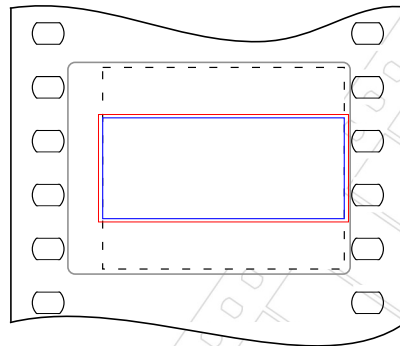




2 Perf Explained

2 perf cinematography originated in 1966 when Technicolor introduced their Techniscope format, which gained notoriety for its use on the Italian “spaghetti westerns” such as Sergio Leone’s “The Good, the Bad, and the Ugly”. Leone used the 2 perf format because it could save 50% off film raw stock & processing costs. The 2 perf 2.40:1 frame is significantly smaller than the 4 perf anamorphic 2.40:1 frame in terms surface area on the film negative, but benefits from the ability to use spherical lenses which tend to be faster, sharper, and offered in a wider selection of focal lengths.



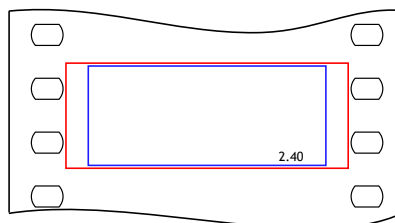
Techniscope 2 perf area

The downside of 2 perf at the time was the need for the optical lab process--as opposed to a contact print used in normal 1.85 or 2.40 anamorphic cinematography--to vertically enlarge the 2 perf frame to a 4 perf anamorphic release print, resulting in an increase in apparent grain. For these productions, the increased grain added to the gritty feel of the movie, and so may have been seen as a benefit.

The rising popularity and subsequent decreasing cost of Digital Intermediates have mostly mitigated the disadvantages of opticals because the DI process offers much improved quality. The rise of DI has made all Super 35 capture formats--4 perf, 3 perf, and 2 perf--more viable.

Panavision currently offers the Panaflex GII and Platinum cameras in 2 perf configuration. The camera and lenses are exactly the same as their 3 and 4 perf brothers, only the movement and some internal gearing are changed. These movements have their apertures centered on the film--Super 35 center vs. Academy center. This allows some side-to-side re-framing flexibility in post, and since Super 35 theatrical productions including 2 perf must go through either a DI or the less common optical process, maintaining the Academy aperture soundtrack on the negative is unnecessary.

The Super35 2 perf camera aperture is 0.980 x 0.365 in [24.89 x 9.27mm], yielding a 2.40:1 extraction area of 0.825 x 0.345 in [20.96 x 8.76mm]

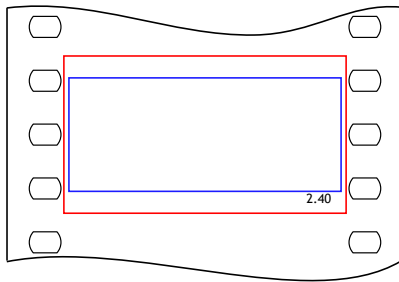


2 Perf 2.40

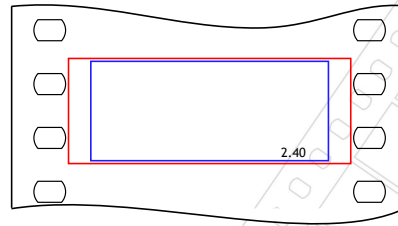


2 Perf Explained

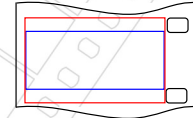
Below is a comparison of image area among 3 perf 2.40, 2 perf 2.40 and Super 16 2.40. The red outline is the camera aperture or gate; the blue outline is the extracted area.



3 Perf 2.40
 0.945 x 0.394 in.
 24.00 x 10.04 mm
 [same area as 4 perf 2.40]



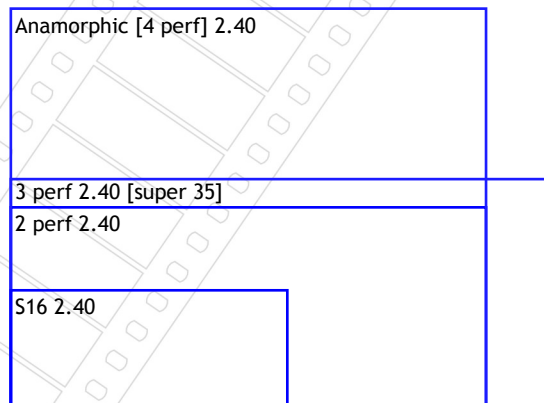
2 Perf 2.40
 0.825 x 0.345 in.
 20.96 x 8.76 mm



S16 2.40
 0.480 x 0.200 in.
 12.19 x 5.08 mm

Difference in negative area:
 3P 2.40 is **3.9x** larger than S16 2.40
 3P 2.40 is **1.3x** larger than 2P 2.40
 2P 2.40 is **3.0x** larger than S16 2.40

Here the negative areas are superimposed for more direct comparison, shown at 2x scale.



Note that 35mm 2x anamorphic has by far the most negative area: 0.825 x 0.690 in. [20.96 x 17.53 mm].

In terms of magnification to the theater screen, using as an example a 40 x 16.66 ft [2.40] screen:

Anamorphic 2.40 is magnified 168,643 times
 3P 2.40 is magnified 257,836 times
 2P 2.40 is magnified 337,286 times

For comparison, a 1.85 image on the same width screen would be magnified 338,471 times, or slightly more than the 2 perf 2.40 image.



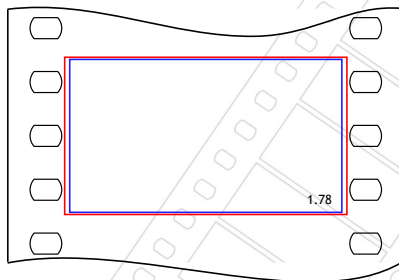
2 Perf Explained

Equivalent Focal Lengths - for same field of view, 2.40:1

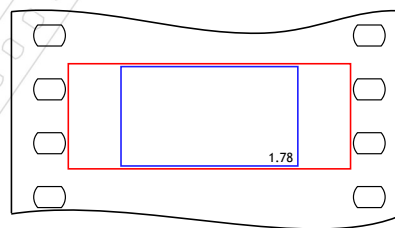
Projection Aper.	Anamorphic 35 2x anamorphosis		Super 35 2.40 spherical		2 Perf 2.40 spherical		Super16 2.40 2x anamorphosis		Angle of View	
	0.839	0.700	0.945	0.394	0.825	0.345	0.335	0.279	Horiz	Vert
18			10		9		7		100.4	53.2
26			14.5		13		10		79.2	38.1
31			17.5		15		12		68.9	31.9
37			21		18		15		59.5	26.8
43			24		21		17		53.1	23.6
48			27		24		19		47.9	21.0
53			30		26		21		43.6	18.9
62			35		31		25		37.8	16.3
71			40		35		28		33.4	14.3
89			50		44		35		27.0	11.4
133			75		66		53		18.2	7.6
151			85		74		60		16.1	6.7
178			100		88		71		13.7	5.7
222			125		109		89		11.0	4.6
240			135		118		96		10.2	4.2
266			150		131		106		9.1	3.8
320			180		158		127		7.6	3.2
355			200		175		142		6.9	2.9

2 perf 1.78

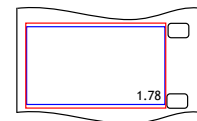
2 perf can also be used for 1.78:1 television production. The height is limited by the 2 perf camera aperture, so the sides must be cropped for 1.78. Below is a comparison of area on the film negative.



3 Perf 1.78
0.945 x 0.531 in.
24.00 x 13.50 mm
[same area as 4 perf 1.78]



2 Perf 1.78
0.614 x 0.345 in.
15.60 x 8.76 mm



S16 1.78
0.480 x 0.270 in.
12.19 x 6.86 mm

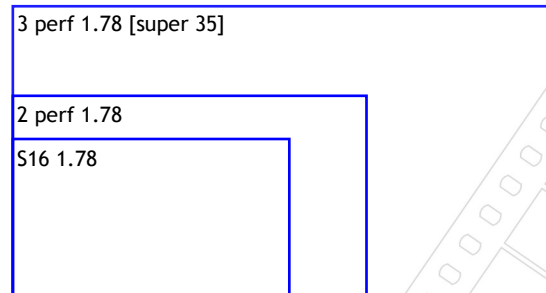
Difference in negative area:
3P 1.78 is **3.9x** larger than S16 1.78
3P 1.78 is **2.4x** larger than 2P 1.78

2P 1.78 is **1.6x** larger than S16 1.78



2 Perf Explained

Here the negative areas are superimposed for more direct comparison, shown at 2x scale.



Equivalent Focal Lengths - for same field of view, 1.78:1

Projection Aper.	Super 35 1.78 spherical		2 Perf 1.78 spherical		Super16 1.78 2x anamorphosis		Angle of View	
	0.945	0.531	0.614	0.345	0.480	0.270	Horiz	Vert
10			6		5		100.4	68.0
14.5			9		7		79.2	49.9
17.5			11		9		68.9	42.1
21			14		11		59.5	35.6
24			16		12		53.1	31.4
27			18		14		47.9	28.0
30			19		15		43.6	25.3
35			23		18		37.9	21.8
40			26		20		33.4	19.1
50			32		25		27.0	15.4
75			49		38		18.2	10.3
85			55		43		16.1	9.1
100			65		51		13.7	7.7
125			81		64		11.0	6.2
135			88		69		10.2	5.7
150			97		76		9.1	5.1
180			117		92		7.6	4.3
200			130		102		6.9	3.9

Advantages to shooting 2 perf:

- 50% savings on film stock vs. 4 perf
- 30% savings vs. 3 perf
- Longer run time per magazine [45 ft/min vs. 90 in 4 perf or 67.5 in 3 perf]
- Spherical lenses with faster T-stops, wider lens selection
- 35mm depth of field

Considerations:

- Requires digital intermediate or telecine transfer
- Less safety area for film repositioning or avoiding "hairs" in the gate
- Currently limited to sync-sound cameras