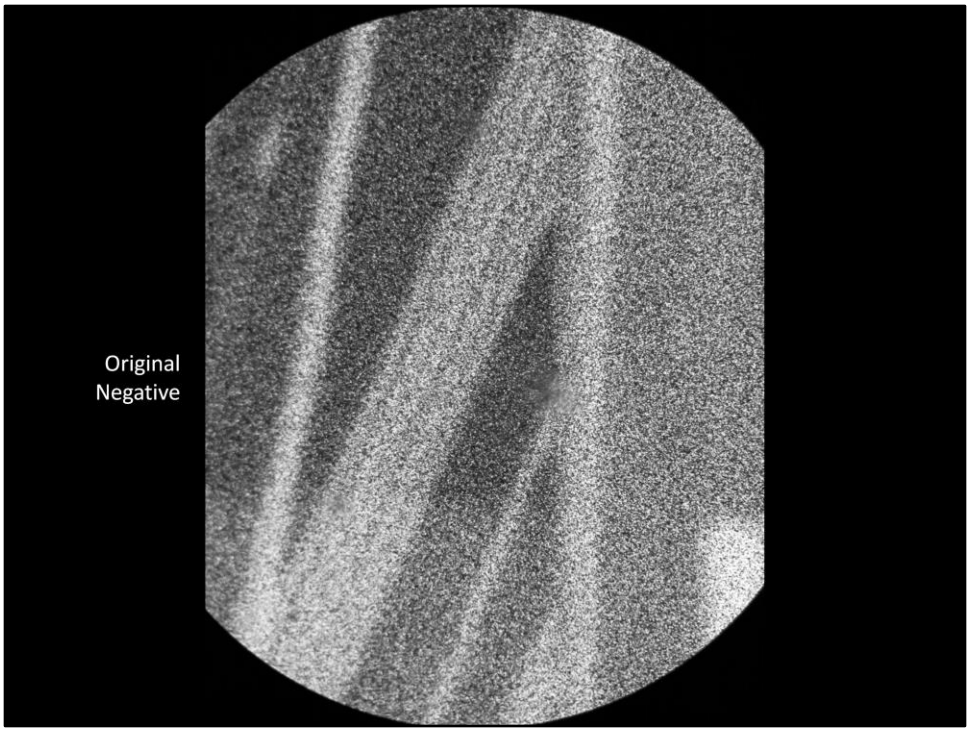
4K scan



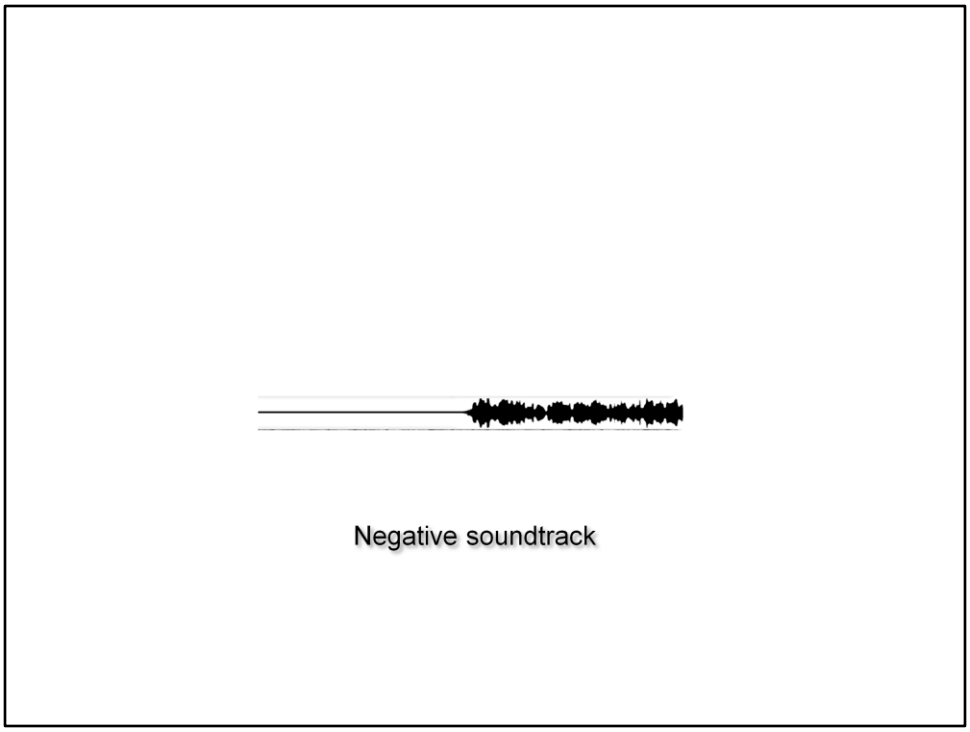
4K scan



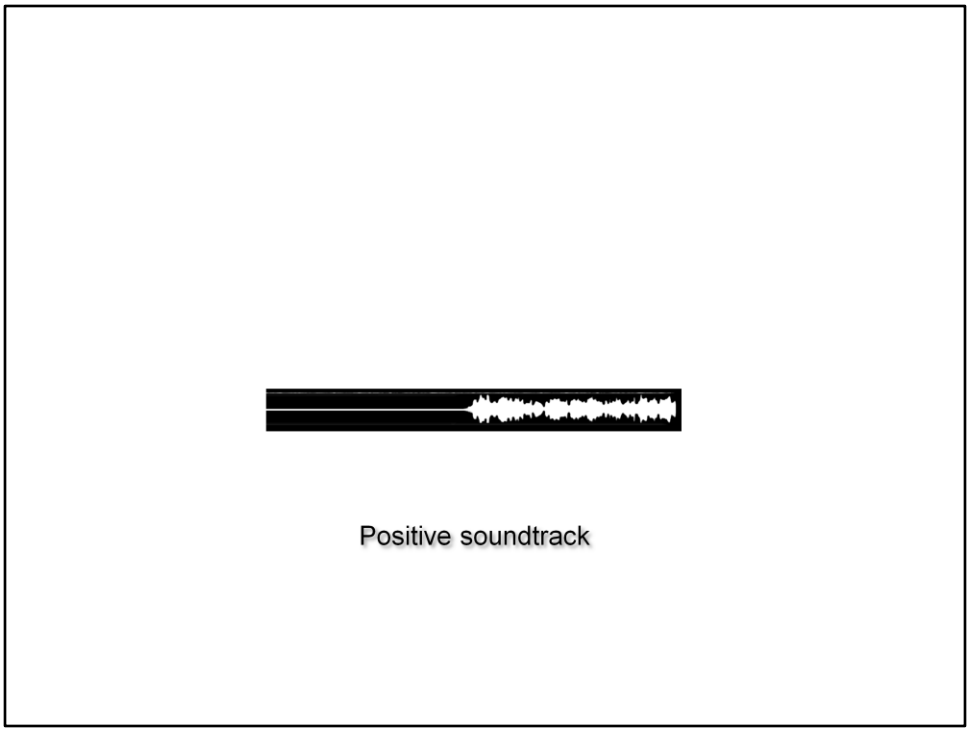
The 4K scan of the 1950 negative seems to be a similar resolution to the photochemical copy.



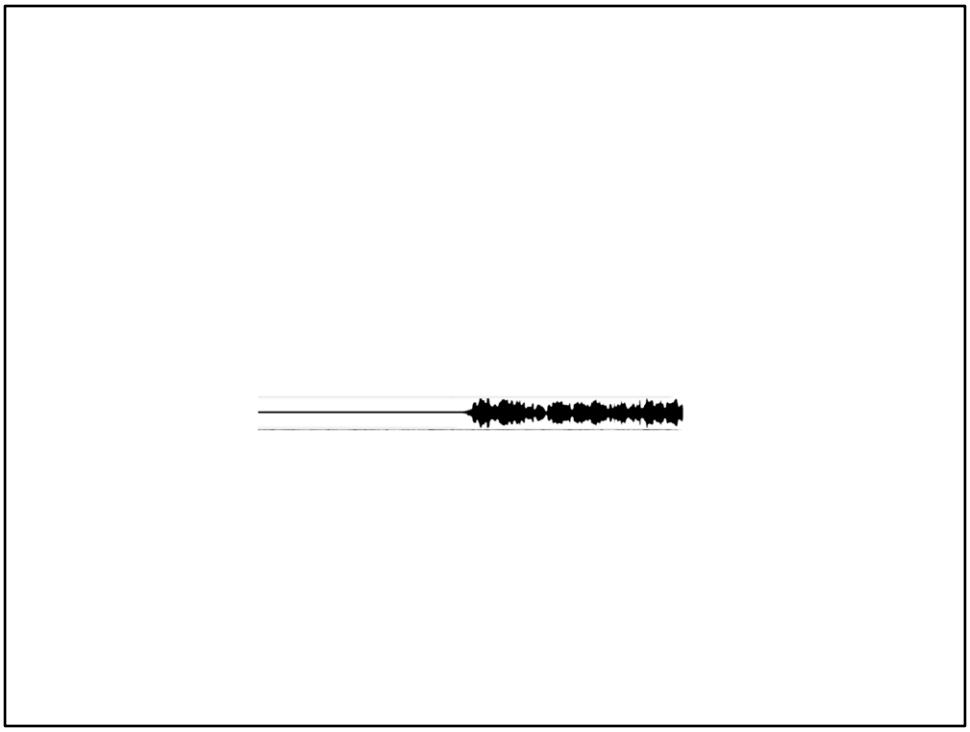
The conclusion is that any copy will be significantly worse than the original using any currently practical method of copying. But it may be acceptable for some types of original and for some purposes.



A variable area negative optical soundtrack.



And the matching positive. Note that when there is no sound, the track is designed so that very little light falls on the photoelectric cell – keeps the noise down when there's little sound on the track.



But if you play a neg track, then when there is no sound, the maximum light falls on the cell – causes hiss.

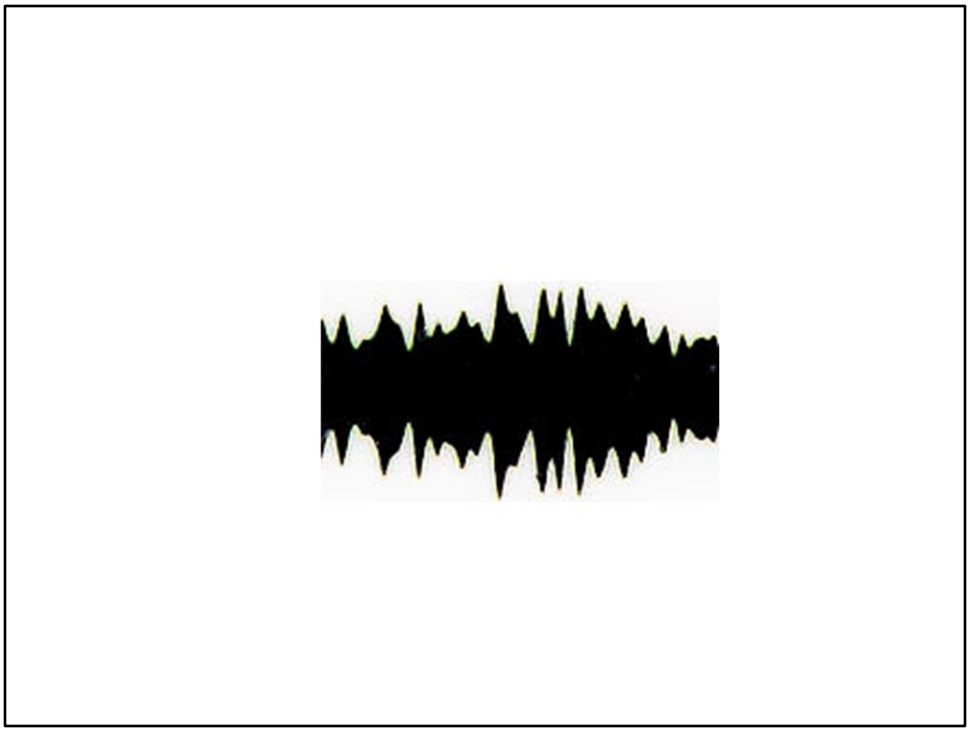
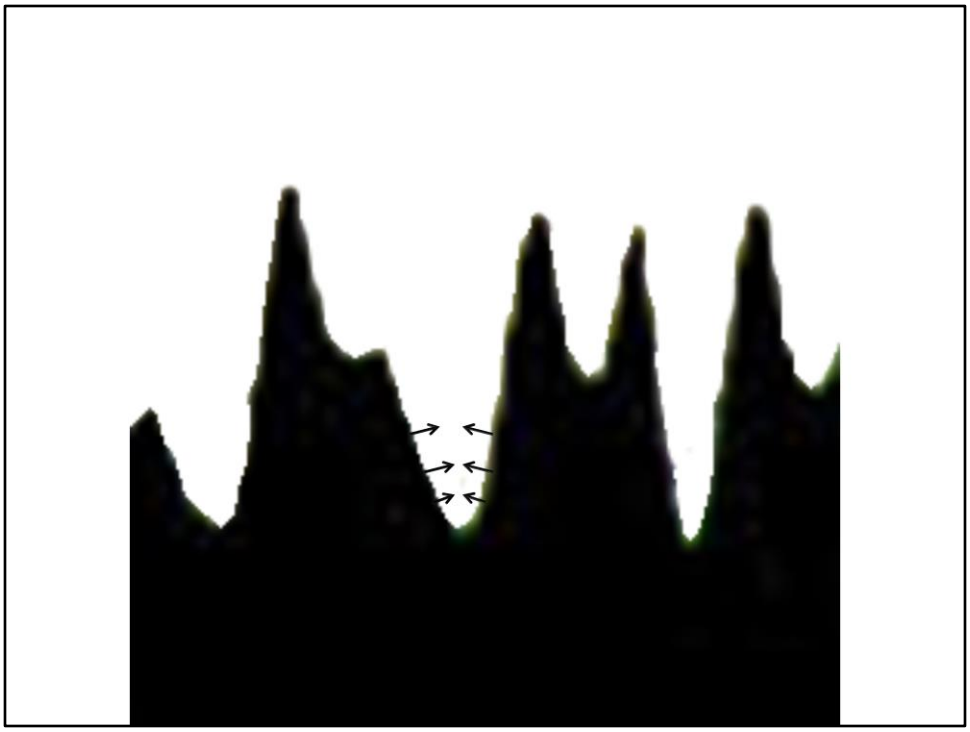
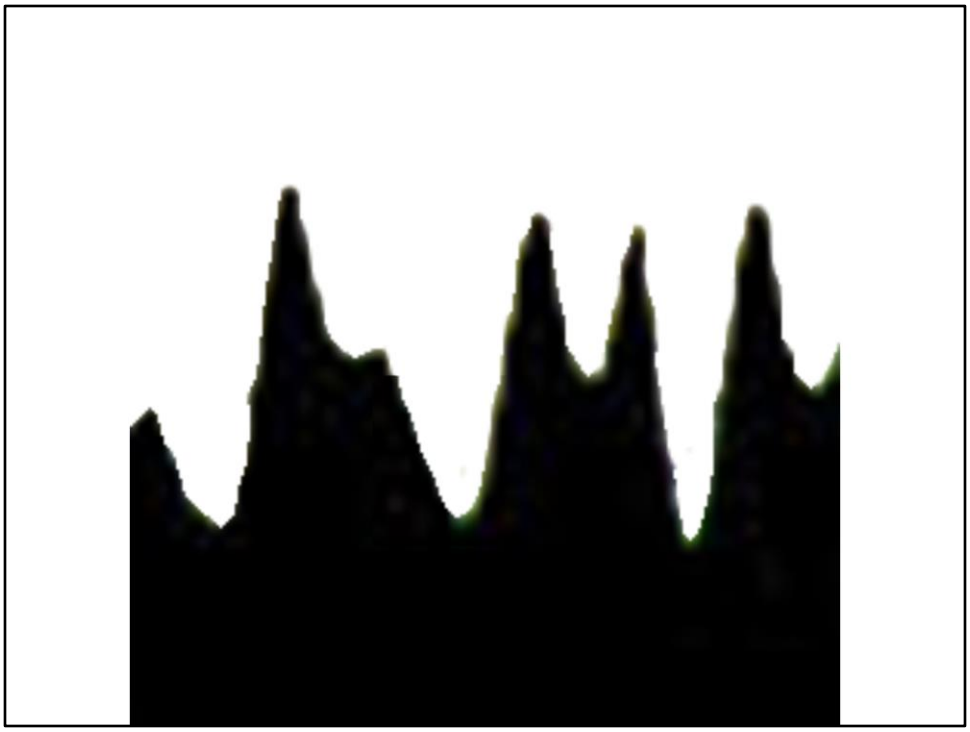
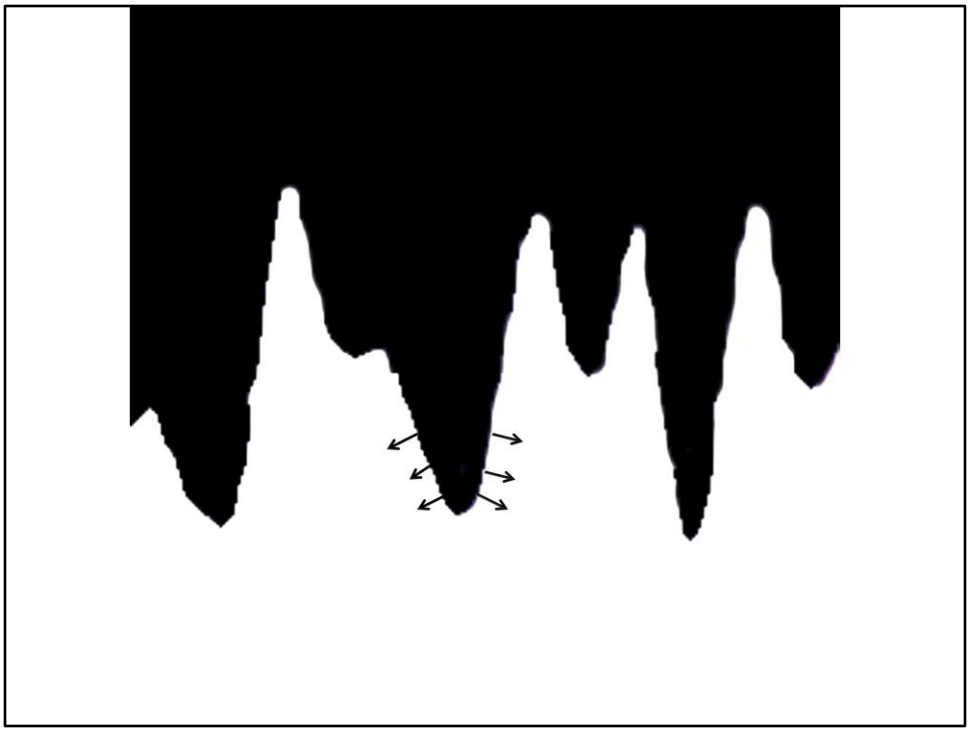


Image spread is often a more serious problem.

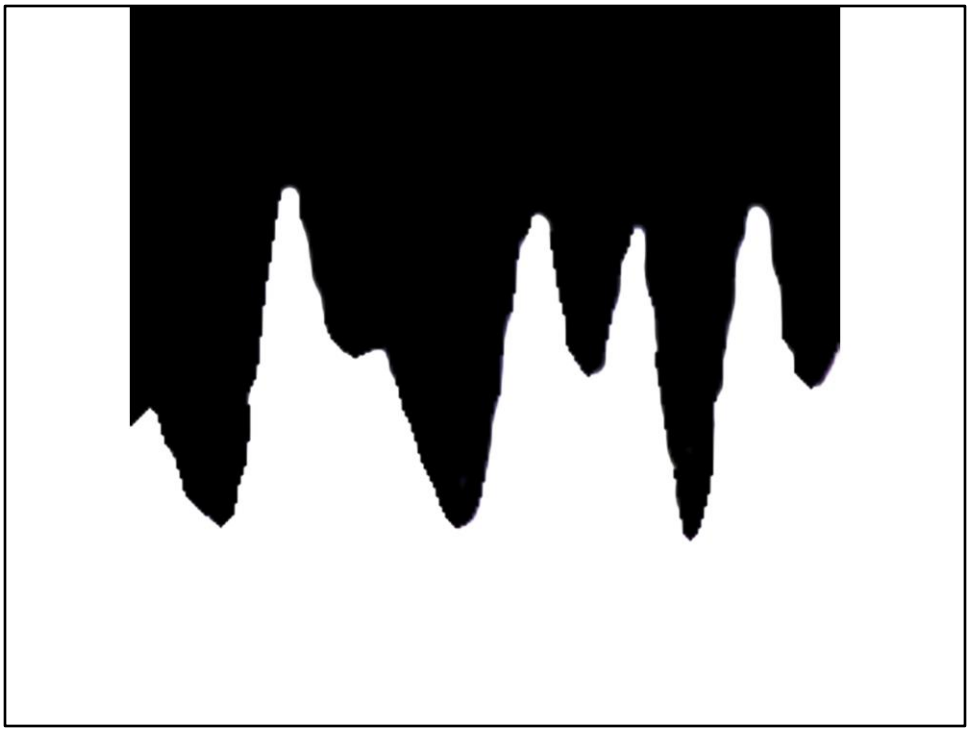


On the negative the image spreads slightly





But this is reversed when printing on to a positive...



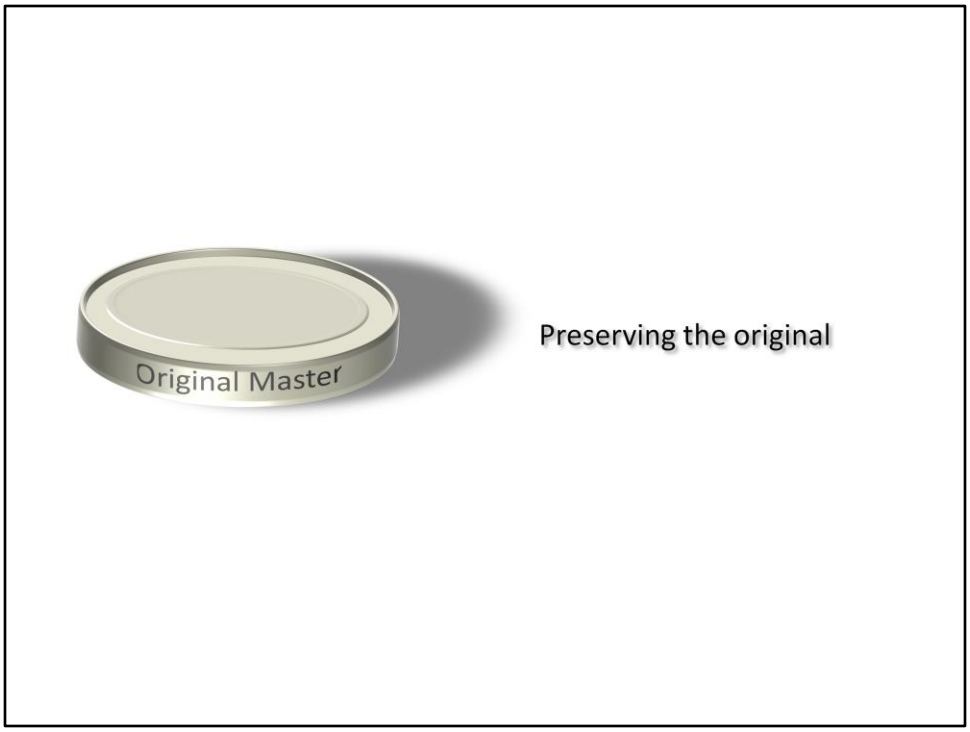
...resulting in a much more accurate track. This meant that processing and exposure control was very important during printing. But it means that a negative will be distorted – usually apparent as being very sibillant.

Developments in software such as AEO-Light (v 2 is now available), help to address some of these problems.

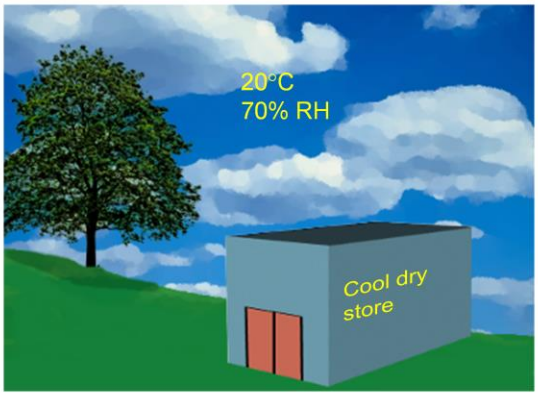
Preservation Strategies
in the real world

If you haven't started it may already be too late

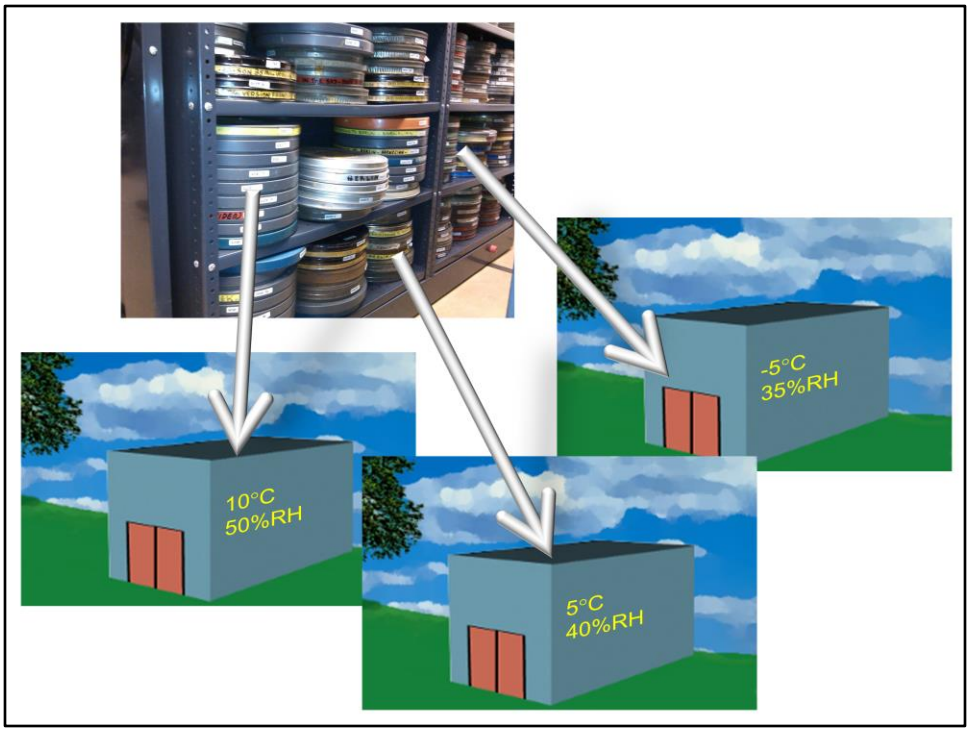
For videotape, the situation is becoming urgent. Soon there will be no machines left to play back these tapes.



For film, strategy one is to preserve the original…



…and the **only** way is to store it in a cool dry store.



If you have sufficient information about your collection, you can separate it into appropriate storage.

British Film Institute master film store

-5°C, 35%RH

Image BFI

Otherwise, you need to put everything into the best store. This approach taken by BFI, for example, where everything is stored at -6°C.

Image IWM

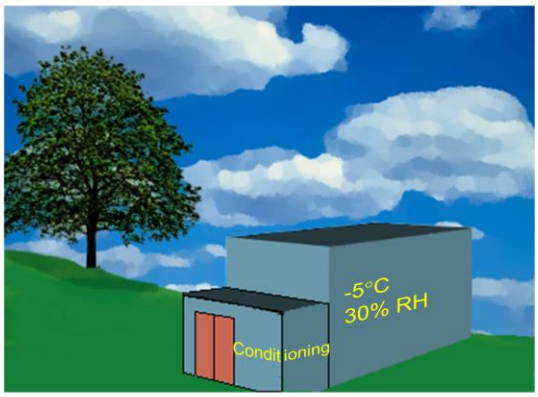
One way of assessing your collection is acid-level testing.
The acid level of the film is a good predictor of life-expectancy. The advantage of the volatility of acetic acid means that a simple test to measure the acid level in the atmosphere inside the can gives a good indication of the acid level of the film, and so can be used to assess the life-expectancy of the film. Once the indicator shows that the film has reached the point where the decomposition speeds up (the 'critical point'), the film needs more urgent attention.
A similar test is not possible for nitrate film, since nitric acid is not very volatile, so the level of acid in the air around the film is too small to measure easily.

Image Thomas Christensen

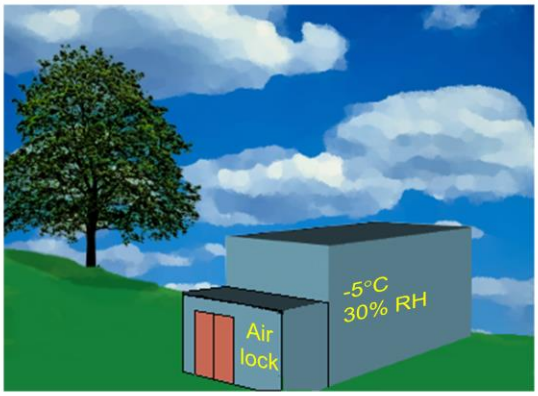
Air conditioning plants can be expensive complex. But there are ways of cutting costs. For instance, perfectly stable conditions are not so important for motion picture film because the film takes a long time to react to the environment.

Simple things can be done, such as limiting the number of times you open the door.

Perhaps you can turn the plant off at night if it is cool outside.



You don’t need a conditioning room. This only makes the design of the store more complex and expensive.



All you need is an air-lock to stop moist air flooding into the store…

…and some insulated boxes to slow down the films' temperature change.

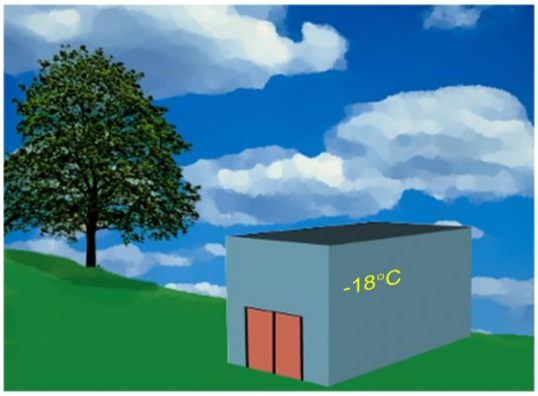
Storage Conditions			Average number of days per year out of storage at 70°F/21°C & 50% RH							
T°C	T°F	RH%	No Days	2 Days	4 Days	7 Days	30 Days	60 Days	90 Days	120 Days
			Time in Years to Reach A-D Strip Level 1.5							
10	50	20	382	364	348	326	219	154	119	96
10	50	40	211	206	201	194	154	121	100	85
10	50	60	118	117	116	114	101	88	78	70
4	40	20	895	753	683	598	308	188	136	106
4	40	40	482	427	404	374	239	162	123	99
4	40	60	264	241	234	224	171	130	105	88
-1	30	20	1873	1502	1240	982	379	211	146	111
-1	30	40	986	880	784	675	326	194	139	108
-1	30	60	528	501	469	429	259	170	127	101
-7	20	20	4711	2732	1966	1384	424	222	151	114
-7	20	40	2413	1732	1391	1074	391	214	147	112
-7	20	60	1258	1026	898	756	342	200	141	109

Figures from filmcare.org

But check the FilmCare.org chart for the effect of Time out of Store. This can have a disproportionate effect on the life expectancy.

Image IWM

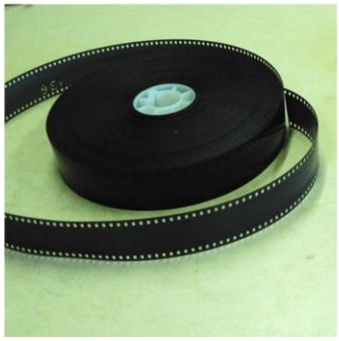
A simpler way to achieve below-zero storage. After pre-conditioning at a RH below 50%, films are sealed in metal/foil bags with only a very small amount of air inside. Then they can be stored in any freezer (but not stored at higher temperatures for any length of time).



A simpler way to have a below-zero store, with no humidity control.

Can be as simple as this.

…or this.



B/W polyester film is the most stable, and is likely to have a long life even at ‘room’ temperature…as long as the humidity does not go so high that there is fungal growth.

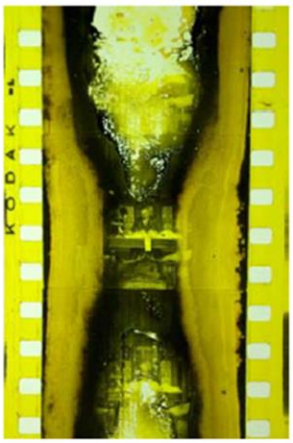
Image IWM

Fungal growth is a killer.

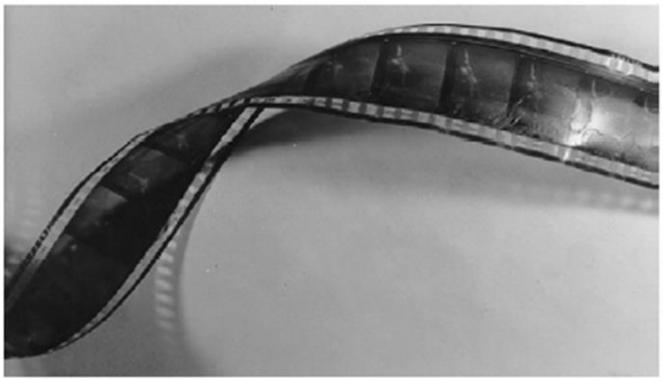
Image IWM

Even quite mild fungal growth attacks the emulsion.

If you plan to keep the original,
good storage is not optional



But good storage is not enough if the film is already in an advanced state of decomposition.



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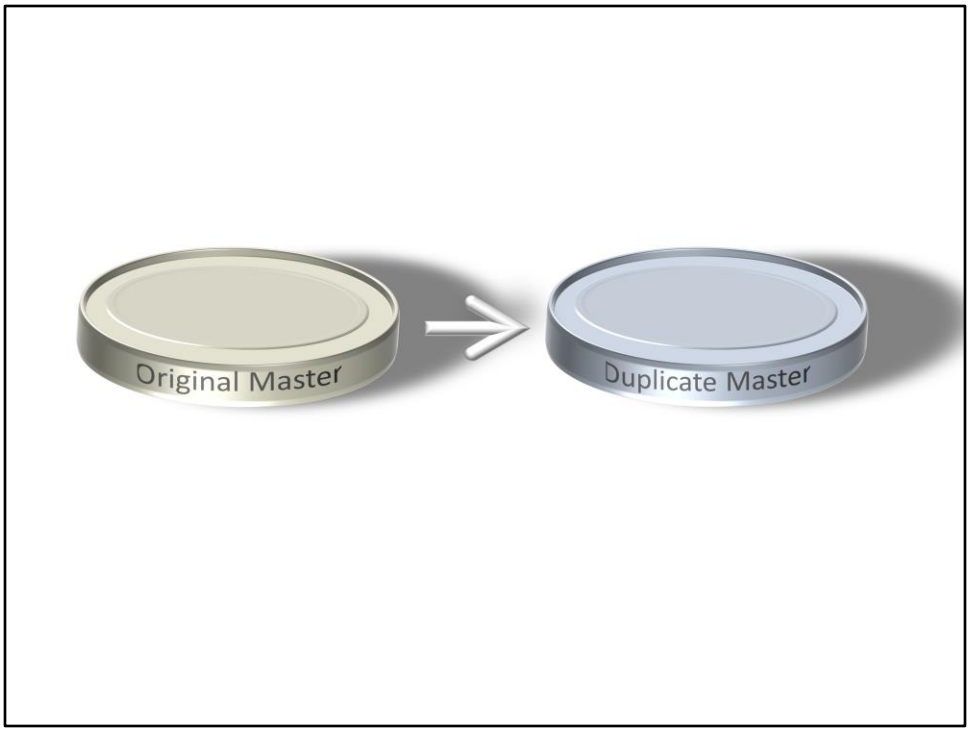
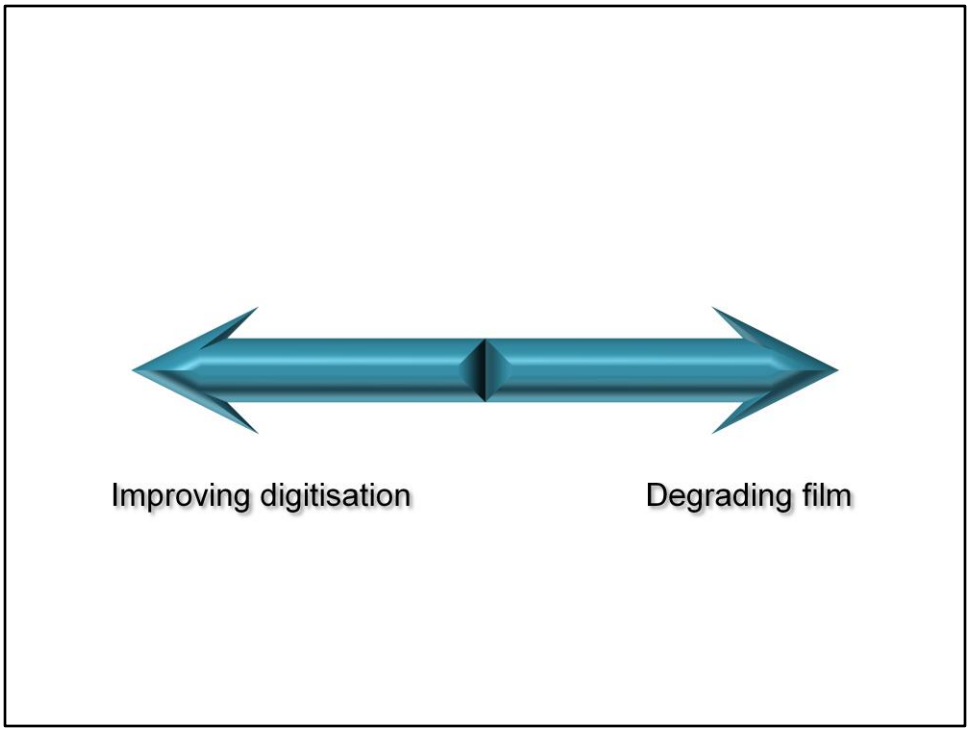


So the only answer is to copy it. In the past this was done by making a film copy…

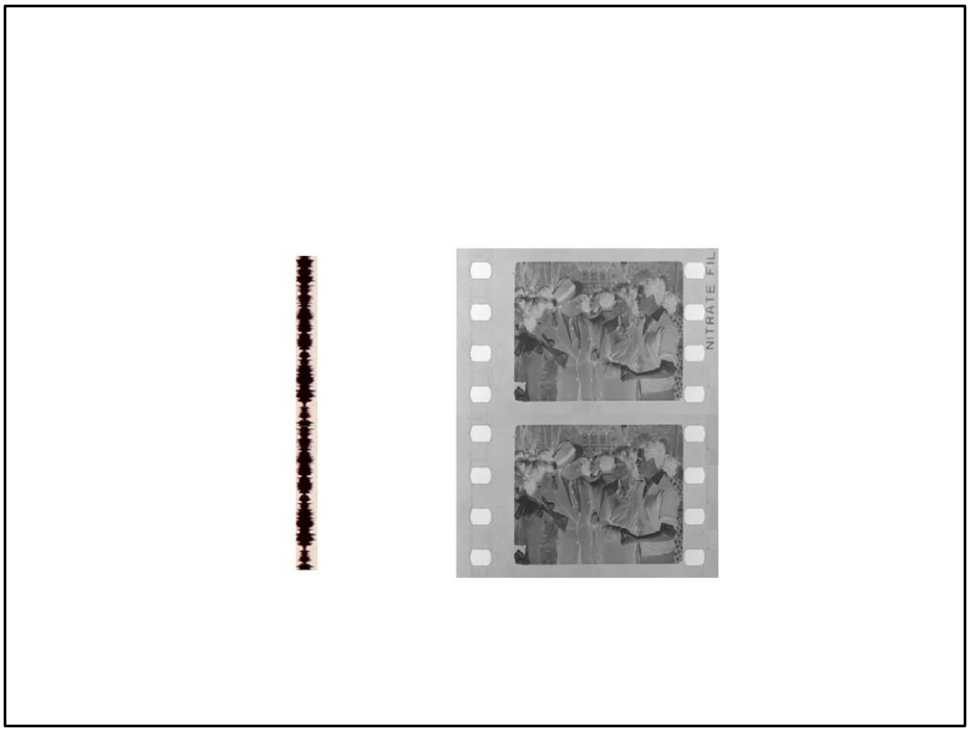
…but now it is done by scanning. Scanners are improving all the time, and becoming cheaper, but it is still difficult to produce a good ‘preservation’ copy if the original is a high-quality negative.



As time goes on, digitisation will get better and cheaper and easier, but the film will degrade further. So there is a balance to be made between investing in storage and digitisation, and waiting for things to get cheaper.

Digitisation – decide on the purpose

It’s easier to scan a print…



…than a separate negative and track. So for access digitisation, it may be better to scan the print.

For preservation, a raw scan covering the full dynamic range of the negative is required.

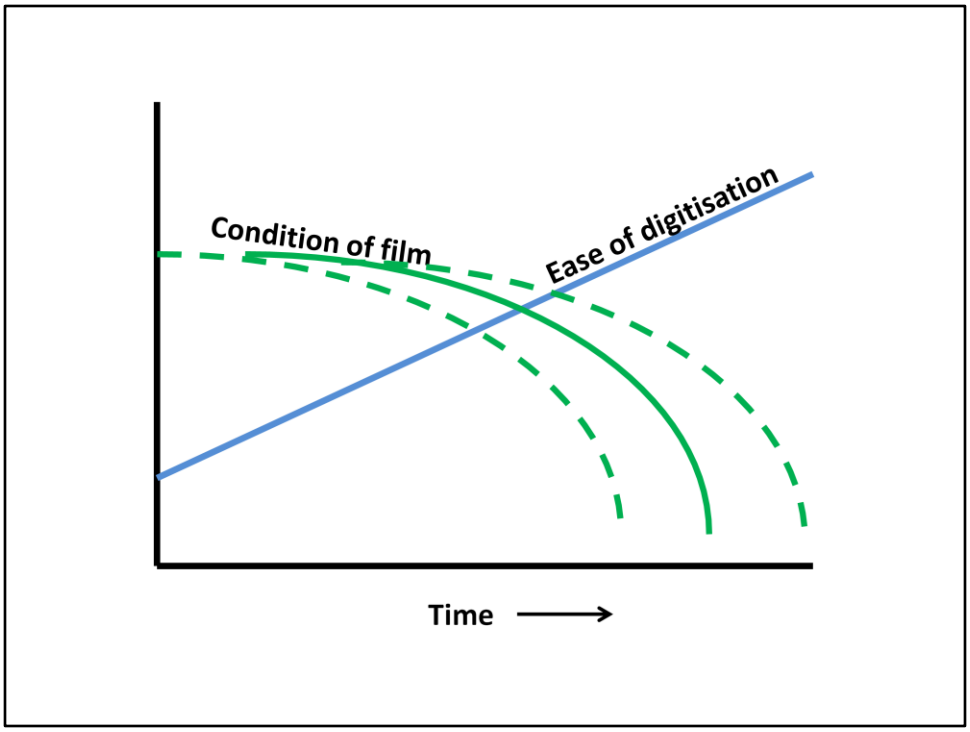
For access, a graded version is needed.

For preservation, a full overscan, even including the perforations is best.

For access, the image needs to be cropped to the frame.

For preservation, all the original blemishes should be retained, because techniques for removing these will continue to improve.

For access, a cleaned up version is preferred.



Each part of the collection should be assessed for its condition and life expectancy, and a strategy devised for its preservation.