

RECOMMENDATION ITU-R BR.716-2*

AREA OF 35 mm MOTION PICTURE FILM USED BY HDTV TELECINES

(Question ITU-R 113/11)

(1990-1992-1994)

The ITU Radiocommunication Assembly,

considering

- a) that telecines are sometimes used as a television post-production tool for special applications such as the scanning of negative film or other image processing operations, and it is necessary to be able to position the scanned area anywhere on the film exposed area for this application;
- b) that telecines are also used to televise film programmes with no image post-processing, and it is desirable that the area to be used on the film frame be specified for this application;
- c) that many formats exist for 35 mm feature films, as listed below, and preferred dimensions for the area used on the frames of all those formats should be recommended:
 - 1.37:1 (“Academy” format, close to 4:3)
 - 1.66:1 (European wide-screen format, close to 16:9)
 - 1.85:1 (United States wide-screen format, close to 16:9)
 - 2.35:1 (anamorphic “Cinemascope” format);
- d) the content of ISO Standard 2906 “Image area produced by camera aperture on 35 mm motion picture film”, and that of ISO Standard 2907 “Maximum projectable image area on 35 mm motion picture film” which specifies the dimensions of the projectable area for all the frame formats listed above;
- e) the content of Recommendation ITU-R BR.713 “Recording of HDTV images on film”, which is based on ISO Standards 2906 and 2907,

recommends

1. that a number of pre-set areas to be used on 35 mm release print film frames should optionally be selectable at choice; Table 1 proposes the nominal dimensions of the areas used on the various film formats, the used areas should be centred on the frame projectable area;
2. that, for operational reasons, the area scanned on 35 mm film by HDTV telecines should preferably be adjustable over the whole film frame. The maximum area of a film frame on 35 mm film, which applies to camera original, has the following dimensions:

$$24.89 \times 18.72 \text{ mm}$$

it covers the whole usable film width between the sprocket holes, a height of 4 sprocket hole pitches, and it does not have a 16:9 aspect ratio.

Note 1 – The dimensions given in Table 1 are those of the area of the image used on the film frame, they do not necessarily correspond to the area scanned on, e.g. the face of the flying spot in a flying spot telecine.

* This Recommendation should be brought to the attention of the International Organization for Standardization (ISO).

TABLE 1

Nominal 16:9 area used on 35 mm release print film frames

(Further sets of dimensions for the area used on film are under consideration for inclusion in future issues of this Recommendation)

Film (intended projection aspect ratio)	Projectable image dimensions (mm)	Used frame area dimensions (mm) for 16:9 presentation	Notes
1.37:1	21.11 × 15.29	21.11 × 15.29 (archive films)	(1)
1.37:1	21.11 × 15.29	21.11 × 11.87 (shoot and protect)	(2)
1.66:1	21.11 × 12.62	21.11 × 11.87	(3)
1.85:1	21.11 × 11.33	20.14 × 11.33	(4)
2.35:1 (anamorphic)	21.29 × 18.21	16.19 × 18.21 (pan-scan)	(5)
2.35:1 (anamorphic)	21.29 × 18.21	18.74 × 18.21 (compromise)	(6)
2.35:1 (anamorphic)	21.29 × 18.21	21.29 × 18.21 (letter-box)	(7)

- (1) These dimensions apply to the case of vintage archive films in which essential picture content is likely to cover the full height of the frame; in this case two vertical black panels will appear at the right and left of the HDTV display, the width of each being 11% of image width.
- (2) These dimensions apply to the case of films photographed according to the "shoot and protect" concept; they will cause a cropping of 11% at the top and bottom of the film image. It should be noted that the telecine operator may be in a position not to be able to tell whether a film has indeed been photographed according to the shoot and protect concept. Consequently, in case of doubt, the used area specified for the case of archive films should preferably be selected.
- (3) This area has an aspect ratio of 16:9 and a width equal to that specified in ISO Standard 2907 for the maximum projectable image area (Annex 1); it will cause a cropping of about 3% at the top and bottom of the film frame.
- (4) This area has an aspect ratio of 16:9 and a height equal to that specified in ISO Standard 2907 for the maximum projectable image area; it will cause a cropping of about 2% on the left and right side of the film frame.
- (5) In this case only 76% of the film frame width will be displayed; if it is necessary to display important picture content in the two cropped side panels (each of them 12% of picture width) recourse should be made to pan-scanning.
- (6) This area is sometimes used for Cinemascope films; it represents a compromise between the pan-scan and the letter-scan methods; it displays 88% of the film frame width and causes two black bars to appear at the top and bottom of the displayed image, each being 6% of image height.
- (7) These dimensions apply when the letter-box method is used. In this case, two black bars will appear at the top and bottom of the displayed image, each being 12% of image height.

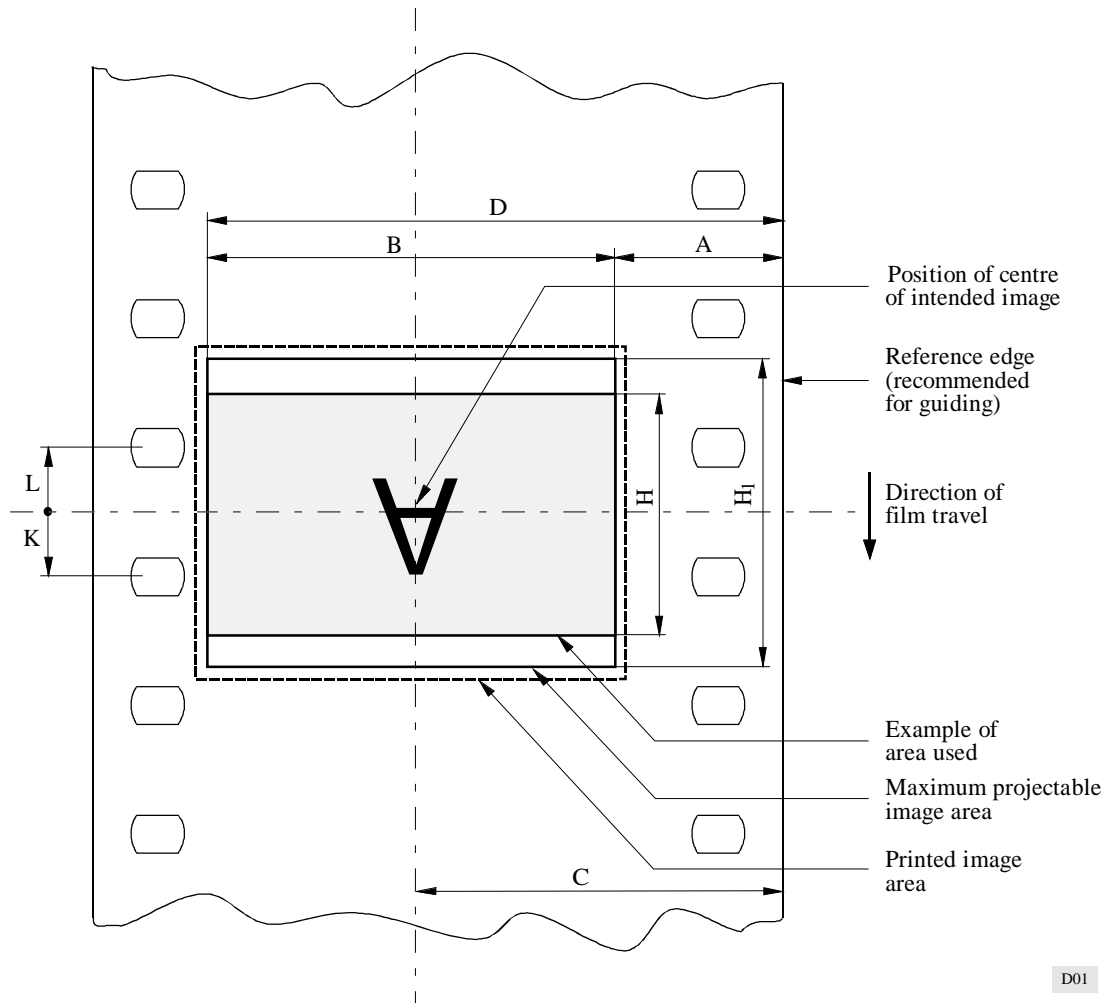
Note 1 – It would be beneficial if the telecine were capable of a considerable range of zoom ratios and horizontal/vertical positioning.

Note 2 – Information on scanning formats is given in Annex 2.

ANNEX 1

Maximum projectable image area and area used in HDTV

Adapted from ISO 2907-1984



D01

Dimensions

(The film is shown as seen from inside the projector looking towards the lens)

Dimension	Non-anamorphic pictures (mm)	Anamorphic pictures (mm)
A (min.)	8.20	8.10
B ⁽¹⁾ (nominal)	21.11	21.29
C (nominal)	18.75	18.75
D (max.)	29.31	29.39
H ₁ (max.)	15.29	18.21
K and L ⁽²⁾		

(1) B: derived value given for information.

(2) K and L: approximately equal.

Projectable image height, *H*, of a non-anamorphic print

Aspect ratio	Image height, <i>H</i> (nominal) (mm)
1.85:1	11.33
1.66:1	12.62
1.37:1	15.29

Telecine scanning formats of 35 mm feature films

1. Introduction

For many years, motion picture film has been an important source of programme material for television services and – at least in the initial phase of wide-screen television systems (e.g. HDTV, D- or D2-MAC, PALplus) – it is expected that film will also play a leading role as a programme medium in the future. In particular, feature films, which are normally composed for a wide-screen showing in the cinema, are expected to be a valuable source of high-quality programme material which will be readily available for future television transmission in the 16:9 aspect ratio.

In recent years television programmes originated on film have increasingly been exchanged in the form of video tape. More and more often the film-to-tape transfer for this has no longer been carried out by the broadcasters themselves, but by post-production and facilities houses. This is especially true in the case of the transfer of feature films, for which the transmission rights are normally purchased for only a limited period of time and which, after the transfer, are returned to the production house or studio for archival storage.

There are a number of film formats and aspect ratios in common use throughout the world, not only for the image capture, but also for the release of feature films. It is important, therefore, to consider the ways in which telecine scanning formats are best applied for the transfer of films.

2. Release print formats

Various film formats are in general use worldwide for the release of feature films on 35 mm film gauge. In the United States of America, most of the feature films for both cinema or TV showing are shot and released either in full aperture (1.33:1) or, more frequently, in the Academy format (1.37:1), although intended for projection in 1.85:1 format. In some cases, the original size of the exposed camera aperture is reduced in the intermediate printing stage with a hard matte in the optical printer. This produces an aspect ratio of 1.85:1 on the release print for cinema showing.

In Europe, however, cameramen nowadays usually photograph their motion pictures with a hard matte in the camera which is close to an aspect ratio of 1.66:1. Consequently, the release print is also delivered in this format. If a feature film is intended for showing predominantly on conventional 4:3 television, the Academy format with an aspect ratio of 1.37:1 is generally chosen.

To achieve an extra wide screen format, feature films are sometimes shot worldwide in the Cinemascope format (2.35:1). An anamorphic camera lens squeezes the image horizontally (by a factor of 2), but does not change the image height.

The Academy format can be found in vintage archive films, and also in recent films which are intended for both wide-screen cinema and conventional television presentation and are therefore photographed according to the “shoot and protect” concept. Vertical cropping of the film frame should be avoided in the former case, while it is legitimate in the latter.

3. Transfer of feature films to TV

Wide-screen feature films for the cinema are normally made without special attention being given as to how they might best be presented on the television screen. Thus, in general, there will be a need to set up the telecine scan characteristics to interpret the desires of the original producer, within the constraints of the TV format. To meet these requirements with regard to the picture content, one possibility is to scan the full or nearly the full width of the wide-screen image on the release print. For conventional television this would normally result in a “letter-box” presentation with black areas at the top and bottom of the screen. In cases, however, where it is desirable to utilize the full area of the display screen the full height of the image on the release print has to be televised. This aim can best be achieved by allowing the area reproduced within the film frame to be panned over the aperture available on the print (pan-scan method).

However, such a selective scanning can lead to difficulties in achieving an accurate and repeatable framing within practical telecine equipment. In the future, an increasing proportion of feature films can be expected to be produced using the “shoot and protect” method. Material of this type is amenable to reproduction using fixed telecine scan positions and sizes. Thus, in addition to the fully flexible scanning mode, it is also desirable to have a number of fixed scanning modes available in telecine equipment. Such fixed scanning modes can be accurately pre-set during normal maintenance procedures and give a reliable way of quickly achieving the chosen optimum conditions for the particular material being reproduced.

The use of a number of fixed scanning options is mainly attractive for reasons of operational convenience. However, at the start of a transfer operation, it may not be known which option best suits the local production preference and the artistic needs of a particular film. The scanning option may therefore need to be changed during the running of the film. Even if these changes are synchronized with cuts in the action, the resulting changes to the black borders at top and bottom (or possibly the sides in 16:9) may be disturbing to the viewer. The option of continuous changes of pan, tilt and zoom during transfer (preferably to preprogrammed instructions) would therefore be an advantage.

The present conception of the European broadcasting organizations concerning the transfer and display for feature films on wide-screen 16:9 television systems is given below.

4. Wide-screen 16:9 television

At present, European broadcasters do not yet have much operational experience with the transfer of feature films to wide-screen television. Consequently, the scanned and transmitted area dimensions are still under discussion. In what follows, some obvious possibilities are given, taking into account both operational convenience and the artistic presentation of a film.

For feature films released in the Academy format (1.37:1), there are two obvious alternative ways of reproduction on wide-screen television:

- the full image height on the print is scanned. By this procedure, the full information on the film frame is shown on the television display, but with black borders down the left and right hand sides of the resulting television picture. This procedure is likely to be more suitable for archive material not produced for wide-screen presentation;
- the full width of the film frame is scanned and consequently the full height is not scanned. The television picture is completely filled, but information from the top and bottom of the film frame is discarded. This is admissible if the important action in the picture was captured in the inner portion of the image (“shoot and protect” method).

In some cases, neither fixed height nor fixed width may offer an acceptable solution from the artistic point of view for wide-screen scanning of the Academy format. More operational flexibility would then be required, with both vertical and horizontal panning and zooming facilities (selective scanning of picture segments). This process has to be used with extreme care, because such a recomposition of the image content may change the artistic integrity of the film creation.

Feature films which are released in the normal wide-screen formats (most frequently 1.66:1 in Europe and 1.85:1 in the United States of America) are highly unlikely to present any problems as both formats are very close to the 16:9 aspect ratio of television. Such prints can be scanned either in full width (1.66:1) or in full height (1.85:1). In both cases, only a small proportion of the film information is discarded.

Finally, there are several options to reproduce material shot in the Cinemascope (2.35:1) format. If the full information has to be retained, the full width must be scanned. As a result black bars appear on the top and bottom of the picture (letter-box method). Another possibility is to scan the full height and underscan the width, which results in a loss of approximately 25% of the total information on both sides of the film frame (central scanning). In order to minimize the effects of this on the television output, it could be necessary, in some rare cases, to allow the scanned part of the image to be panned from side to side within the film frame (pan-scan method). The need for this may be expected to decrease as more material is produced using the “shoot and protect” principle. A compromise solution would be to scan neither the full height nor the full width, but somewhere in between. If the scene content allows, Cinemascope films could be transmitted, for example, with an aspect ratio of 2.1:1 with some cropping on both sides (about 5% each) and with small black bars on top and bottom (in total 15% of screen area). In any case, more of the picture content of Cinemascope films can be shown on the 16:9 television screen than the 4:3 one.

5. Conclusion

For the exchange of recorded television programmes transferred from feature films, it is common practice to come to an arrangement – prior to the film-to-tape transfer – on the scanned area and aspect ratio on the film. In this, not only the various film formats which are normally used for release prints have to be taken into account, but also the aspect ratio of the actual television system which will be used for transmission.

In this Annex, the different possibilities which are conceivable and which are already used at broadcasting organizations are described from the European point of view. In order to facilitate the future exchange of programmes originated on film, it is suggested that:

- telecine scanning should be as fully flexible as possible;
- a limited number of fixed scanning rasters are agreed,

for the transfer of feature films to wide-screen 16:9 television systems.

ANNEX 3

Future considerations

Electronic blanking (hard masking) should be enabled on horizontal and vertical edges. This is considered to be a necessary facility for cleaning up the picture edges when overscanning the exposed film image area.

When the letter-box is used a shifting of the picture area to the top or bottom of the television raster is regarded as desirable by some broadcasters to allow sub-titles to be placed outside of the picture area.
