Black & White Fundamentals, part 1

A test report by Erwin Puts

Intro: the basics of Black & White technique.

I do assume that you are familiar with the basic ideas of BW technique. The characteristic curve is a graph that maps the response of the emulsion to increasing levels of light. This response is seen as an increasing density of the negative, from the almost clear base to the opaque areas where the light has blackened all silver halide grain. There is a theoretical maximum density that may be indicated the absolute density of the negative and there is a practical maximum density, that indicates that level of opaqueness within which small density differences may be seen as shades of white in the print. The same holds for the other side: the shadow area. Here the maximum is of course an unexposed negative, which is identical to the base density of the film itself.

Is has been established that the theoretical maximum density in log units is between D= 3.0 and D=4.0. In words this means that the film can cover a brightness range from 1:1.000 and 1:10.000. But what we can use as pictorial density is much less: it is D=1.2 to 1.5, or a brightness rage from 1:16 to 1:32. All manufacturers provides curves which cover the maximum range which is not practical from a users perspective. Every density value above D=1.5 will print as pure white, however dense the negative is. That is thus useless bandwidth. My tests are geared to characteristic curves that can be fully printed with the maximum range of tonality.

On the shadow side part of the negative, the latitude is less wide. To get a deep black on the print and still retain some detail in these shadow areas, the minimum density on the negative is D=0.15 and we need a steep curve to record clear detail in these shadow areas.

Developers:

There is a long standing history of developer types and all kinds of characteristics attached to them. We have solvent type fine grain developers, we have maximum acutance developers, standard developers and developers that try to increase the inherent speed of an emulsion.

And it is a part of the photographic lore that these developers perform all kind of magic , when used expertly. The basic fact is that developers nowadays have only limited influence on the basic character of an emulsion. The famous acutance developer like Rodinal, has less effect on modern emulsions that previously assumed. The whole acutance effect in itself is diminished in importance, as current grain technology is quite resistant to developer influence. Still some differences do exist. In this test I used some standard films and a wide range of developer types to cover all tastes. For D76 you may read also XTOL and for Ultrafin Plus substitute TMax developer.

I used the developer times as provided by the manufacturer. That is a good starting point. As we all know , thanks to the Zone System, we can manipulate the curves, by lowering the speed setting and/or expanding the developer time. With these two simple tools we can give a film a family of curves, with more or less steepness and more or less density in the highlights or shadow areas.

The density range in the negative has been selected to print on a grade 2 or 3 with a full range of tonal scale.

Below we have the table with results.

		FX39 1+9	D76 stock	LC29 1+29	Rodinal 1+100	Ultrafin-Plus 1+6
time	TMX100	10.5 mins	9	7.5	15	12
sharpness	TMX100	high	high	medium	medium	medium
grain	TMX100	fine	fine	medium	medium	medium
contrast	TMX100	7 stops	6 stops	7 stops	6 stops	5 stops
time	D100	8.5 mins	9	5	15	9
sharpness	D100	high	high	medium	medium	medium
grain	D100	fine	fine	medium	medium	medium
contrast	D100	8 stops	6 stops	7 stops	7 stops	7 stops
time	APX100	8.5 mins	9	7.5	20	9
sharpness	APX100	high	high	medium	low	medium
grain	APX100	fine	fine	coarse	medium	medium
contrast	APX100	8 stops	6 stops	5 stops	7 stops	5 stops
time	Plus-X	7.5 mins	5,5	5	15	9
sharpness	Plus-X	high	high	low	medium	low
grain	Plus-X	medium	medium	coarse	coarse	coarse
contrast	Plus-X	7 stops	7 stops	6 stops	7 stops	5 stops

With densitometer analysis to get real life graphs. The goal was to see whether there are differences in grain, sharpness and contrast range, including the shape of the characteristic curve.

All sharpness tests at enlargements at 14 times and grain test at 150 times.

Evaluation is relative that is compared to each other.

Development times according to specs of the manufacturer.

The important issue is that at enlargements of 10 times or below, the differences in sharpness and grain are small with all 20 combinations.

So every combo will give very good results.

First the characteristic curve: (see below). We can distinguish four types of curve:

13 combinations give identical curve shape:

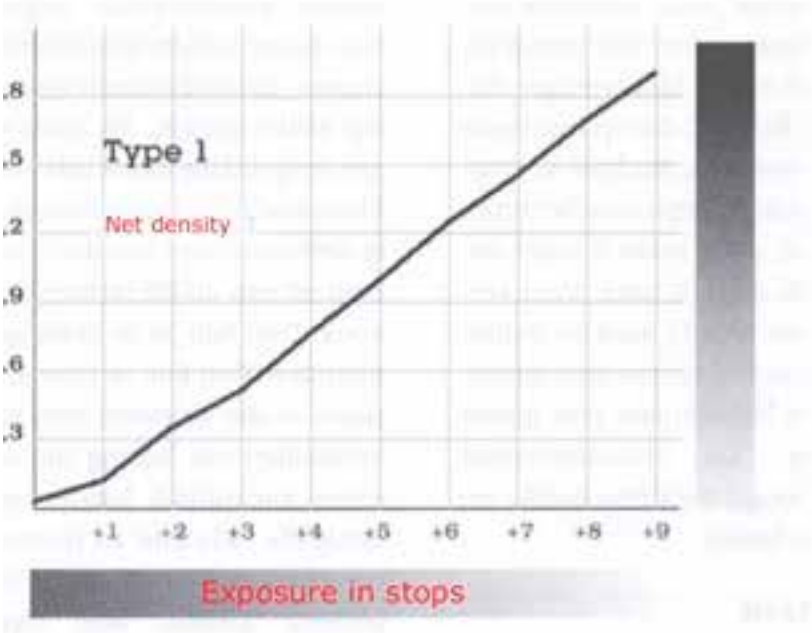
Type 1 is suitable for a subject with low contrast range, and has very good shadow density with a straight and steep curve. 5 Stops

Type 4 is suitable for a high subject contrast and has low shadow detail. 8 Stops.

Type 3 can reproduce a 6 to 7 stops contrast range with shadow and high light detail,

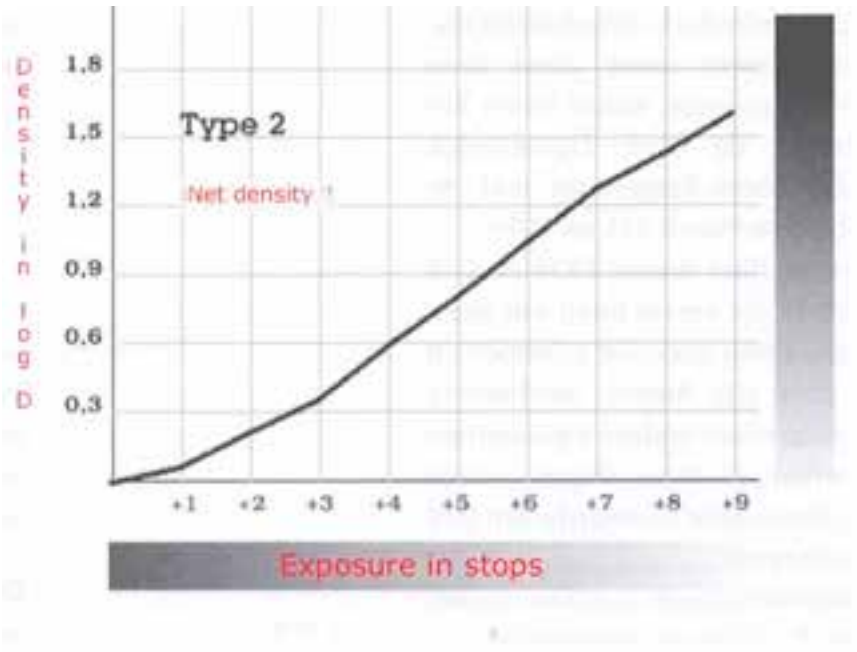
Type 2 is close to type 3, but has a steeper and straighter curve.

Type 1:
TMX and Ultrafin
APX100 and LC29
APX100 and Ultrafin
PlusX and Ultrafin

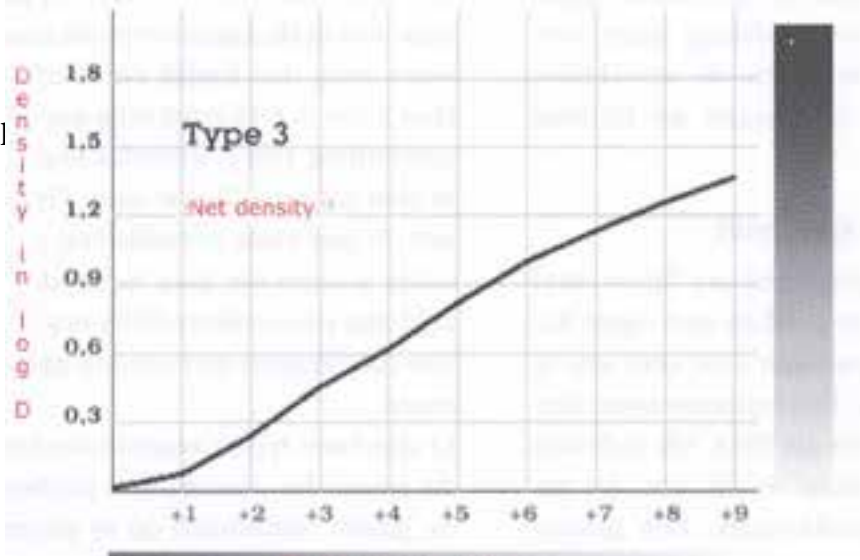


Type 2

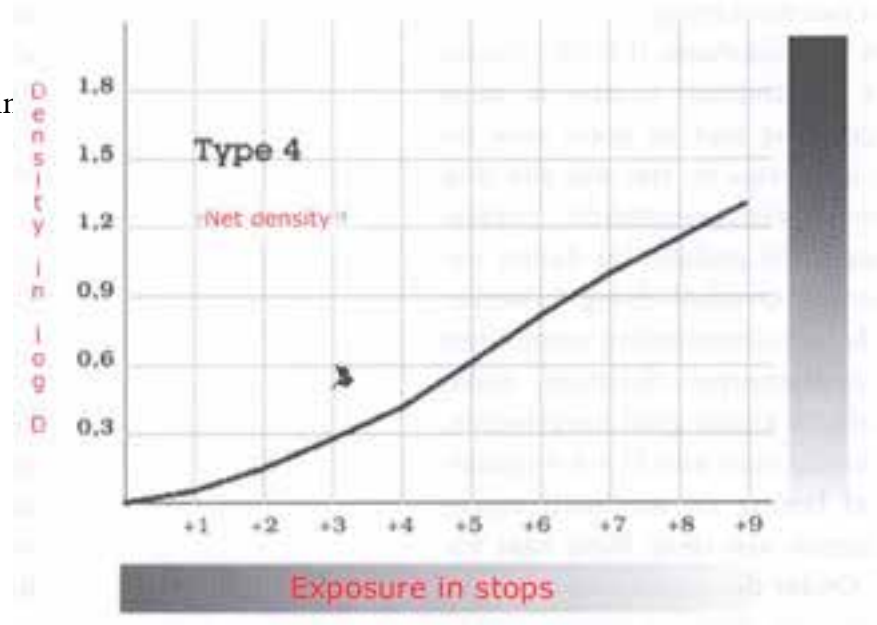
TMX and D76
D100 and D76
PlusX and LC29
APX 100 and D76



Type 3
D100 and Rodinal
APX 100 and Rodinal
TMX!00 and LC29
PLusX and FX39
D100 and LC29
PlusX and D76
TMX100 and FX39
D100 and Ultrafin
PLus X and Rodinal



Type 4
TMX100 and Rodir
APX100 and FX39
D100 and FX39



It is clear that type 1 and 2 can be reduced in development time by 15% to lower the curve and type 4 can be extended by 15%.

The density range was limited to 0.15 to 1.20 as this will reproduce excellently on grade 2 to 3. The test was done at such exactitude that it was able to reproduce the finest detail that the current Summicron 2/50 can capture. There are many even finer discriminatory issues and I intend to do an even more exciting test.

Some general conclusions:

The finest grain you get with D76, the grain however is a bit fuzzy edged, Rodinal has the tightest grain, with clearly defined edges, but the grain clumps are rough and irregular.

TMax is the finest grained film, even in Rodinal the grain is imperceptible. Plus-X has the most visible grain, but is a most beautiful character: if you want acutance effects, here you get it!

Clean and clearly defined detail definition is the domain of the Tmax and D100 and with some restrictions to the enlargement factor of the APX too.

If you need only one allround film, the APX is a fine choice if you limit yourself to enlargements below 10x. If you want to do big enlargements and need reserve capacity the D100 and TMX are best choices. I use both and can get along without any trouble.

The Plus-X is still an enjoyable film and the TMX- PX combo gives you classical and current pictorial effects. Start with D76/XTOL and expand to Rodinal if you need enhanced edge sharpness with some grain increase.

Use many different films but stick to one developer (or maybe two if you are brave or have the time to experiment). See the characteristic curve as a basis for exploration and find one that has the tonal scale and density that suits your style. If your method calls for a reduction in nominal speed of more than 1/3 stop, you are going in the wrong direction.

Speedpushing does not work: it gives a steeper curve in the midrange tonal scale, but no real gain in shadow speed.

Author: Erwin Puts email: <imxputs@ision.nl>
Last Updated: Sunday, August 26, 2001